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Elise Smith, MA, RDN, LD, FAND

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Become Comfortable with the Uncomfortable:
The Rewards of Leaving Our Comfort Zone

In any area of practice, at any level of expertise, it’s common eventually to find ourselves in what many have termed a comfort zone—a physical place or a state of mind (or both) where we feel at ease, at home... comfortable. If we’re in search of challenges, advancement or increased fulfillment (personal or professional), it’s often necessary—and often a good idea—to step out of our comfort zone.

In the words of author Daniel Pink, the Closing Session keynote speaker at the 2020 Food & Nutrition Conference & Expo: “We need a place of productive discomfort. If you’re too comfortable, you’re not productive. And if you’re too uncomfortable, you’re not productive. Like Goldilocks, we can’t be too hot or too cold.”

I asked some of our Academy colleagues for their thoughts on stepping out of our zone: why and how they did it, and what were the results.

Sandra G. Affenito, PhD, RDN, CD-N, FAND, became vice chancellor of academic administration at Johnson & Wales University in 2021, after working for more than 40 years in health care, private practice, the corporate sector, research and higher education. She says a willingness to step out of our zone is needed for any type of professional growth—a subject that will be covered at an October 10 education session she is moderating at FNCE 2022 Food & Nutrition Conference & Expo™ on “Advancing the RDN Education Trajectory to Ensure our Profession’s Sustainability: Doctorate Degree Standards.”

“We must continually prepare ourselves to step up and lead self, based on our goals,” Affenito says. “Potentially, we may be able to make a difference where we are, or we may need to seek out new experiences to realize our dream. As we transition into a new role, we must embrace all opportunities to learn and aim to tackle challenges through an inclusive, creative, data-informed lens. Taking calculated risks can lead to significant professional development.”

“As with changing any behavior, it is always helpful to break the chain of what is holding us back, potentially the fear of failure and disappointment. Taking small steps to become comfortable with the uncomfortable helped me to achieve my aspirations,” Affenito says. “Be strategic as you plan for your success with your new endeavor—pursue stretch assignments, equip yourself with a robust toolkit, and stand ready to assume greater responsibilities to achieve results.”

Sarah M. Baudoin, MS, RD, CDN, system director of clinical nutrition at Compass One at Hartford (CT) HealthCare, says she used her professional interests in clinical nutrition as a springboard to improve both her practice and how her department provided care. “I have always loved the process behind serving meals, especially patients in the hospital,” Baudoin says. “I saw an opportunity to elevate my practice as well as to provide a dietitian’s perspective to the operational management of the department and the hospital. In taking on the role of director of food and nutrition, I had never been responsible for an entire department. And while I’ve supported operations before, leading an operational team was new territory for me. I felt confident that stepping into an operational leadership role would open other exciting professional opportunities for me, which it did! Plus, I have a hard time walking away from a good challenge,” she says with a smile.

“I stepped out of my comfort zone because I wanted to experience new things, learn new things and go to new places or a state of mind (or both) where we feel at ease, at home... comfortable. If we’re in search of challenges, advancement or increased fulfillment (personal or professional), it’s often necessary—and often a good idea—to step out of our comfort zone.

Ideas for Moving Out of Our Comfort Zone ...

and What Comes Next

RDNs have the foundational knowledge, skills, and interpersonal capabilities to be successful and to advance a vision—what you aspire to be! Find someone you can rely on as a trusted mentor or sponsor, who can provide thoughtful feedback for your ongoing enhancement. Network with colleagues across your institution and outside of your institution. Get involved with your professional organizations, such as the Academy, dietetic practice groups, committees, and other professional development opportunities that enable you to prepare for your next step in your positive trajectory. At our upcoming FNCE, engage with learning opportunities that will enable you to advance your practice, gain new skills or even step into new areas of practice.

Sandra Affenito
places,” says Robert M. Skinner, RD, CSSD. After 13 years working with athletes at Georgia Tech and the University of Virginia, Skinner was approached by the U.S. Navy to create a new sports performance model for the Naval Special Warfare Command, which includes Navy SEALs. He subsequently worked for the Washington, D.C., National Football League team known today as the Commanders; and the U. S. Olympic and Paralympic Committee, working with athletes in combat and acrobat sports. Since 2021, Skinner has been working in a contract position in Germany with Special Operations Command Europe/Africa.

“I approached every new position as a challenge that I needed to figure out. Each new place was a puzzle, being open-minded enough to apply what you know but being humble enough to learn new things from each experience,” Skinner says.

Steps we take out of our comfort zone can be big or small, incremental or radical. Our education and experience are amazing preparation for any challenge. I worked in foodservice and as a consultant dietitian before becoming in the 1970s one of the relatively few registered dietitian nutritionists to earn an MBA, and I transitioned into higher education. I soon found myself outside my comfort zone, writing grant proposals for the first time; over the years these included USDA grants for programs teaching food safety to high-risk and low-literacy foodservice employees using distance education and the internet.


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Reference

Do it! Be open minded and curious about areas of the profession you never considered before. You never know what lessons you will learn or what other opportunities it may open up for you. Also, nothing is ever permanent. If you find a role is not right for you, you can always pivot and change direction. That is part of the beauty of dietetics: We have so many options! Don’t let fear limit your potential.

Sarah Baudoin

The only difference between a rut and a grave is the depth of the hole. Don’t stay in a rut for a job. If you want to experience new things, step out and experience them; you can always step back.

Robert Skinner
Increasing Annual Registered Dietitian Nutritionist Visits for Patients with Diabetes

Alison Ruffin, MHA, RDN, LD; Danielle Brooks, RDN-AP, LD; Kasey Metz, MS, RDN, LD

PROJECT RELEVANCE
Nutrition care is an essential component of diabetes management success. Dietary adherence, diabetes self-management education, and medical nutrition therapy are associated with improved glycemic control in patients with diabetes.1-3 The American Diabetes Association3 states, “Individualized medical nutrition therapy is recommended for children and adolescents with type 1 diabetes as an essential component of the overall treatment plan.” In addition, “comprehensive nutrition education at diagnosis, with annual updates, by an experienced registered dietitian is recommended to assess caloric and nutrition intake in relation to weight status and CVD [cardiovascular disease] risk factors and to inform macronutrient choices.”4 The Academy of Nutrition and Dietetics’ Evidence Analysis Library section on diabetes types 1 and 2 for adults classifies the recommendation for a minimum of 1 annual medical nutrition therapy encounter as strong and imperative; the practice is associated with maintained and continued lowering of hemoglobin A1C for up to 6.5 years for patients with type 1 diabetes and for up to 2 years for patients with type 2 diabetes.5

ORGANIZATION NAME AND BACKGROUND
Dayton Children’s Hospital is a 178-bed freestanding pediatric hospital in Ohio with 2 emergency departments, 2 urgent care locations, a substantial outpatient presence with ambulatory clinics, laboratory, and rehabilitation at the main campus and 16 other locations, 2 pediatrician offices, 4 KidsExpress locations, 2 pediatric pharmacies, and home care services.

A culture of quality improvement is essential to ensure safe, effective, and innovative care. Recognizing the value of quality improvement training for frontline clinicians, leaders, and support roles, Dayton Children’s Hospital began offering a formal 9-month quality improvement program in 2015 and is currently mentoring the seventh cohort of quality improvement champions.

QUALITY IMPROVEMENT PROCESS ON WHICH THE INITIATIVE IS BASED
Dayton Children’s Hospital uses the Institute for Healthcare Improvement’s (IHI) Model for Improvement.6 The 3 key questions the IHI model asks are the following:

1. What are we trying to accomplish?
2. How will we know that a change is an improvement?
3. What change can we make that will result in improvement?

Plan-Do-Study-Act (PDSA) cycles are used as part of the IHI Model for Improvement to determine the answer to the question: “what change can we make that will result in improvement?” In addition to using the IHI Model for Improvement, Dayton Children’s Hospital has developed an organizational standard for quality improvement projects. Each quality improvement project includes the following:

- SMART (specific, measurable, attainable, relative, and timely) aim
- Global aim
- Key Driver Diagram (KDD)
- simplified Failure Mode Effects Analysis (sFMEA)
- PDSA cycle
- Data displayed on a run or control chart

PROBLEM STATEMENT
A gap in nutritional care for patients with diabetes was identified as part of the Dayton Children’s Hospital endocrinology department’s application for U.S. News & World Report ranking.7 At the start of this project,
pediatric endocrinology practices received half a point toward the total application score if ≥50% of patients met with an RDN annually and 1 full point if ≥75% of patients met with an RDN annually.* The patient population was defined as patients younger than 18 years who have type 1 or type 2 diabetes, had been followed by the practice at least 1 year, and had at least 2 clinic visits in the last year.

In calendar year 2017, only 27% of patients with diabetes in the target population met with an RDN. An RDN was available in clinic daily, however, there was not a standard frequency for RDN visits, and the general approach to medical nutrition therapy was reactive rather than proactive. The *U.S. News & World Report* expectation in 2018 for patients with diabetes to meet with an RDN annually was reactive rather than proactive.

**KEY STAKEHOLDERS**

Key stakeholders included the following:

- Diabetes RDNs (both are also Certified Diabetes Care and Education Specialists)
- Endocrinologists
- Endocrinology leaders
- Clinical nutrition and lactation leaders
- Diabetes clinic nurses and medical assistants
- Quality improvement leaders
- Patients and families

**PATIENT VOICE**

Patient and family feedback was obtained through informal feedback in the clinic and a formal patient complaint on an after-visit survey. The clinical nutrition and lactation manager contacted the family who raised a concern on the after-visit survey via telephone. The parent expressed frustration that their child had only met with an RDN twice in more than 5 years—once at diagnosis and once at the family’s request. The family recognized the value of an RDN and wanted the RDN to be regularly involved in their child’s preventative care. Patients and families who informally provided feedback during the beginning of this project were either concerned that seeing an RDN was punitive if the provider had concerns or offered appreciation to regularly receive proactive nutrition counseling and education.

**KDD**

A KDD was created (Figure 1). The KDD included the global aim, SMART aim, primary and secondary drivers, interventions, and level of reliability for each intervention. For consistency, Dayton Children’s Hospital uses the same 5 categories as primary drivers for all quality improvement projects—people, environment, materials, methods, and equipment. The secondary drivers are considered affirmative nouns or tangibles that are needed to achieve the SMART aim. Secondary drivers are not interventions and may be or may not already be present in the system. Generally, interventions are targeted to create or optimize the listed secondary drivers to support the success of the SMART aim.

**Level of reliability for the selected interventions should be considered.** A 10⁻¹ or level of reliability of 1 indicates a low level of reliability, in which an error is anticipated to occur 1 in every 10 instances. A 10⁻² level of reliability would have an error in 1 in every 100 instances or a 10⁻³ level of reliability would have an error in 1 in every 1,000 instances. Education and reminders are types of intervention that are considered to have a low level of reliability, whereas process changes that rely less on human memory and decision making have a higher level of reliability, such as implementing a tool within the electronic medical record that would identify patients due for an RDN visit.

**sFMEA**

An sFMEA was completed (Figure 2). The sFMEA was used to create a high-level process map on the method of identifying which patients with diabetes were due for an RDN visit. For each step of the process, potential failure modes and interventions to prevent those failure modes were identified. High priority interventions identified on the sFMEA should align generally with interventions listed on the KDD.

At the start of the project in early 2018, 1.25 full-time equivalent (FTE) RDNs were dedicated to diabetes and endocrinology clinics and inpatient care of patients with diabetes. Due to budget constraints related to the pandemic, total dedicated FTE was reduced to 1.0 in the summer of 2020.

**STAFFING**

A staffing benchmark of 1 full-time RDN for every 750 patients with type 1 diabetes was published by Guttmann-Bauman and colleagues in 2018. The project target population of patients with type 1 or type 2 diabetes was approximately 730 patients. The total population of patients with diabetes served by the clinic was approximately 1,000, and the RDNs also provided care for other patients seen in the endocrinology clinics. Based on the published benchmark, an estimate of 1.5 to 2.0 FTE would likely be most appropriate.

An important factor to consider in team dynamics is that RDNs report to the Department of Clinical Nutrition and Lactation rather than Endocrinology. Before endocrinology’s application for U.S. News and World Report ranking, both departments were unaware of the status for annual RDN visits for the target population of patients with diabetes. When results for the RDN portion were presented initially, the reaction of both departments was that more FTE RDNs would be needed to meet the target. However, leaders of the endocrinology and clinical nutrition and lactation departments ultimately recognized an opportunity to first maximize efficiency and utilization of the existing RDN resources before requesting additional FTE.

Both departments recognized the clinical value of annual RDN visits for all patients with diabetes, although there was some resistance at the beginning of...
Figure 1. Key Driver Diagram. CY, calendar year; NDTR, nutrition and dietetics technician, registered; RDN, registered dietitian nutritionist.
Figure 2. Simplified Failure Mode Effects Analysis. RDN, registered dietitian nutritionist; RN, registered nurse.
the project due to perceived impact on workload and potential to disrupt clinic flow for providers. At the start of the project in 2018, a culture supportive of quality improvement was beginning to build; that culture has grown exponentially in the past 4 years, especially in the endocrinology and clinical nutrition and lactation departments, because multiple clinicians, providers, and leaders have completed the Dayton Children’s Hospital quality improvement course.

PROJECT AIM STATEMENT
The global aim for the project is to provide optimal nutrition care for all patients with diabetes receiving care at Dayton Children’s Hospital.

The SMART aim was to increase the percentage of patients’ with diabetes who were seen by an outpatient RDN annually at Dayton Children’s Hospital from 29% in calendar year 2017 to 75% in calendar year 2020.

IMPROVEMENT CYCLE
Emphasis on use of the PDSA cycle and frequent fine-tuning made this project successful. Many PDSA cycles were completed, studied, and adapted, adopted, or abandoned during this project. See Figure 3 for a summary of 3 PDSA cycles.

BARRIERS
Most prominent barriers to early success were RDN availability, provider engagement, patient schedule, and offsite accommodations.

RDN availability was enhanced by having the RDN work from clinic rather than an office space, reducing travel time to clinic. Considering that the RDN could also be asked to see endocrinology patients without diabetes or to complete a new-onset type 1 diabetes education inpatient, there were times when an RDN was unavailable to see an established patient with diabetes for the annual RDN visit. Realizing that the annual RDN visits were a priority, the clinic team increased collaboration to strategize which patients needed to be seen by the RDN and when. The endocrinologists value the RDN team members, although sometimes would overlook that the patient needed to be seen by the RDN and dismiss the patient or would not feel the patient had nutrition concerns. The RDNs began reminding providers and clinic staff which patients needed to be seen rather than waiting to be invited into the patient’s care. Provider-specific accountability data for the metric was shared with individuals, blindly comparing the percentage of the provider’s patient population that had an RDN in the past year blindly with the populations cared for by their peers in the same practice.

Patient schedule was sometimes a barrier due to patients having other commitments, not anticipating a longer visit, not wanting to wait to see the RDN if with another patient, or not wanting to meet with an RDN. The noted barriers were reported anecdotally, were not quantified in data collection, and the patients remain in the data set. The clinic team, however, began setting the expectation that the RDN was a part of the care plan, to anticipate a longer fasting visit annually, and establishing a relationship with the RDN helped patients view the RDN as a preventative member of the care team rather than punitive.

In addition to the main hospital location, Dayton Children’s Hospital offers diabetes clinic at 3 additional locations—Springboro, Springfield, and Troy. At the start of this project, the RDNs served the main campus location only, and patients would need to come to main campus to see an RDN. Telehealth from main campus clinic to the off-site locations was added during this project and increased access and equity of care for the patients receiving services at the off-site locations. In addition, the pandemic led to developing telehealth video visit capability for RDN-only visits, which further increased opportunities for all patients served by the clinic. Next steps in the next fiscal year include addition of an RDN physically at off-site locations.

OUTCOMES
The project was successful with the SMART aim goal achieved in 2020 and sustained through all of calendar year 2021, with a mean of 81% of patients with diabetes in the target population meeting with an RDN annually. The data are displayed in a control chart (Figure 4). The x-axis is the month and the y-axis is the percent of patients in the target population who had seen an RDN in the past year. A rolling 12-month period was used to allow for real-time data.

There were 6 statistically significant changes present on the control chart, as evidenced by the changes in the stairstep solid line. The dotted lines above and below the stairstep solid line are the upper and lower control limits. Dayton Children’s Hospital considers 3 types of statistically significant variation—a trend (6 consecutive increasing or decreasing data points), a shift (8 data points above or below the mean line), or an outlier (a data point above or below the upper or lower control limit). Key PDSA cycles and interventions are annotated on the chart.

RESULTS
Key Learnings
The first major learning of the project was to critically evaluate data for accuracy. Although fortunate to have access to an electronic report generated from the electronic medical record, the first version was created without input from the clinical nutrition and lactation department, and later required multiple revisions and audits to ensure the data being evaluated were comprehensive and measuring the intended outcome.

A common reaction to a process problem is to add additional staff. This project was a great example of maximizing efficiency, and supported the case that additional staffing is not always needed to accomplish a goal. In this case, a 50% increase in volume of patients with diabetes who had an annual RDN visit was achieved through process changes.

In addition, process changes take time to hardwire as part of the system. A key example is the concept of having the RDN see patients with diabetes as part of an annual fasting visit; this was not a new idea, yet engaging the team in accepting this process as the norm took years.

CELEBRATION AND CONCLUSIONS
Success was celebrated throughout the course of the project through results sharing, informal celebration, and verbal and written staff recognition in both clinical nutrition and lactation and endocrinology departments. RDNs also received a financial incentive of a $200 bonus 2 years in a row because
Figure 3. Plan-Do-Study-Act (PDSA) summary. MNT, medical nutrition therapy; RDN, registered dietitian nutritionist.
Figure 4. Control chart. RDN, registered dietitian nutritionist.
this project was the clinical nutrition annual accountability metric. Dayton Children’s Hospital senior leadership team supported and recognized the success of the project.

The strategies used in this project have been spread to multiple other projects, including the diabetes annual social worker metric and annual RDN visits for patients in the gastroenterology department with gastrostomy or gastrojejunostomy feeding tubes. In addition, the report created to measure results for this project and the tool to identify the patients within the medical record have both been modified and are anticipated to be used for multiple additional projects.

IMPLICATIONS FOR PRACTICE

After more than 1 year of sustained success, the endocrinology and clinical nutrition and lactation departments are now planning next steps to further improve quality and frequency of care for patients with diabetes at Dayton Children’s Hospital, while remaining committed to maintaining at least annual RDN visits for >75% of patients with diabetes.

Efficiency of the current RDN staffing strategy in endocrinology has been maximized. To expand success, additional FTE will be needed. An additional 1.0 FTE has been requested for the next fiscal year, beginning July 2022. Plans for enhanced services include offering an RDN physically at off-site clinic locations and reduction in telehealth from main campus to off-site locations. Although positive feedback was received about the availability of telehealth visits at the off-sites in lieu of needing to travel to another location, there was also consistent feedback from patients and staff that in person would be preferable and would save time for ancillary clinic staff who set up the mobile telehealth clinic for the existing telehealth from main campus to off-site locations.

A next step in consideration is to enhance frequency of medical nutrition therapy for newly diagnosed patients, offering 3 to 6 sessions in the first 6 months, as suggested by the Academy of Nutrition and Dietetics’ Evidence Analysis Library for adults with type 1 and 2 diabetes.5 Alternatively, increasing target frequency of RDN visits to twice annually may be considered.

References

Family-Empowered Treatment in Higher Levels of Care for Adolescent Eating Disorders: The Role of the Registered Dietitian Nutritionist

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Family-Based Treatment (FBT) is the leading evidence-based treatment for adolescents with eating disorders, and has particularly strong research support for the treatment of anorexia nervosa (AN). FBT is an outpatient treatment consisting of 3 phases. In phase 1, because patients with AN are often ambivalent about treatment and recovery, parents are given the responsibility for weight restoration. This involves making all eating-related decisions for their child, including deciding what will be eaten and when, how much will be eaten, monitoring all meals and snacks, and curtailing physical activity. Once the patient has gained weight, eating disordered behaviors have lessened, and the adolescent’s thoughts and behaviors are no longer being driven by the eating disorder, responsibility for eating is gradually handed back to the adolescent—to whatever extent is age-appropriate— in phase 2. In phase 3, the treatment team ensures that the adolescent is back on track with healthy development. FBT has also been found to be effective for bulimia nervosa. Although the phases of treatment are the same for bulimia nervosa, the focus of treatment is on developing a regular pattern of eating and eliminating binge eating and purging. The following are the fundamental tenets of FBT:

1. FBT takes an agnostic view of the cause of the eating disorder. There are no assumptions made about what might have caused the disorder; rather, the focus is on what can be done to help reverse the dangerous physical and psychological consequences of the eating disorder as quickly as possible.
2. Parents are empowered to take on the often difficult task of weight restoration. This is done in part by encouraging parents to rely on the knowledge they already have about raising and feeding healthy children and putting this knowledge into action rather than relying on prescriptive measures, such as meal plans.
3. Relatedly, it is important that parents feel confident in their role as the main agents of change in treatment; thus, FBT therapists guide parents in their decision making rather than telling them what to do.
4. It is emphasized to families that the ill child is under the influence of a powerful disorder that is affecting his or her emotions, thoughts, and behaviors when it comes to issues of food, eating, shape, and weight. The healthy child is not in control—the eating disorder is. Thus, there is an emphasis in FBT on separating the child from the illness. The illness is often referred to as “the eating disorder” in an effort to remind parents that when their child has difficulty eating a meal, for example, the child is not being “difficult.” The eating disorder has taken over and it is the eating disorder, not the child, that needs to be challenged.
5. Finally, FBT is a pragmatic approach. The focus of treatment is squarely on eating and weight until these issues have been resolved.

FBT’s efficacy as an outpatient treatment has led to the incorporation of its principles into higher levels of care for eating disorders, including inpatient units, partial hospitalization or day hospital programs, and intensive outpatient settings. Caregiver involvement in residential programs has traditionally been somewhat limited due to factors such as distance to the treatment setting (as many residential patients travel out of state for treatment); program philosophy; and length of stay, although many inpatient and residential programs do incorporate family work to a limited degree. Given the now widely accepted view that parental involvement is essential to the recovery process for adolescents with eating disorders, it is important that parents are empowered in the treatment of their child at all levels of care. However, FBT cannot be replicated in higher levels of care. It was designed as an outpatient treatment, and clinical dynamics prevent it from being implemented as originally designed at any other level. Research has found, however, that FBT principles can be incorporated successfully into higher levels of care, if programs adhere to the core FBT tenets.

Eating Recovery Center (ERC) is a national, multisite treatment facility offering higher levels of care for patients with eating disorders, including inpatient programs, partial hospitalization programs (PHPs), in-person intensive outpatient programs (IOPs), and virtual IOPs (VIOPs). Inpatient and residential programs offer 24/7 care, PHPs offer 6 to 10 hours of treatment 5 to 7 days per week, and IOPs offer 3 hours of
treatment per day for 3 days per week. Inpatient treatment is generally reserved for patients who are medically unstable or psychiatrically unsafe, and residential and lower levels of care can focus more on psychological aspects of treatment. Patients may enter at any level of care, but once they enter treatment at ERC, they are encouraged to step-down through IOP treatment in order to provide them with the most support and structure possible.

Due to the research evidence supporting the use of FBT, ERC has made an effort to involve family and draw on FBT principles to the extent possible, referred to here as family-empowered treatment. ERC provides nutritional rehabilitation for patients with support from a registered dietitian nutritionist (RDN). Although research studies on FBT have not included RDNs, RDNs are an important part of ERC’s multidisciplinary treatment teams, which also include psychiatrists, therapists, nurses, primary care doctors, and case managers, and may play a particularly important role at higher levels of care when caregiver involvement is necessary more limited than it is on an outpatient basis. RDNs facilitate nutritional rehabilitation, which is a vital component to the patient’s recovery. Without adequate nutrition, therapeutic work can be difficult to conduct, and sustained recovery may not be achievable. In order to work within an FBT framework, RDNs work primarily with the caregivers, as opposed to the ill child or adolescent, and should refrain from recommending rigid meal plans. Although meal plans are not used in outpatient FBT, they are often helpful at higher levels of care and are used routinely at ERC.

The purpose of this article was to outline ERC’s recommendations for family-empowered care in the context of the RDN scope of practice and the nutritional rehabilitation process. When relevant, recommendations are provided separately for different levels of care. This description may aid other programs that are searching for ways to incorporate families into the treatment process at higher levels of care.

RDN COMMUNICATION WITH PARENTS

Parental empowerment and promoting parental self-efficacy is a fundamental tenet of FBT. At ERC, this tenet is incorporated into family-empowered care by welcoming caregivers as essential members of the treatment team. The RDN partners with caregivers to educate them on the need for nutritional rehabilitation for recovery, to empower caregivers to make food and nutrition care decisions, and to support them throughout the recovery journey.

Inpatient, Residential, and Partial Hospitalization Programs

At higher levels of care, it is essential that communication with caregivers occurs frequently. Starting from the first day of admission, the RDN updates the caregivers at least weekly, although communication may occur more frequently, depending on patient care and progress. Information discussed with families includes weight status; target weight goals; evaluation of growth charts; laboratory values and/or vital signs of interest; enteral nutrition plans, if indicated; meal plan; future meal plan changes; completion goals; food challenges; progression through family-empowered care phases; family meals; and status of eating disordered behaviors. The RDN and caregivers work together to determine interventions and next steps in treatment. The RDN may provide this communication during a family therapy appointment along with the therapist, or during a weekly RDN session with caregivers.

IOP and VIOP

The RDN continues to support caregivers during biweekly in-person IOP sessions or weekly VIOP sessions, although these sessions may also include the patient for part or all of the session, as indicated by patient progress in treatment.

RDN INVOLVEMENT WITH PARENTS

During phase 1 of outpatient FBT, the therapist empowers parents to feed their child, giving parents the responsibility for making all choices around food. Research has shown that the effectiveness of FBT is predicted by parents’ self-efficacy in feeding their child. Following FBT principles, ERC puts caregivers in charge of menu planning, including completing menus for their child while in inpatient or residential programming, as well as choosing, preparing, plating, and monitoring all meals and snacks if the child is at home during the PHP level of care. Patients are not involved in menu planning at these levels.

Inpatient, Residential, and Partial Hospitalization Programs

RDNs at ERC meet with caregivers for weekly nutrition sessions to educate and support them in meal planning; incorporating challenge foods; and, for caregivers eating meals with their child, developing strategies for redirecting eating disorder behaviors at meals and snacks. The degree to which caregivers experience self-efficacy around feeding and supporting their child determines how much guidance and structure the RDN provides around the meal plan. A study conducted by Nilsen and colleagues found that some parents felt that having a structured meal plan was helpful in re-establishing parental authority. It should be noted that manualized outpatient FBT does not use meal plans, but they are often considered necessary at higher levels of care. At ERC, RDNs use a structured meal plan as a tool to aid caregivers in better understanding, implementing, and enforcing meal and snack expectations. The RDN aims to take a nonauthoritarian approach, consistent with one of the main tenets of FBT, guiding and empowering caregivers in making food choices rather than telling them exactly what to do.

Using family-empowered treatment means that RDNs work primarily with the caregivers, not the patients, when discussing meal plans and meal plan changes. The RDN’s work should focus on increasing caregiver alignment and confidence in renourishment. To reach these goals, caregivers should be involved in all steps of the meal planning process. Consistent with outpatient FBT, weight restoration is a priority during the initial phase of treatment. Meal plans are adjusted frequently to aid in this process, and caregivers are kept informed as to when and why meal plan changes are being considered. It is important to get caregivers’ buy-in, as they will be a key source of support and encouragement for the patient as the new meal plan is implemented.
implemented. It is important to seek caregiver input or insight into ways in which to change the meal plan whenever possible.

Given that the patient is likely entrenched in his or her eating disorder at this point and unable to make appropriate food and eating decisions on his or her own, it is best in the early stages of recovery to refrain from providing detailed meal plan information to patients. It is sufficient to provide general information as to frequency of meals, variety of the meal plan, and expected meal completion; for example, an RDN might say:

You will begin on a meal plan to help you develop more consistent eating. You will receive 3 meals and 3 snacks per day. Your meals and snacks will incorporate all types of foods. Your goal will be to complete 100% of the meals and snacks you receive.

At ERC, as part of family-empowered care, caregivers are provided with opportunities to eat meals or snacks with their child on the unit. They may eat the ERC-served food with their child, they may practice cooking for their adolescent by coming onto the unit to prepare a meal, or they may bring a home-cooked meal on site to eat with the patient. Caregivers are also given opportunities to practice portioning for their adolescent via on-unit buffet portioning, which is facilitated by the support of a RDN. This can allow caregivers more responsibility for food decision making and preparation than they have at higher levels of care.

Adolescents join their families at the dinner table and direct their screens toward themselves, with their volume muted, so that the RDN and/or therapist can monitor the meal, while allowing for the patient to engage with his or her family.

RDN INVOLVEMENT WITH CHILDREN AND ADOLESCENTS

In outpatient FBT, once eating disordered behaviors and cognitions have improved and weight is normalized or nearly normalized, families move into phase 2, in which the adolescent begins to gain back some autonomy and decision making around food. At ERC, adolescent patients are generally not given any input into, or control over, their eating until the end of PHP or the IOP level of care, depending on when weight restoration is achieved, negotiation and eating disordered behaviors are significantly reduced, and the adolescent is demonstrating a commitment to work toward recovery.

Inpatient, Residential, and Partial Hospitalization Programs

At the inpatient, residential, and partial hospitalization program levels of care, RDNs support adolescents with meal-time coaching, check-ins to build rapport, and encouraging and tracking meal-time goals through incentive plans and/or goal charts. Although RDNs do not meal plan with the adolescent, it is important that they are building rapport with patients in order to help support and validate them through the challenges of treatment. The main focus of the RDN, however, is to educate and empower the caregivers.

IOP

In order to gain more autonomy and move to the IOP level of care, adolescent patients should be able to demonstrate the ability to make food choices that are not (or are minimally) affected by their eating disorder. This may include the following: completing 100% of their meal plan and not requiring a supplement; completing their meal plan with no or very minimal negotiation around meals and snacks; incorporating a variety of foods, including regular integration of challenge or fear foods; abstaining from eating disordered behaviors; abstaining from compensatory behaviors (such as exercise, purging, and laxative use); or receiving food-related feedback from caregivers without becoming agitated or defensive.

Giving adolescent patients more autonomy should be a gradual process to ensure that the adolescents are able to make food choices without their eating disorder interfering with their decisions. Responsibility for making food choices can first be initiated at ERC or at home, depending on the family’s preference. The RDN or caregivers may give the adolescent 2 to 3 options to choose from at a snack, starting with 1 snack per day and increasing as appropriate, with this same approach being replicated at home. Another option while in program is for the adolescent to choose a snack from a snack buffet, again starting with 1 time per day and increasing as appropriate.

At home, caregivers may allow the adolescent to choose a snack with caregiver approval. Additional examples of adolescent involvement at this level of treatment include the adolescent being in the kitchen when meals or snacks are being cooked or prepared by caregivers; being able to gather ingredients for caregivers when making a meal from a recipe; being given permission to go to the pantry or refrigerator to get the snack a caregiver has prepared; or being able to select at a restaurant from 2 to 3 options that caregivers have decided would be appropriate based on the adolescent’s meal plan. Once the adolescent is successfully choosing and plating snacks with little to no feedback, the
adolescent may be allowed to start giving input or participating in choosing or making meals, as developmentally appropriate. Patients are not provided with calorie amounts or ranges, but are guided by their caregivers and the RDN to choose balanced, appropriate meals and snacks that follow the principle of “all foods fit.”

RDN ROLE IN NUTRITION SUPPLEMENTATION

In outpatient FBT, it is expected that patients will complete 100% of what their parents give them. If this does not happen, parents are often encouraged to either “wait out” the eating disorder until all food is eaten, or to carry over remaining food into the next meal or snack, as a way to ensure that the patient is receiving the adequate nutrition for recovery and to send the message to the eating disorder that it cannot get away with restricting nourishment. Foodservce and food safety limitations prevent carrying over of refused nutrition in higher levels of care, and staffing patterns do not permit program staff to wait out the eating disorder, especially as this can, at times, take hours. Instead, a supplement is provided for each patient directly after inability or unwillingness to complete meals and snacks. The amount of supplement to be served is determined by the RDN and indicated on the meal plan, which is available for staff to reference during the meal and snack times. Caregivers are educated on this process and updated and involved in any changes to supplement type.

Inpatient and Residential Programs

All patients are offered a supplement after each meal or snack that is not completed. If patients repeatedly refuse the supplement, the RDN will work with caregivers around options to ensure that nutritional needs are met. These options might include the following:

1. Any supplement that is not completed during the day is offered to caregivers at the end of the day when they arrive to pick up their child. The caregiver will then sit at the facility with the patient until the patient completes the supplement.
2. Caregivers can provide the supplement at home to make up for restriction inside or outside of the program.
3. With RDN guidance, caregivers can serve additional food at home to make up for food that was not completed during the program day.

IOP and VIOP

In general, supplements are not offered at the IOP level of care, as most patients have progressed enough that supplements are no longer needed. If restrictions were occurring, additional food would be recommended first. If a restricting pattern continued, a supplement may be used as a temporary means to get the patient back on track with treatment, or to maintain an appropriate level of nutrition until the patient is moved to a higher level of care.

RDN ROLE IN CAREGIVER NUTRITION GROUPS

Another way that ERC seeks to empower caregivers and increase caregiver self-efficacy is to have RDNs teach and facilitate weekly nutrition education groups. This is recommended for caregivers at all levels of care. Given that caregivers will typically have a great deal of control over the meal plan once the adolescent discharges, it is important for them to understand the nutritional rehabilitation process and how they can be successful at home.

PHP

When the patient steps down to the PHP level of care, the RDN can then expand upon topics that are geared toward discharge and continuing recovery at home. Recommended topics include ways to use flexibility in the meal plan, how to integrate fear-food exposures, how to normalize eating behaviors, how to navigate home cooking vs restaurants, and how to reestablish physical activity. The RDN should also encourage caregivers to reflect on their own relationship with food and to consider how their child will recover from their eating disorder in a world that idealizes

Inpatient and Residential Programs

When the adolescent patient is in an inpatient or residential level of care, the caregiver nutrition groups should focus on the nutritional rehabilitation process, nutrition during child and adolescent growth and development, weight normalization and growth chart utilization for goal weight setting, meal plan education, and a healthy food philosophy. It is important for the RDN to explore family food beliefs and to assist caregivers in understanding that all foods can fit into a healthy diet, and that balance, variety, and moderation may aid in their adolescent's recovery. Indeed, reduction in dietary restraint has been found to be a mediator of treatment outcome in cognitive-behavioral therapy. The RDN explains the ERC exchange system, which is based on the diabetic exchange system, discusses each category and the nutrients of each category, and shows caregivers how to complete menus and challenge the eating disorder.

These nutrition education groups also address the various behavioral interventions that are used by staff on site, as many of these interventions can also be used by caregivers at home. For example, it is beneficial to teach caregivers about bathroom monitoring if their child has a history of purging. It could also be useful to teach them how to perform mouth and pocket checks if there is a history of hiding food. Other behavioral interventions that should be discussed are how to adequately supervise eating times, how to redirect disordered mealtime behaviors, how to interrupt restrictive behaviors using food and supplements, and how to interrupt excessive movement or exercise against medical recommendations.
thiness and control over food intake. Misinformation about nutrition, food, and health is prevalent, so it can be difficult for children, adolescents, and caregivers to know when something is important for good health or just a passing fad. The RDN should discuss how this becomes even more difficult when information is filtered through the lens of an eating disorder, which will impact which information adolescents want to believe. The RDN will coach caregivers on how to debunk myths and misconceptions with their adolescents at home.

IOP and VIOP
Issues that arise during IOP may be different than those that need to be addressed at higher levels of care. For example, patients may struggle to incorporate challenging foods at home, where there are more choices and there is more freedom than there would be in a more structured higher level of care environment. Caregivers may therefore need more guidance as their adolescent spends more time at home.

RDN ROLE IN PATIENT NUTRITION GROUPS

Inpatient and Residential Programs
When adolescents are at the inpatient or residential levels of care, they are likely entrenched in their eating disorder and unable to think about food in a beneficial, healthy, or educational way. Therefore, nutrition education groups are not recommended for adolescent patients at these levels.

PHP, IOP, and VIOP
Once adolescents enter or step down to PHP or IOP levels of care, it is recommended that the RDN teach a weekly nutrition education group. At this point, adolescents are likely completing their meal plans, engaging in therapy, and are cognitively able to learn why food is beneficial and necessary. Recommended topics for nutrition education groups include macro- and micronutrient education, how the body digests and metabolizes food, the health consequences of eating disorders, and how to navigate recovery in a sociocultural context that promotes dietary restriction. It may be helpful for the RDN to make these education lessons interactive, have patients discuss and share their experiences, and make some lessons into games (eg, Jeopardy and Bingo) so that the adolescent can better retain the information.

RDN ROLE IN TUBE FEEDING
Enteral nutrition via a nasogastric (NG) feeding tube is not used in outpatient manualized FBT, as patients are expected to complete all meals orally. However, there are times when tube feeding is necessary for certain patients. Delivering nutrition via a feeding tube is a service sometimes offered at higher levels of care when patients are unable to meet necessary oral nutrition and hydration to maintain medical stability or weight gain for recovery.

Inpatient and Residential Programs
To align with family-empowered care, the RDN and treatment team will ensure that caregivers are included in the decision to use enteral nutrition, that they are provided with education on feeding tubes and specifics about individual tube feed plans, and that they approve of tube use. Keeping caregivers informed on their child’s progress throughout treatment will minimize any surprise on the part of the caregivers regarding a recommendation for tube feeding. The following are recommendations for family-empowered care: if able, caregivers will join the RDN and/or the therapist to inform patients of NG tube placement; caregivers must give consent before any enteral intervention; caregivers are called after the NG tube is placed to inform them of the placement and how it was tolerated; and patients are provided with an opportunity to call their caregivers before or after the NG tube placement for their caregivers’ support.

The caregivers, patient, and RDN will work together to create oral completion goals that will result in NG tube removal and discontinuation of enteral nutrition. The RDN will update caregivers with the status of goals, tube feeds, and overall tolerance.

PHP, IOP, and VIOP
Tube feedings are not generally used at these levels of care. If a patient has progressed to the point that he or she is in PHP or IOP, it is expected that meals and snacks are able to be completed orally.

ADDITIONAL CONSIDERATIONS

Emotion-Focused Family Therapy
Emotion-focused family therapy is the basis of family therapy at ERC. Its focus is to teach caregivers skills to support their loved one through emotion coaching, behavior coaching, and relationship repair. It also focuses on “caregiver blocks” that may interfere with caregivers’ effective involvement in those areas. The primary focus is to help parents support their child’s nutritional rehabilitation, interrupt eating disorder symptoms, and become their child’s emotion coach. Emotion coaching involves validation (communication of understanding of the child’s experience), followed by emotional support (eg, comfort, reassurance, or space) and/or practical support (eg, boundary holding, limit setting, problem solving, or redirection).

Given the difficult nature of RDN work in the eating disorder field, ERC recognizes that RDN skill development around counseling and communication techniques supports better treatment outcomes. RDNs work to implement nutrition recommendations for care that directly challenge the eating disorder and can cause fear and resistance from families and adolescent patients. Furthermore, patients experience elevated acuity of illness at higher levels of care, and thus emotional distress for patients and families can be high and difficult to navigate. Ensuring that RDNs are equipped with a broad understanding of the emotion-focused family therapy treatment approach, and how to use emotion coaching and validation in their work, is part of the recommended training when onboarding and throughout employment. It is recommended that RDNs use the skill of emotion coaching with both adolescent and parent concerns, as it can address hesitation, resistance, or avoidance in response to treatment recommendations. RDNs also have the opportunity to take additional training in motivational interviewing.
dissociative behavior therapy, radically open dialectical behavior therapy, cognitive behavioral therapy, acceptance and commitment therapy, and exposure and response prevention.

Support of a Variety of Family Systems
Family-empowered treatment can require a great deal of oversight and work on the part of caregivers at all levels of care. Research has found that outpatient FBT is as effective for single-parent families as it is for 2-parent families, but single-parent families may benefit from a longer course of treatment. Thus, it is important in both outpatient FBT and family-empowered care to be flexible in meeting the needs of various types of family systems. ERC recognizes that all family systems are unique and complex. They are made up of different cultures, caregivers, financial situations, housing situations, history, and needs. Using the fundamental tenets of FBT, families are supported by the treatment team to navigate their individual needs to make the recovery process possible and achievable for all family constellations. Some ways that ERC has supported families in need include the following: using transportation services to bring patients to and from programming; using school counselors, nurses, or teachers, and 504 plans to allow for meal monitoring before, during, and occasionally after school hours if a caregiver cannot provide monitoring due to work obligations or transportation obstacles; and including extended family or close friends in treatment when needed to support caregivers. ERC also offers interpreter services to support families who do not speak English fluently.

Challenges of Incorporating Intuitive Eating at Higher Levels of Care
In outpatient FBT, the ultimate goal for patients is relearning to eat according to hunger and satiety cues, and to be able to eat flexibly and spontaneously, likely similar to how they were able to eat before the onset of the eating disorder. Intuitive eating can be defined as eating based on biological and physical hunger and fullness, and allowing oneself to find pleasure in eating without feeling guilty. The following are the 3 core characteristics of an intuitive eater: the ability to eat based on physical hunger vs emotional hunger, consistently relying on regular hunger and satiety cues, and giving oneself unconditional permission to eat. Although intuitive eating may be a goal for many RDs treating patients with eating disorders, ERC does not recommend this approach for patients at higher levels of care. Many aspects of intuitive eating, such as rejecting the diet mentality, challenging the internal “food police,” coping with emotions without food, and respecting the body, are promoted at ERC. However, eating based on hunger and satiety cues is not recommended at higher levels of care, as patients are usually not displaying the 3 core characteristics of intuitive eating.

Eating disorders have significant negative effects on the gastrointestinal (GI) tract, which may impact one’s ability to distinguish between physical hunger cues and emotional cues. Salvioli and colleagues found that >90% of patients with eating disorders reported GI symptoms. When surveying patients at an eating disorder treatment center, Boyd and colleagues found that 98% of patients met the criteria for 1 or more functional GI disorders. GI symptoms, such as early satiety and abdominal discomfort, can complicate treatment and may play a role in skewing normal hunger and fullness cues.

In addition, studies have found that instead of food stimulating pleasure and reward in individuals with AN, it stimulates anxiety. The way the brain responds to hunger is altered in individuals with AN, leading to low reward stimulation in the brain regarding food. In other words, individuals are likely to have high levels of anxiety and low levels of pleasure around food throughout the recovery process, potentially affecting their ability to listen to and develop normal hunger and fullness cues needed to effectively engage in intuitive eating. Therefore, individuals early in eating disorder recovery are not able to consistently rely on regular hunger and fullness cues to meet their nutritional needs.

Individuals with eating disorders are also unable to give themselves unconditional permission to eat, one of the requirements of intuitive eating. Hunger cues and one’s nutritional needs may not be respected by an individual who is struggling with an eating disorder. Eating disorders are driven by distorted and inaccurate beliefs around food and nutrition, and those with eating disorders do not have an accurate understanding of their nutritional needs and what makes up a balanced diet. Individuals with AN also often eat the same low-energy foods with limited variety.

Given these findings, structure around meals and snacks is needed to ensure that individuals recovering from an eating disorder are meeting their nutritional needs, including all food groups, eating at regular times, weight restoring if necessary, and not engaging in disordered eating.

CONCLUSIONS
Although FBT is the leading treatment for children and adolescents with eating disorders, it is an outpatient treatment and cannot be replicated in higher levels of care. However, it is possible to incorporate FBT principles...
into higher levels of care. ERC has developed a treatment protocol that incorporates FBT principles, such as caregiver empowerment, into higher levels of care. RDNs play an important role in implementing this protocol. Decisions about the level of caregiver and patient involvement at meals and snacks, and the content covered in RDN sessions and groups, are based largely on the degree to which the eating disorder is influencing thoughts and behaviors related to eating. As the eating disorder recedes and patients progress through treatment, they are gradually given more responsibility over their eating, with the ultimate goal of eating behaviors returning to normal for each individual patient and family. This article may serve as a guide to other programs seeking to incorporate family-empowered care into their treatment, and to describe the important role of RDNs in this novel treatment model. Although the focus of this article is on family-empowered care based on outpatient FBT, future research may seek to examine the efficacy of treatment facilities offering higher levels of care that focus on approaches other than FBT. For example, preliminary data support the use of the Unified Protocol in a residential program for eating disorders.42

References


How do researchers know what they are measuring when they use questionnaires? Confidence in the ability of measures to appropriately capture intended constructs for a particular population is essential to scientific rigor and a challenge for the social sciences. Parnarouskis and colleagues bring up a critical point in their Discussion about the limitations of using a measure for which the validation samples may not have adequately represented specific groups of interest. We appreciate the opportunity to continue this important conversation because it is a topic that is of high importance to the study of food insecurity and eating-related behaviors.

It is common for researchers to use psychometrically validated measures in populations that were not systematically included (or were even systematically excluded) in measures’ initial validation studies. This occurs because measures may be validated in samples with lower diversity in important variables like race, ethnicity, socioeconomic status, gender, and sexual orientation. Further, even when there is diversity represented within an overall sample, studies may be underpowered to test measure performance differences in sample subgroups. Consequently, measures are often used to assess questions for populations in which they have yet to be validated. It is often not practical for measure developers to conduct an in-depth psychometric validation using all potential populations before releasing a measure. However, it is critical that measurement validation work continues beyond the initial validation to establish that measures function appropriately in populations of interest, which will increase confidence in conclusions drawn from research.

For a measure to have adequate psychometric properties, it must be both reliable and valid. Reliability refers to the extent to which measurement scores replicate across different populations, across time, and across different components of the measure itself. Validity is the extent to which a psychometric tool measures what it was designed to measure. When researchers develop a new measure, they often conduct an initial study in participants from the general population to establish internal consistency, test–retest reliability, and construct validity, as well as to identify the factor structure. The measure may then be tested within a specific subpopulation of interest. Below, we describe some challenges with applying measures to novel populations for whom such measures have not been psychometrically validated and—to help equip researchers with the necessary psychometric toolbox—outline some methodological approaches to determine whether measures perform similarly across novel populations.

Psychometric Validation is Needed for Measures Assessing Populations with Food Insecurity

One must be cautious in interpreting study results when using measures in populations for whom the psychometric validity of such measures has not been established. This seems particularly important when measuring eating-related constructs in people with food insecurity because their eating patterns may deviate from those of the general population for reasons other than those intended to be captured by a given measure. Furthermore, caution is warranted to avoid overpathologizing natural physiological, behavioral, and emotional responses to the stressor of food insecurity.

There are conceptual reasons why it would be critical to validate eating-related measures (e.g., food addiction, and eating disorder symptoms) in populations with food insecurity. Because the experience of food insecurity involves—by definition—disruption of food intake or eating patterns because of lack of money and other resources, items of measures such as the Yale Food Addiction Scale (YFAS) which is used in the study by Parnarouskis and colleagues, may be interpreted differently by individuals experiencing food insecurity. As examples, the YFAS includes items that measure eating beyond hunger and eating until feeling physically ill. Yet, individuals with limited resources have identified overeating when food is available as a coping strategy to make it through the month with enough food. Thus, in populations with food insecurity, items on the
YFAS, which assess overeating-related phenomena may capture strategies to cope with food insecurity rather than symptoms of food addiction. Likewise, the YFAS asks about strong urges to eat certain foods, which, in the context of food insecurity, may stem from deprivation rather than food addiction. In addition, the YFAS item about distress caused by one’s eating behaviors may similarly tap into unique experiences of populations with food insecurity and could thus be interpreted differently in the case that people with food insecurity have a different definition or source of distress than those without food insecurity. It is possible that for people with food insecurity, unplanned eating of even small amounts of food could cause less food to be available for themselves or for their families, which could cause high distress but may not reflect food addiction.

Considering the reasons that eating behavior measures such as the YFAS could conceivably capture different constructs in people with food insecurity, one must be cautious in interpreting findings using these measures to avoid over-pathologizing or misclassifying behaviors. Thus, to advance understanding of maladaptive eating behaviors in these populations and enhance confidence in findings, more psychometric testing of measures is required in populations with food insecurity. This can be achieved using both qualitative and quantitative approaches, as described below.

IMPLEMENTING QUALITATIVE RESEARCH TO UNDERSTAND MEASURE PERFORMANCE

A critical step toward understanding whether or not a measure appropriately captures the construct of interest across different populations is to assess the extent to which item interpretation is similar across those populations. Qualitative research serves as a valuable tool to achieve this goal. Qualitative studies using interview or focus group procedures can be implemented to evaluate how specific items are interpreted, which situations or contexts respondents consider when responding to questions, and in the case that there are points of confusion regarding how items are worded. A specific approach that is particularly valuable in this realm is cognitive interviewing, which involves gathering information about how individuals arrive at their responses on particular items. In general, qualitative approaches could verify whether or not the items are interpreted and answered in a way that is consistent with the overall construct of interest. For example, Meza and colleagues found, using a qualitative approach, that some undergraduate students with food insecurity experienced frequent stressful thoughts about food that interfered with daily life, a sense of not feeling worthy of food, and/or not feeling worthy of help from others in obtaining food. Thus, qualitative research has the ability to help us make inferences about the more nuanced emotional context of reported experiences, such as thinking a lot about food or restricting food.

IMPLEMENTING QUANTITATIVE RESEARCH TO UNDERSTAND MEASURE PERFORMANCE

Future research should also employ specific quantitative approaches to evaluate whether or not eating-related measures perform similarly in individuals with food insecurity compared with individuals without food insecurity. Quantitative approaches can provide a statistical gauge on the extent to which measures assess their intended constructs when administered in individuals with food insecurity. Such approaches could inform particular items or overarching constructs that may need to be interpreted with greater caution or amended to accurately assess/reflect the experiences of individuals with food insecurity.

First, it is essential to ensure the structural similarity, and thus construct validity, of eating-related measures across samples with and without food insecurity. An initial step could be to use confirmatory factor analysis to verify that measures such as the YFAS replicate on a structural level in individuals with food insecurity. A measurement invariance approach would be ideal for exploring whether or not a measure captures the same constructs in groups with and without food insecurity and whether or not the comparison of scores on a given measure is appropriate. In measurement invariance testing, multigroup confirmatory factor analysis is first conducted to assess whether or not a measure’s factors (usually representing scales or subscales on a measure) replicate across groups of interest (eg, across a group of individuals with food insecurity and a group of individuals without). Next, more restrictive confirmatory factor analysis models are conducted to evaluate whether or not model fit to the data substantially worsens when item factor loadings and item intercepts/thresholds are specified as equal across groups of interest. Worsening of model fit with the addition of such constraints (ie, evidence of measurement noninvariance) indicates that notable differences across groups are present at the level being evaluated (eg, at the loading or intercept/threshold level), which means greater caution may be warranted when comparing measure scores across groups. For example, Perez and colleagues utilized a measurement invariance approach with the Child Feeding Questionnaire and the Child Eating Behaviour Questionnaire, finding that several constructs varied as a function of food insecurity, leading to the inference that certain constructs were less relevant to households with food insecurity.

As previously mentioned, there may be conceptual reasons why individuals with food insecurity would respond differently to certain items intended to measure constructs such as food addiction. Future research should thus also consider the extent to which responses on such items may be explained by measurement differences rather than reflecting true group differences in levels of the eating-related construct being measured. Such clarification at the item level can be achieved by testing for differential item functioning. Differential item functioning—which corresponds to measurement noninvariance at the item intercept or factor loading level—refers to situations in which the probability of endorsing an item differs across groups, even at similar levels of the overall construct being measured. Testing for differential item functioning using an item response theory approach may prove particularly informative because it can examine both uniform and nonuniform differential item functioning, as well as yield item characteristic curves depicting the likelihood of endorsing a particular item response at various levels of the underlying latent variable.

Although measurement invariance testing provides a more comprehensive assessment of how an overall measure performs across groups, differential item functioning may be a useful alternative approach in some circumstances. For example, differential item functioning may be particularly
useful for measures whose factor structures do not consistently replicate or whose development was not focused on having a clear, robust factor structure, given that achieving adequate fit in confirmatory factor analysis is a prerequisite for measurement invariance testing. An illustrative example of this approach is provided by O’Connor and colleagues, who recently detected differential item functioning by food security status on a measure of disordered eating. Specifically, certain items related to overeating on the Eating Disorder Diagnostic Scale demonstrated differential item functioning in individuals with food insecurity, such that incorrect inferences about the severity of disordered eating may be made when interpreting responses on particular items in individuals with food insecurity. This example highlights how differential item functioning can be used to identify certain items that do not perform as measures intended in food-insecure samples.

NEXT STEPS AND CHALLENGES

Implementing the above qualitative and quantitative approaches is critical to ensure that research on eating-related behaviors in individuals with food insecurity draws valid and reliable conclusions. The consequence of not performing further psychometric validation is that erroneous (and potentially harmful) conclusions may be drawn about the prevalence and severity of different eating-related behaviors, which could result in the misidentification of pathology and/or a failure to identify true concerns facing communities, families, and individuals.

The work of psychometric validation in populations with food insecurity will also need to consider the heterogeneity of identities represented within this population. Food insecurity often coexists within the complex intersection of variables such as race, ethnicity, socioeconomic class, gender, sexual orientation, and disability. Many people with food insecurity have multiple marginalized identities because food insecurity disproportionately influences Black, Hispanic, and Indigenous communities due to past and present factors such as socioeconomic conditions, structural racism, discrimination, and disruptions to traditional subsistence methods. Consequently, psychometric validation must also take into account intersectional identities (which are often not centered in the original validation studies) in ensuring representation within samples and subsamples. Such careful validation work is critical to scientific rigor and is necessary for research on food insecurity to continue to move forward.

In addition to validation work, researchers should also continue to follow best practices for reporting statistics related to the reliability and validity of measures in their study samples and note when measures are being used with populations not centered in the original validation studies. Furthermore, authors should clearly state the limitations of using such measures in their discussion sections and consider alternate explanations resulting from measurement error. Reliability and validity statistics may aid readers in understanding the performance of different measures and shape their interpretations of findings. It should be noted that common reliability statistics, such as Cronbach alpha, do not establish the validity of a construct in different populations. Furthermore, a measure may be reliable, but not valid, particularly in the case that items are interpreted in a manner that is consistent but does not reflect the intended construct. Thus, such reporting should be considered a minimum—but not sufficient—requirement moving forward.

CONCLUSIONS

As research on food insecurity grows, we urge researchers studying food insecurity and eating-related behaviors to work together to complete psychometric validation studies, which will enhance the field’s ability to understand phenomena related to food insecurity and to draw conclusions that can positively influence public health, the field of nutrition and dietetics, public policy, and mental health treatment.

References


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AUTHOR CONTRIBUTIONS

K. A. Christensen conceptualized the editorial. All authors wrote the first draft, reviewed, and commented on subsequent drafts.
THE US HOUSEHOLD FOOD SECURITY SURVEY MODULE AND ITS RELATIONSHIP WITH NUTRITION

Access to adequate, nutritious food, particularly in early childhood, is essential for keeping current and future generations healthy across the life span. When families lack enough resources to afford competing basic necessities, such as housing, utilities, health care, medication, and child care, food is often where they economize. Coping strategies include reducing the quality of food purchased, decreasing the quantity of food eaten or served to family members, acquiring food from emergency private food assistance sources (e.g., charities and food pantries), and other behaviors.

An oft-used abbreviated definition of food insecurity, “lack of consistent access to enough healthful food for an active healthy life,” is directly linked to inadequate availability of household-level financial resources, which in turn is a consequence of persistent societal inequities and systemic barriers. Food insecurity negatively influences cognitive function and the physical and mental health of children and adults. Food insecurity aggravates a wide variety of co-occurring adverse health conditions, disproportionately burdening families with low socioeconomic status, families of color, and immigrant families.

Preceding the development of a food security measure, food insecurity was indirectly assessed to inform mitigation of the social problem of hunger. Aggregate food availability indicators (e.g., Food and Agriculture Organization of the United Nations [FAO] food balance sheets, and indicators of malnutrition prevalence), poverty indicators (e.g., income and education), nutritional status indicators (e.g., anthropometric, biochemical, and clinical indexes), and food intake indicators (e.g., 24-hour recall and food frequency) all were used to infer food insecurity.

Nutrition, nutritional status, and nutritional state were all prominent features of the conceptualization and definition of food security by the Life Sciences Research Office of the Federation of American Societies for Experimental Biology. An expert panel of the Life Sciences Research Office, including highly regarded experts in nutrition from around the United States (e.g., William H Dietz Jr, MD, PhD; Johanna Dwyer, DSc; and Jean-Pierre Habicht, MD, MPH, PhD) articulated a conceptual framework for nutritional state defined as “the assimilation and utilization of nutrients by the body plus interactions of environmental factors such as those that affect food consumption and food security. Thus, evaluation of nutritional state requires assessment of food consumption and food insecurity as well as biochemical, clinical, and anthropometric indices of nutritional status.”

Later, during development and validation of the US Household Food Security Survey Module (HFSSM), four dimensions were incorporated as its foundational basis: “quantity of food intake, quality of food intake, anxiety about the adequacy of food supply, and social acceptability of the sources of food.” Based on this construct, the expanded definition of food security was stated as “access by all people at all times to enough food for an active, healthy life. Food security includes at a minimum: (1) the ready availability of nutritionally adequate and safe foods, and (2) the assured ability to acquire acceptable foods in socially acceptable ways (e.g., without resorting to emergency food supplies, scavenging, stealing, or other coping strategies).” In turn, food insecurity was defined as “whenever the availability of nutritionally adequate and safe foods, or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain.” In this sense, the core HFSSM dimensions and definitions of food security and food insecurity were understood as an outcome of systemic/societal factors influencing economic deprivation, which in turn affected people’s ability to be nourished.

PREVIOUS DEFINITION OF NUTRITION SECURITY INCLUDES NUTRITION COUPLED WITH OTHER NECESSARY SYSTEMS FOR A HEALTHY LIFE

Nutrition security has long been defined by the FAO as “a situation that exists when secure access to an appropriately nutritious diet is coupled with a sanitary environment, adequate health services and care, in order to ensure a healthy and active life for all household members.” Over the
past year, a new suggested definition of nutrition security as “having consistent access, availability, and affordability of foods and beverages that promote well-being and prevent (and if needed, treat) disease”\textsuperscript{16} has been proposed in the United States.

Although concern for ensuring all people in the United States have access to sufficient healthy, affordable food and avoid diet-related diseases is a widely shared goal, domains included in the new definition of nutrition security were, in fact, core to development of the US food security definition and measure. Furthermore, this new, suggested definition narrows the established FAO definition that also considers nutrition security to include health and hygiene, sanitation, and adequate health care, in addition to dietary adequacy.\textsuperscript{15} Thus, shifting from food security to the proposed nutrition security definition comes with grave concern because it is based on a partial understanding of existing internationally established concepts, historical context, the core essence of the food security measure, and its relation to nutritional state, while also undermining 25 years of robust national, state, and local data and research solidifying causes and consequences of food insecurity.

### Why Is the Proposed New Definition of Nutrition Security Likely to Pose a Risk for Food Policy?

The steady increase since the 1970s in prevalence of non-communicable diseases, such as obesity, hypertension, and type 2 diabetes, is without doubt a public health issue that requires attention.\textsuperscript{17} Nutrition-sensitive conditions and income are the main motivations cited as the need for a nutrition security measure. However, to address these conditions, it is crucial to understand that they are products of complex trends in our political and economic system that influence the entire population, not just individual consumer behaviors or choices. For example, a 2017 Centers for Disease Control and Prevention brief\textsuperscript{18} showed that among men, obesity prevalence is similar at all income levels, with a tendency to be higher at income levels above 130% of the federal poverty level; and among women, obesity prevalence increases as income decreases. Thus, obesity is multifactorial and not entirely dependent on income. Comparing data points between 1999 and 2014, the prevalence of obesity increased in adults at all income and education levels, meaning that obesity is present in all strata of society independent of financial access to food.

When high prevalence of obesity and other related non-communicable diseases and their relationship with income are proposed as reasons for shifting focus from food insecurity to nutrition security, it must be acknowledged that this shift comes with complications for food policy and program implementation. Specifically, when a new terminology is proposed, it needs to be studied, developed and validated before being advertised as a substitute for an established, internationally accepted reference measure. Policy makers, health care and service providers, and community leaders rely heavily on recognized researchers to make informed decisions. Thus, there is a special responsibility on the part of researchers to ensure that they are accurately representing context and research when sharing information. The primacy of the proposed nutrition security term over food security is likely to result in erroneous and misleading assumptions, as already seen happening in the halls of Congress.\textsuperscript{20} In addition, serious concerns arise when such claims are also used as a rationale for circumscribing what people with low incomes can purchase in perhaps well intended but misguided attempts to improve their nutritional state. Poor quality diets are a society-wide problem in the United States, not merely an individual choice, and thus solutions must also be societal.\textsuperscript{21} Fundamental systemic changes in food advertisement to children and adults,\textsuperscript{22,23} ensuring that work pays real cost-of-living wages,\textsuperscript{24} reining in rampant “financialization” of the economy,\textsuperscript{25} eliminating inequities in education attainment, earnings, and incomes by race, ethnic origin, nativity, and gender,\textsuperscript{26,27} and reducing the excessive influence of corporate food and agriculture industries on the US food system\textsuperscript{18,29} are all necessary to decrease rates of noncommunicable diseases. None of these factors are addressed by shifting the emphasis from food security to the proposed narrow definition of nutrition security. Thus, it is important to recognize systemic causes of low prices and unlimited availability of poor quality, energy-dense, nutrient-sparse foods, and limited availability and high costs of healthy foods, instead of attributing high prevalence of noncommunicable diseases to people’s poor choices—and, more specifically, the choices of people who are poor.\textsuperscript{30}

### Conclusions

Replacing food security, the well-established and widely used HFSSM measure that is backed by 25 years of data and empirical research, with the new, ambiguous and poorly defined construct of nutrition security, for which there is no measure, has the potential to have detrimental effects on research, policy, and ultimately on the health and well-being of people. Although focusing on and emphasizing the necessity for all people to have a healthy nutritional state is essential and laudable, shifting focus from food security to nutrition security, or healthy nutritional state, is similarly risky because food security is a necessary condition for a healthy nutritional state, or nutrition security. Instead, focus should be given to action-oriented research examining the multiple systemic, political–economic factors that perpetuate food insecurity and make a healthy nutritional state unachievable for a large proportion of the US population. Those factors include inequitable and exclusionary social policies, lack of jobs that pay living wages, food advertising to adults and children, inequitable education funding mechanisms and low education attainment, and trends in corporate food production and marketing that strongly influence nutritional state in all sociodemographic groups. Nutrition scientists and other leaders in the field can play important roles in mitigating the adverse influence of these factors; however, continued insistence on shifting attention, resources, and effort from reducing and eliminating food insecurity to nutrition security is certain to be damaging to those living with food insecurity and others in need of improvement in their nutritional state.
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THE ART OF DIETETICS
Fall is one of my favorite times of the year as it coincides with the harvesting of my garden. The carving of pumpkins each fall is a tradition I treasure. The smell of pumpkin seeds baking and the giggles of family and friends as they watch my first-place pumpkin rolling down the sidewalk remind me to appreciate the small things.

Photo taken by Alena M. Clark, PhD, MPH, RDN, CLC

(Want to make your own Art of Dietetics contribution? Submission details are available at: www.jandonline.org/artofdietetics.)
Dietary Supplement and Prescription Medication Use Among US Military Service Members With Clinically Diagnosed Medical Conditions: The US Military Dietary Supplement Use Study

Joseph J. Knapik, ScD; Daniel W. Trone, PhD; Ryan A. Steelman, MPH; Emily K. Farina, PhD, RD; Harris R. Lieberman, PhD

ABSTRACT

Background Use of prescription medications (PMs) with dietary supplements (DSs) can be hazardous because of potential adverse interactions, but patterns of dual use in military service members (SMs) has not been examined.

Objective Investigate dual use of filled PMs (FPMs) and DSs, factors associated with dual use, and dual use among SMs with clinically diagnosed medical conditions (CDMCs).

Design Cross-sectional. Data on FPMs and CDMCs were obtained from medical surveillance records. Between December 2018 and August 2019, participants completed a questionnaire on DS use in the previous 6 months.

Participants A stratified random sample of 26,880 SMs from all military services.

Main outcome measures Prevalence of dual use of FPMs with DSs within a 6-month period, demographic/lifestyle factors associated with dual use, and prevalence of dual use among SMs with CDMCs.

Statistical analysis Prevalences were calculated as percents, χ² statistics examined differences across various strata of demographic and lifestyle characteristics, and univariable and multivariable logistic regression determined the odds of using FPMs with DSs for various CDMCs.

Results About one-half (49%) of SMs had dual use of FPMs with DSs in the 6-month period. Dual use was higher among women; increased with older age, more formal education, higher body mass index, and more physical activity; was highest among American Indian SMs and lowest among Asian SMs; was higher among former tobacco users; and was highest among Army personnel and lowest among Marine Corps personnel. The overall prevalence of dual use in the 6-month period was higher among those with a CDMC than those without (62% vs 19%), and this relationship was maintained for 20 International Classification of Diseases, Revision 10, code groupings covering virtually all CDMCs.

Conclusion This is the first study to document a high prevalence of dual FPMs and DSs in SMs, especially among those with CDMCs.

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Dietary Supplements (DSS) are commercially available products consumed as an addition to the usual diet and include vitamins, minerals, amino acids, herbs (botanicals), and a variety of other products. More than half of adults in the United States (US) and more than 70% of military service members (SMs) use DSs. DS use appears to be increasing over time among SMs, although use has been more stable among civilians, at least between 1999 and 2012. Importantly, SMs are more likely than civilians to use weight loss and pre-/postworkout supplements that contain multiple compounds with potential or documented adverse effects.

Some DSSs are potentially hazardous and combining prescription medications (PMs) with some DSSs can be dangerous. Studies have estimated that among patients taking both DSSs and PMs, 12% to 20% had potential drug-supplement interactions. Interactions can occur when a DS or compound in the DS competes with a PM through mechanisms
involve absorption, distribution, metabolism, or excretion resulting in a change in the drug's concentration at the site of action. Alternately, the DS or compound within may have a direct effect on the PM and antagonize or exacerbate clinical effects.14

Although some evidence is available on use of PMs with DSs in the general population,5-10 we are not aware of any study that has examined dual use among US military SMs. In addition, studies of the civilian population examining use of PMs with DSs among those with medical conditions have used self-reports of these conditions, not actual clinical records where conditions are diagnosed by medical care providers. The purposes of the current study were to: (1) investigate the prevalence of dual use of PMs with DSs in a 6-month period; (2) explore factors associated with dual use; and (3) compare the prevalence of dual use among SMs with and without clinically diagnosed medical conditions (CDMCs).

MATERIALS AND METHODS

This cross-sectional investigation involved a web-based survey of DS use that investigators combined with electronic medical and pharmacy records of US military SMs. It was part of a larger study designed to investigate the effects of DSs on SM health.7,19 The Naval Health Research Center's institutional review board approved the investigation, and SMs electronically consented to participate by signing an informed consent document. Investigators adhered to policies and procedures for protection of human subjects as prescribed by Department of Defense Instruction 3216.01, and the research was conducted in adherence with provisions of 32 Code of Federal Regulations Part 219.

Sampling Frame and Solicitation Procedures

Details of the sampling frame, solicitation of SMs, participant recruitment flowchart, sample size determination, and response bias have been previously reported.7 Briefly, investigators requested from the Defense Manpower Data Center a random sample of 200,000 SMs stratified by gender (88% male and 12% female) and branch of service (Army 36%, Air Force 24%, Marines 15%, and Navy 25%). Recruitment of SMs in this random sample involved a maximum of eight sequential contacts. The prospective participant was first sent an introductory postal letter with a $1 pre-incentive designed to increase the response rate.20,21 The letter also included a description of the survey, a link to a secure website, and a unique number that could be used to access the survey and electronically sign the consent form. A follow-up e-mail message after 10 days and postcard after 3 weeks were sent as a reminder to those who did not initially complete the survey. If no response was received after sending the postcard, up to five additional e-mail reminders were sent over 8 months, after which contact with the SM ended. All postal and online contacts stated that at any time the SM could decline participation and be removed from the contact list. Recruitment began in December 2018 and no further recruitment was conducted or surveys accepted after August 2019.

RESEARCH SNAPSHOT

Research Question: What is the prevalence of use of prescription medications (PMs) with dietary supplements (DSs)? What demographic and lifestyle factors are associated with dual use among US military service members (SMs)? How prevalent is PM and DS use among SMs with clinically diagnosed medical conditions (CDMCs)?

Key Findings:

About 49% of SMs used PMs with DSs in a 6-month period. Dual use was higher among women; increased with older age, more formal education, higher body mass index, and more physical activity; was highest among American Indian SMs and lowest among Asian SMs; was higher among former tobacco users; and was highest among Army personnel. Dual use was higher among those with a CDMC than those without (62% vs 19%).

Survey Description

The online survey used a standardized, web-based procedure to obtain the type and frequency of DS use and characterize participants. Supplement use questions included 96 generic DSs (eg, multivitamins/multiminerals, individual vitamins and minerals, proteins/amino acids, herbal products) and 67 brand-name products. The brand-name products included some that were included in previous armed forces DS surveys,4,6,22,23 but were updated based on recent data on DSs sold in the Army, Marine Corps, and Air Force Exchange Systems and General Nutrition Center stores on or near military installations. There were also open text fields on the questionnaire where SMs could include supplements not on the provided lists. SMs were asked to estimate how frequently they consumed particular DSs in the past 6 months (never, once a month, once a week, 2-6 times per week, or daily). The Figure provides DS category definitions used in this study. To characterize participants, the survey included questions on demographics (gender, age, ethnicity, race, height, weight), lifestyle factors (cigarette smoking, smokeless tobacco use, physical activity), and military service branch (Air Force, Army, Marine Corps, Navy). Race and ethnicity were categorized according to the National Institute of Health classifications.24

Medical and Pharmacy Data

Once participants were identified by completing the informed consent and survey, the list of participants was sent to the Armed Forces Health Surveillance Branch of the Defense Health Agency. From the Defense Medical Surveillance System relational database,25,26 the Defense Health Agency returned medical encounters and filled PMs (FPMs) of the consenting participants for the 6-month period prior to survey completion. Medical data consisted of International Classification of Diseases, Revision 10 (ICD-10), Clinical Modification codes.27 The medical data included CDMCs (ICD-10 codes) occurring within military treatment facilities (ie, Standard Ambulatory Data Record, Standard Inpatient Data Record, and Comprehensive Ambulatory/Professional Encounter Record), as well as those occurring outside these facilities (civilian care) and paid for by the US Department of Defense (reimbursable) (ie, Tricare Encounter Data—
Institutional and Tricare Encounter Data—Non-Institutional). Pharmacy data within the 6-month surveillance period were provided by the Defense Health Agency from the Pharmacy Data Transaction Service as American Hospital Formulary Service codes.28 This included prescriptions filled at military medical treatment facilities, retail pharmacies in the United States, or through mail-order programs.

Statistical Analysis
All statistical analyses were conducted using the Statistical Package for the Social Sciences.29 Body mass index (BMI) was computed from the questionnaire responses as weight/height² (kg/m²). Weekly duration of aerobic and resistance training (minimum per week) was calculated by multiplying reported weekly exercise frequency (sessions per week) by the reported duration of training (minutes per session). Supplements that SMs recorded as “other” were individually examined and placed into their appropriate categories.

Prevalences (as a percent) with standard errors were calculated for dual use of FPMs and DSs within the 6-month period. We used χ² statistics to examine differences across various strata of demographic factors, lifestyle characteristics, and military services. A baseline stratum of each variable was defined with a prevalence ratio = 1.00 and other strata of that variable were compared with the baseline stratum. Effect sizes for χ² were calculated as $\sqrt{\text{var}(\chi^2)/n}$, where $\chi^2$ is the chi-square statistic and n the sample size. Small, medium, and large effect sizes were defined as 0.10, 0.25, and 0.40, respectively.30

CDMCs were categorized by 20 code groups representing ICD-10 codes from A00 though Y9927 (eg, infections/parasitic diseases [ICD-10 codes A00-B99], neoplasms [ICD-10 codes C00-D49], disease of blood and blood forming organs [ICD-10 codes D50-D89]). Within each code group, prevalences (%) with standard errors were calculated for DS use, FPMs, and dual DSs and FPMs within the 6-month period. Univariable and multivariable logistic regression determined the odds of dual use within each CDMC code group. Univariable logistic regression included only the presence or absence of the code group (dependent variable); multivariable analysis adjusted for the presence or absence of the code group (dependent variable) by all demographic and lifestyle factors (independent variables).

The prevalence of CDMCs by FPMs and DSs (Figure) categories was also calculated. FPMs were arranged into the first tier American Hospital Formulary Service code groupings (eg, antihistamines, anti-infectives, autonomic drugs) covering most drugs used by SMs in this cohort. American Hospital Formulary Service code groups that included FPMs with fewer than 100 SMs were not included. These codes were antineoplastics (code 10, n = 67), diagnostic agents (code 36, n = 80), local anesthetics (code 68, n = 2), oxytocics (code 76, n = 19), devices (code 94, n = 2), and pharmaceutical agents (code 96, n = 69). We used $\chi^2$ statistics to compare (1) the risk of a CDMC within each DS category (Figure) with any FPM and (2) the risk of a CDMC within each FPM category with use of any DS.

RESULTS
From the sample of 200,000 SMs, 73% (n = 146,365) were successfully contacted (ie, no returned postal mail), and of these, 26,680 (18.2%) signed the informed consent and completed the survey. The mean ± standard deviation age of the participants was 33 ± 8 years.

Table 1 displays the participant characteristics (demographic and lifestyle factors) and the prevalence of dual FPM and DS use. In the 6-month survey period, almost half (49%) of SMs had dual use. Women were more likely than men to have dual use. Prevalence of dual use increased with older age, more formal education, higher BMI, and more aerobic or resistance exercise training. Dual use prevalence did not differ by ethnicity, but was highest among American Indian SMs and lowest among Asian SMs. Dual use prevalence was similar among smokers/smokeless tobacco users and those who had never been a smoker/smokeless tobacco user, but higher among those who had quit either type of tobacco. Prevalence of dual use was highest among Army personnel and lowest among Marine Corps personnel. Those

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dietary supplement</td>
<td>Any substance defined by the DSHEA²</td>
</tr>
<tr>
<td>Multivitamin/multimineral</td>
<td>DS³ containing 2 or more vitamins and/or 2 or more minerals with no additional supplement ingredients</td>
</tr>
<tr>
<td>Protein or amino acid</td>
<td>Amino acid mixtures, protein powders, and similar products where the intent is to provide a single or complex protein source</td>
</tr>
<tr>
<td>Individual vitamin or mineral</td>
<td>DS³ that is a single vitamin or mineral supplement, such as vitamin D or calcium</td>
</tr>
<tr>
<td>Herbal supplement</td>
<td>DS³ that includes 1 or more herbal ingredients with no nutrient or other supplement ingredient; also includes plant-derived ingredients</td>
</tr>
<tr>
<td>Purported prohormone</td>
<td>Steroidal hormone or herbal substitute for hormones marketed as a DS and included in the Supplement Facts panel on the label</td>
</tr>
<tr>
<td>Combination product</td>
<td>DS³ with mixtures of ingredients from any of the above categories including two or more categories and multiple ingredients; includes products marketed as weight loss, pre- or postworkout supplements, and muscle/body-building products</td>
</tr>
<tr>
<td>Joint health product</td>
<td>Substance that purports to improve the functioning of body joints such as glucosamine (with or without chondroitin) or methylsulfonylmethane</td>
</tr>
<tr>
<td>Other dietary supplement</td>
<td>Other DS³ that do not fit into the categories above</td>
</tr>
</tbody>
</table>

Figure. Dietary supplement categories and category definitions in the us military dietary supplement study. ²DSHEA = Dietary Supplement Health and Education Act; ³DS = dietary supplement.
Table 1. Dietary supplement use and filled prescription medications by demographic and lifestyle factors in a representative cohort of military service members in the US Military Dietary Supplement Use Study.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Strata</th>
<th>Sample size, n (%)</th>
<th>Prevalence (%) ± SE</th>
<th>Prevalence ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total SMs</td>
<td>None</td>
<td>26,680 (100.0)</td>
<td>49.1 ± 0.3</td>
<td>—</td>
</tr>
<tr>
<td>Gender</td>
<td>Men</td>
<td>23,037 (86.4)</td>
<td>46.1 ± 0.3</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>3641 (13.6)</td>
<td>67.7 ± 0.8</td>
<td>1.47 (1.43-1.51)</td>
</tr>
<tr>
<td>Age</td>
<td>18-24 y</td>
<td>4660 (17.6)</td>
<td>40.3 ± 0.7</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>25-29 y</td>
<td>5580 (21.0)</td>
<td>45.5 ± 0.7</td>
<td>1.13 (1.08-1.18)</td>
</tr>
<tr>
<td></td>
<td>≥30-39 y</td>
<td>11,030 (41.6)</td>
<td>50.3 ± 0.5</td>
<td>1.25 (1.20-1.30)</td>
</tr>
<tr>
<td></td>
<td>≥40 y</td>
<td>5275 (19.9)</td>
<td>57.7 ± 0.7</td>
<td>1.43 (1.37-1.49)</td>
</tr>
<tr>
<td>Formal education</td>
<td>Some high school/ high school grad.</td>
<td>3879 (14.5)</td>
<td>38.7 ± 0.8</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Some college</td>
<td>11,378 (42.7)</td>
<td>50.2 ± 0.5</td>
<td>1.30 (1.24-1.36)</td>
</tr>
<tr>
<td></td>
<td>Bachelor's/graduate degree</td>
<td>11,417 (42.8)</td>
<td>51.5 ± 0.5</td>
<td>1.33 (1.27-1.39)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Not Hispanic or Latino</td>
<td>22,452 (84.1)</td>
<td>48.9 ± 0.3</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Hispanic or Latino</td>
<td>4227 (15.8)</td>
<td>49.8 ± 0.8</td>
<td>1.02 (0.99-1.05)</td>
</tr>
<tr>
<td>Race</td>
<td>American Indian</td>
<td>228 (0.9)</td>
<td>54.4 ± 3.3</td>
<td>1.12 (0.99-1.26)</td>
</tr>
<tr>
<td></td>
<td>Asian</td>
<td>1340 (5.0)</td>
<td>45.2 ± 1.4</td>
<td>0.93 (0.87-0.99)</td>
</tr>
<tr>
<td></td>
<td>Black</td>
<td>3237 (12.1)</td>
<td>51.2 ± 0.9</td>
<td>1.05 (1.01-1.09)</td>
</tr>
<tr>
<td></td>
<td>Hawaiian</td>
<td>163 (0.6)</td>
<td>46.0 ± 3.9</td>
<td>0.94 (0.80-1.12)</td>
</tr>
<tr>
<td></td>
<td>More than 1 race</td>
<td>1559 (5.8)</td>
<td>51.2 ± 1.3</td>
<td>1.05 (0.99-1.11)</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>937 (3.5)</td>
<td>49.7 ± 1.6</td>
<td>1.02 (0.96-1.09)</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>19,216 (72.0)</td>
<td>48.7 ± 0.4</td>
<td>1.00</td>
</tr>
<tr>
<td>Body mass index d</td>
<td>&lt;25.0</td>
<td>7857 (30.0)</td>
<td>44.6 ± 0.6</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>25.0-29.9</td>
<td>13,897 (53.1)</td>
<td>49.3 ± 0.4</td>
<td>1.11 (1.07-1.14)</td>
</tr>
<tr>
<td></td>
<td>≥30.0</td>
<td>4424 (16.9)</td>
<td>56.7 ± 0.7</td>
<td>1.27 (1.23-1.32)</td>
</tr>
<tr>
<td>Smoking</td>
<td>Never smoked</td>
<td>16,706 (64.3)</td>
<td>48.2 ± 0.4</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Smoked but quit</td>
<td>4767 (18.3)</td>
<td>53.7 ± 0.7</td>
<td>1.11 (1.08-1.15)</td>
</tr>
<tr>
<td></td>
<td>Smoker</td>
<td>4511 (17.4)</td>
<td>48.1 ± 0.7</td>
<td>1.00 (0.96-1.03)</td>
</tr>
<tr>
<td>Smokeless tobacco</td>
<td>Never used</td>
<td>20,378 (87.9)</td>
<td>48.7 ± 0.4</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Used but quit</td>
<td>2047 (8.8)</td>
<td>53.0 ± 1.1</td>
<td>1.09 (1.04-1.14)</td>
</tr>
<tr>
<td></td>
<td>User</td>
<td>756 (3.3)</td>
<td>49.2 ± 0.9</td>
<td>1.01 (0.97-1.05)</td>
</tr>
<tr>
<td>Aerobic exercise</td>
<td>≤90 min/wk</td>
<td>7286 (27.3)</td>
<td>46.4 ± 0.6</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>91-180 min/wk</td>
<td>7285 (27.3)</td>
<td>48.5 ± 0.6</td>
<td>1.04 (1.01-1.08)</td>
</tr>
<tr>
<td></td>
<td>181-300 min/wk</td>
<td>5869 (22.0)</td>
<td>50.0 ± 0.7</td>
<td>1.08 (1.04-1.12)</td>
</tr>
<tr>
<td></td>
<td>&gt;300 min/wk</td>
<td>6240 (23.4)</td>
<td>52.0 ± 0.6</td>
<td>1.12 (1.08-1.16)</td>
</tr>
<tr>
<td>Resistance exercise</td>
<td>&lt;45 min/wk</td>
<td>7776 (29.1)</td>
<td>44.3 ± 0.6</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>46-135 min/wk</td>
<td>6257 (23.5)</td>
<td>47.5 ± 0.6</td>
<td>1.07 (1.03-1.11)</td>
</tr>
<tr>
<td></td>
<td>136-300 min/wk</td>
<td>6581 (24.7)</td>
<td>51.6 ± 0.6</td>
<td>1.17 (1.13-1.21)</td>
</tr>
<tr>
<td></td>
<td>&gt;300 min/wk</td>
<td>6066 (22.7)</td>
<td>54.0 ± 0.6</td>
<td>1.22 (1.18-1.26)</td>
</tr>
<tr>
<td>Service branch</td>
<td>Air Force</td>
<td>9788 (36.7)</td>
<td>48.6 ± 0.5</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Army</td>
<td>7935 (29.7)</td>
<td>53.6 ± 0.6</td>
<td>1.10 (1.07-1.14)</td>
</tr>
<tr>
<td></td>
<td>Marine Corps</td>
<td>3194 (12.0)</td>
<td>42.4 ± 0.9</td>
<td>0.87 (0.83-0.91)</td>
</tr>
<tr>
<td></td>
<td>Navy</td>
<td>5763 (21.6)</td>
<td>47.4 ± 0.7</td>
<td>0.98 (0.94-1.01)</td>
</tr>
</tbody>
</table>

aSE = standard error.
bCI = confidence interval.
cSMs = service members.
dBody mass index calculated as kg/m². Categories as defined by Center for Disease Control and Prevention.48
Table 2. Prevalence of dietary supplement use, filled prescription medications, and dual use in representative cohort of military service members in the US Military Dietary Supplement Use Study (n = 26,680)

<table>
<thead>
<tr>
<th>CDMC&lt;sup&gt;a&lt;/sup&gt; (ICD-10&lt;sup&gt;b&lt;/sup&gt; code group)</th>
<th>Cases (n)</th>
<th>Prevalence of dietary supplement use (% ± SE&lt;sup&gt;c&lt;/sup&gt;)</th>
<th>Prevalence of filled prescription medications (% ± SE)</th>
<th>Prevalence (%)</th>
<th>Unadjusted (univariable)</th>
<th>Adjusted for demographics and lifestyle factors (multivariable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any ICD-10 code (A00-Y99)</td>
<td>18,775</td>
<td>74.8 ± 0.3</td>
<td>71.7 ± 0.3</td>
<td>61.8 ± 0.4</td>
<td>6.92 (6.50-7.38)</td>
<td>6.72 (6.28-7.19)</td>
</tr>
<tr>
<td>Infectious/parasitic diseases (A00-B99)</td>
<td>1870</td>
<td>75.7 ± 1.0</td>
<td>94.1 ± 0.5</td>
<td>71.1 ± 1.0</td>
<td>2.73 (2.47-3.03)</td>
<td>2.70 (2.42-3.02)</td>
</tr>
<tr>
<td>Neoplasms (C00-D49)</td>
<td>1069</td>
<td>75.6 ± 1.3</td>
<td>84.5 ± 1.1</td>
<td>64.1 ± 1.5</td>
<td>1.90 (1.67-2.16)</td>
<td>1.61 (1.40-1.84)</td>
</tr>
<tr>
<td>Diseases of blood and blood organs (D50-D89)</td>
<td>261</td>
<td>78.9 ± 2.5</td>
<td>90.8 ± 1.8</td>
<td>72.0 ± 2.8</td>
<td>2.70 (2.06-3.54)</td>
<td>2.46 (1.81-3.33)</td>
</tr>
<tr>
<td>Endocrine, nutritional and metabolic diseases (E00-E89)</td>
<td>2427</td>
<td>78.1 ± 0.8</td>
<td>91.5 ± 0.6</td>
<td>72.0 ± 0.9</td>
<td>2.92 (2.67-3.21)</td>
<td>2.45 (2.22-2.71)</td>
</tr>
<tr>
<td>Mental, behavioral diseases (F01-F99)</td>
<td>3364</td>
<td>78.1 ± 0.7</td>
<td>92.9 ± 0.4</td>
<td>72.9 ± 0.8</td>
<td>3.20 (2.95-3.47)</td>
<td>2.95 (2.70-3.21)</td>
</tr>
<tr>
<td>Diseases of nervous system (G00-G99)</td>
<td>3976</td>
<td>76.6 ± 0.7</td>
<td>91.4 ± 0.4</td>
<td>70.2 ± 0.7</td>
<td>2.84 (2.64-3.06)</td>
<td>2.50 (2.30-2.70)</td>
</tr>
<tr>
<td>Diseases of eye and adnexa (H00-H59)</td>
<td>4578</td>
<td>74.7 ± 0.6</td>
<td>78.9 ± 0.6</td>
<td>59.0 ± 0.7</td>
<td>1.69 (1.58-1.80)</td>
<td>1.61 (1.50-1.73)</td>
</tr>
<tr>
<td>Diseases of ear and mastoid process (H60-H95)</td>
<td>1364</td>
<td>74.7 ± 1.2</td>
<td>86.9 ± 0.9</td>
<td>66.5 ± 1.3</td>
<td>2.14 (1.91-2.42)</td>
<td>2.01 (1.78-2.27)</td>
</tr>
<tr>
<td>Diseases of circulatory system (I00-I99)</td>
<td>1395</td>
<td>74.6 ± 1.2</td>
<td>94.8 ± 0.6</td>
<td>70.8 ± 1.2</td>
<td>2.64 (2.35-2.98)</td>
<td>2.30 (2.02-2.61)</td>
</tr>
<tr>
<td>Diseases of respiratory system (J00-J99)</td>
<td>4308</td>
<td>76.3 ± 0.6</td>
<td>96.1 ± 0.3</td>
<td>73.6 ± 0.7</td>
<td>3.51 (3.26-3.77)</td>
<td>3.47 (3.21-3.76)</td>
</tr>
<tr>
<td>Diseases of digestive system (K00-K95)</td>
<td>1817</td>
<td>76.4 ± 1.0</td>
<td>95.3 ± 0.5</td>
<td>72.8 ± 1.0</td>
<td>2.98 (2.68-3.32)</td>
<td>2.77 (2.48-3.11)</td>
</tr>
<tr>
<td>Diseases of skin and subcutaneous tissue (L00-L99)</td>
<td>2834</td>
<td>75.3 ± 0.8</td>
<td>90.1 ± 0.6</td>
<td>67.9 ± 0.9</td>
<td>2.40 (2.21-2.60)</td>
<td>2.29 (2.10-2.50)</td>
</tr>
<tr>
<td>Diseases of musculoskeletal system (M00-M99)</td>
<td>9688</td>
<td>76.6 ± 0.4</td>
<td>86.5 ± 0.3</td>
<td>66.5 ± 0.5</td>
<td>3.09 (2.93-3.26)</td>
<td>2.88 (2.72-3.04)</td>
</tr>
<tr>
<td>Diseases of genitourinary system (N00-N99)</td>
<td>1778</td>
<td>77.3 ± 1.0</td>
<td>93.3 ± 0.6</td>
<td>72.6 ± 1.1</td>
<td>2.92 (2.62-3.25)</td>
<td>2.19 (1.95-2.46)</td>
</tr>
<tr>
<td>Pregnancy-related conditions (O00-O9A)</td>
<td>250</td>
<td>88.0 ± 2.1</td>
<td>95.2 ± 1.4</td>
<td>83.6 ± 2.3</td>
<td>5.36 (3.83-7.50)</td>
<td>3.02 (2.10-4.34)</td>
</tr>
<tr>
<td>Congenital abnormalities (Q00-Q99)</td>
<td>216</td>
<td>75.8 ± 2.9</td>
<td>89.1 ± 2.1</td>
<td>67.0 ± 3.2</td>
<td>2.13 (1.66-2.73)</td>
<td>1.86 (1.44-2.42)</td>
</tr>
<tr>
<td>Signs, symptoms, abnormal labs NOS&lt;sup&gt;f&lt;/sup&gt; (R00-R99)</td>
<td>9132</td>
<td>76.1 ± 0.8</td>
<td>91.2 ± 0.3</td>
<td>69.5 ± 0.5</td>
<td>3.66 (3.47-3.86)</td>
<td>3.45 (3.26-3.66)</td>
</tr>
<tr>
<td>Injury and poisoning (S00-T88)</td>
<td>2795</td>
<td>75.5 ± 0.8</td>
<td>88.4 ± 0.6</td>
<td>67.0 ± 0.9</td>
<td>2.29 (2.11-2.49)</td>
<td>2.26 (2.10-2.47)</td>
</tr>
<tr>
<td>External causes of morbidity (V00-Y99)</td>
<td>1403</td>
<td>74.9 ± 1.2</td>
<td>88.5 ± 0.9</td>
<td>66.5 ± 1.3</td>
<td>2.14 (1.91-2.40)</td>
<td>2.16 (1.91-2.44)</td>
</tr>
</tbody>
</table>

<sup>a</sup>CDMC = clinically diagnosed medical condition.

<sup>b</sup>ICD-10 = International Classification of Diseases, Revision 10.<sup>27</sup>

<sup>c</sup>SE = standard error.

<sup>d</sup>CI = confidence interval.

<sup>e</sup>Odds of filled prescription medications with dietary supplement use.

<sup>f</sup>NOS = not otherwise specified.
who had quit smoking had a higher incidence of CDMCs than those who had never smoked (73.6% vs 70.4, P < .01).

Table 2 shows the prevalence of DS use, FPM, and dual use in the 6-month period by CDMC code groups. Among those with CDMCs of any type (codes A00 through Y99), 75% were DS users, 72% had an FPM, and 62% had dual use. DS use was highest among SMs diagnosed with a pregnancy-related condition; however, for other CDMCs DS use was similar, ranging from 75% to 79% of the sample. Prevalence of FPMs ranged from 79% (diseases of the eyes and adnexa) to 95% (pregnancy-related conditions) within the different CDMC code groups. The prevalence of dual use of DSs and FPMs within CDMC code groups ranged from 59% (diseases of the eyes and adnexa) to 84% (pregnancy-related conditions). The odds of dual use being higher for all DS categories with any FPMs: risk was 2.87 to 90.91 times higher if the SM had an FPM with any DS use.

The risk of a CDMC was higher for all FPM groups in both univariable (unadjusted) and multivariable (adjusted) models.

Table 3 compares the risk of a CDMC by different categories of FPMs and DS use was similar, ranging from 75% to 79% of the sample. The risk of a CDMC by different categories of FPMs and DS use was 2.87 to 90.91 times higher if the SM had an FPM with any DS use. The risk of a CDMC by the DS categories in the Figure with any FPMs. The risk of a CDMC was higher for all DS categories with any FPM: risk was 3.08 to 3.73 times higher if the SM reported use in a particular DS category and had an FPM. Table 4 compares the risk of a CDMC by different categories of FPMs and DS use in the 6-month period was significant within all CDMC code groups in both univariable (unadjusted) and multivariable (adjusted) models.

Table 3 compares the risk of a CDMC by the DS categories in the Figure with any FPMs. The risk of a CDMC was higher for all DS categories with any FPM: risk was 3.08 to 3.73 times higher if the SM reported use in a particular DS category and had an FPM. Table 4 compares the risk of a CDMC by different categories of FPMs and DS use in the 6-month period was significant within all CDMC code groups in both univariable (unadjusted) and multivariable (adjusted) models.

**DISCUSSION**

The present study involving a large sample of SMs (>26,000) found that 49% of those with FPMs were also DS users within the 6-month surveillance period. Dual use was higher among women; increased with older age, more formal education, higher BMI, and more physical activity; was highest among American Indian SMs and lowest among Asian SMs; and was higher among former tobacco users. Army personnel had the highest prevalence of dual use and the Marine Corps the lowest. Dual use was over 3 times higher among those with a CDMC compared with those without (62% vs 19%). When 20 individual ICD-10 code groupings were examined, dual use was higher in each one, even after controlling for age, gender, education, BMI, tobacco use, physical activity, and military service.

### Prevalence of FPMs and Concomitant FPM and DS Use

Comparisons between the current study and others examining DS and PM use is complicated by methodology, the nature of the sample, how DSs are defined, and possible changes over time in both DS and PM use. In the current study, with an average 33-year-old sample, dual use prevalence in a 6-month period was 49%. Studies involving nationally representative samples from over 20 years before reported that 18% and 16% of participants concomitantly

<table>
<thead>
<tr>
<th>Dietary supplement category and any filled medical prescription (n)</th>
<th>CDMC</th>
<th>Prevalence (CDMC/no CDMC)</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any dietary supplement use and filled medical prescription (n = 13,093)</td>
<td>Yes</td>
<td>61.8 ± 0.4</td>
<td>3.27 (3.12-3.42)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>18.9 ± 0.4</td>
<td></td>
</tr>
<tr>
<td>Multivitamin/multimineral use and filled medical prescription (n = 8121)</td>
<td>Yes</td>
<td>38.6 ± 0.4</td>
<td>3.48 (3.27-3.71)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>11.1 ± 0.4</td>
<td></td>
</tr>
<tr>
<td>Individual vitamin/mineral use and filled medical prescription (n = 5876)</td>
<td>Yes</td>
<td>28.1 ± 0.3</td>
<td>3.73 (3.44-4.05)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>7.5 ± 0.3</td>
<td></td>
</tr>
<tr>
<td>Protein/amino acids use and filled medical prescriptions (n = 7026)</td>
<td>Yes</td>
<td>32.9 ± 0.3</td>
<td>3.08 (2.88-3.29)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>10.7 ± 0.4</td>
<td></td>
</tr>
<tr>
<td>Combination product use and filled medical prescription (n = 7690)</td>
<td>Yes</td>
<td>36.3 ± 0.4</td>
<td>3.25 (3.05-3.47)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>11.2 ± 0.4</td>
<td></td>
</tr>
<tr>
<td>Prohormone use and filled medical prescription (n = 857)</td>
<td>Yes</td>
<td>4.1 ± 0.1</td>
<td>3.38 (2.73-4.17)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>1.2 ± 0.1</td>
<td></td>
</tr>
<tr>
<td>Herbal use and filled medical prescription (n = 3757)</td>
<td>Yes</td>
<td>18.0 ± 0.3</td>
<td>3.72 (3.36-4.12)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>4.8 ± 0.2</td>
<td></td>
</tr>
<tr>
<td>Joint health product use and filled medical prescription (n = 1785)</td>
<td>Yes</td>
<td>8.5 ± 0.2</td>
<td>3.45 (2.99-4.00)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>2.5 ± 0.2</td>
<td></td>
</tr>
<tr>
<td>Other dietary supplement use and filled medical prescription (n = 5542)</td>
<td>Yes</td>
<td>26.5 ± 0.3</td>
<td>3.70 (3.41-4.03)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>7.2 ± 0.3</td>
<td></td>
</tr>
</tbody>
</table>

CDMC = clinically diagnosed medical condition.
SE = standard error.
CI = confidence interval.
used PMs and DSs, but in those studies, DSs were more narrowly defined than in the current study. Data from the 2005-2008 National Health and Nutrition Examination Survey (NHANES) involving 20- to >60-year-olds and using a more inclusive definition of DSs found that 34% used DSs with PMs. Another nationally representative sample of

### Table 4. Prevalence of a CDMC with both a filled prescription medication and any dietary supplement use (CDMC n = 18,775, no CDMC n = 7905) in a representative cohort of military service members in the US Military Dietary Supplement Use Study (n = 26,680)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Prevalence CDMC (% ± SE)</th>
<th>Prevalence ratio, CDMC/no CDMC (95% CI)</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any prescription and any dietary supplement (n = 13,090)</td>
<td>Yes 61.75 ± 0.35</td>
<td>3.27 (3.11-3.42)</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>No 18.91 ± 0.44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antihistamines (AHFS code 4) and any dietary supplement (n = 2563)</td>
<td>Yes 12.62 ± 0.24</td>
<td>5.15 (4.44-5.95)</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>No 2.45 ± 0.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-infectives (AHFS code 8) and any dietary supplement (n = 4137)</td>
<td>Yes 19.73 ± 0.29</td>
<td>3.60 (3.27-3.97)</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>No 5.48 ± 0.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autonomic drugs (AHFS code 12) and any dietary supplement (n = 3418)</td>
<td>Yes 17.15 ± 0.28</td>
<td>6.80 (5.92-7.82)</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>No 2.52 ± 0.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood formation, coagulation, thrombosis agents (AHFS code 20) and any dietary supplement (n = 143)</td>
<td>Yes 0.75 ± 0.06</td>
<td>29.41 (7.35-125.00)</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>No 0.03 ± 0.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CV drugs (AHFS code 24) and any dietary supplement (n = 1930)</td>
<td>Yes 9.60 ± 0.21</td>
<td>5.99 (5.00-7.14)</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>No 1.61 ± 0.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CNS agents (AHFS code 28) and any dietary supplement (n = 8294)</td>
<td>Yes 40.60 ± 0.36</td>
<td>4.78 (4.42-5.15)</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>No 8.50 ± 0.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrolyte, caloric, water agents (AHFS code 40) and any dietary supplement (n = 392)</td>
<td>Yes 1.98 ± 0.10</td>
<td>7.81 (5.00-12.35)</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>No 0.25 ± 0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory tract agents (AHFS code 48) and any dietary supplement (n = 2426)</td>
<td>Yes 12.19 ± 0.24</td>
<td>7.04 (5.92-8.33)</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>No 1.73 ± 0.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eye, ear, nose throat preparations (AHFS code 52) and any dietary supplement (n = 4106)</td>
<td>Yes 20.00 ± 0.29</td>
<td>4.50 (4.05-5.00)</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>No 4.44 ± 0.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GI drugs (AHFS code 56) and any dietary supplement (n = 3656)</td>
<td>Yes 18.45 ± 0.28</td>
<td>7.58 (6.58-8.77)</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>No 2.43 ± 0.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hormones and synthetics (AHFS code 68) and any dietary supplement (n = 1431)</td>
<td>Yes 6.74 ± 0.18</td>
<td>3.22 (2.75-3.79)</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>No 2.09 ± 0.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antitoxins, globulins, toxoids, vaccines (AHFS code 80) and any dietary supplement (n = 861)</td>
<td>Yes 4.56 ± 0.15</td>
<td>90.91 (33.33-250.00)</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>No 0.05 ± 0.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin and mucous membrane agents (AHFS code 84) and any dietary supplement (n = 2714)</td>
<td>Yes 13.73 ± 0.25</td>
<td>7.93 (6.67-9.35)</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>No 1.73 ± 0.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smooth muscle relaxants (AHFS code 86) and any dietary supplement (n = 179)</td>
<td>Yes 0.94 ± 0.07</td>
<td>25.00 (7.87-76.92)</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>No 0.04 ± 0.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamins (AHFS code 88) and any dietary supplement (n = 878)</td>
<td>Yes 4.44 ± 0.15</td>
<td>8.00 (5.92-10.75)</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>No 0.56 ± 0.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous therapeutic agents (AHFS code 92) and any dietary supplement (n = 1087)</td>
<td>Yes 5.05 ± 0.16</td>
<td>2.87 (2.41-3.42)</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>No 1.76 ± 0.15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CDMC = clinically diagnosed medical condition.

n = number of participants using listed AHFS category with any dietary supplement.

SE = standard error.

CI = confidence interval.

AHFS = American Hospital Formulary Service.

CV = cardiovascular.

CNS = central nervous system.

GI = gastrointestinal.
older adults (57-85 years of age) found that concomitant DS and PM use increased from 54% in 2004-2006 to 66% in 2010-2011, suggesting concomitant use is increasing over time, at least in older adults. However, the definition of DSs was not clear in that study.  

Also it should be noted that we do not know if the DSs and PMs were consumed at exactly the same time since SMs only reported DS use within the 6-month surveillance period and not the exact date the DSs were consumed.

Demographic and Lifestyle Factors Associated With Dual Use

Data from NHANES 2005-2008 indicated that women were more likely than men to concomitantly use DSs and PMs and that concomitant use increased with age and formal education, in general agreement with the current study. PMs are provided by health care professionals for specific medical conditions, and DS users most often cite general health enhancement as the primary reason for use. Women, older individuals, and those with more formal education often believe using DSs with their PMs is a way to further enhance their health. Women are more likely than men to make behavioral changes to improve health, and individuals who have achieved higher educational levels are generally more proactive, more health conscious, prone to engage in health-promoting behaviors, and more likely to explore multiple channels of information related to their health.

Associations between dual use and BMI, lifestyle factors, and military service are unique to the current study, have not been investigated previously, and will need to be confirmed by future research. One intriguing finding was that those who had quit tobacco use had a higher dual use prevalence than users or nonusers. Those who had quit smoking had a higher prevalence of CDMCs and FPMs. Smokers have numerous reasons for giving up smoking, but the primary reason is health concerns. 

Health enhancement is also the primary reason for using DSs and these motivations may work synergistically in former smokers to increase the use of DSs along with PMs. A similar mechanism may be involved in the higher dual use among former smokeless tobacco users.

It should be noted that in contrast to most civilian occupations, the military have strict physical fitness and body weight/body fat standards, and SMs are tested twice a year to ensure they meet the requirements. Individuals who do not meet the criteria for fitness or body weight/body fat can receive adverse performance reports and can be discharged from service for repeated failures to achieve the standards. This may prompt some individuals who have difficulty meeting these requirements to use DSs marketed for weight control and/or improving physical performance, thus increasing the likelihood of combining DSs with PMs.

Dual PM and DS Use Among SMs With CDMCs

A study using data from 2005 to 2008 NHANES examined concomitant DS and PM use among individuals with self-reported medical conditions. Nine types of self-reported conditions were examined including arthritis, heart/vascular conditions, respiratory conditions, liver problems, thyroid problems, cancer, diabetes, kidney problems, and osteoporosis. The authors demonstrated that the odds of concomitant DS and PM use (adjusted for gender, age, education, and income) was 1.67 to 2.42 times higher among those with a CDMC and was higher regardless of the category of PM or DS examined. The current study of SMs involved medical conditions from clinical records as well as a broader range of conditions. Results indicated that the adjusted odds of dual use were 1.60 to 3.45 times higher within the 20 categories of CDMCs and was higher for all categories of PMs and DSs examined. Both studies indicated that among those with medical conditions (self-reported or from clinical records), dual use of DS and PM was considerably higher for a very broad range of PMs and DSs. 

There are potential risks of interactions when individuals concomitantly use PMs and DSs. Studies using convenience samples have estimated that 12% to 20% of patients taking PMs have potential interactions with DSs. In a nationally representative sample, major potential drug interactions increased from 8% in 2005-2006 to 15% in 2011, but this included interactions between two PMs as well as between PMs and DSs. Potential drug-DS interactions may be even higher in some populations. For example, in a study of seniors (≥60 years) in US and Mexico border towns (El Paso and Juarez) 32% had a potential drug-DS interaction. The most commonly reported interactions are between herbal supplements and PMs, and many combination products contain herbal substances. In the current study, 18% of SMs with a CDMC were using herbs and with FPMs, and 36% of combination product users had potential interactions between some minerals (iron, potassium, calcium) and PMs that have also been reported and 28% of SMs with a CDMC had vitamin/mineral use with FPMs.

Strengths and Limitations

The current study recruited a very large stratified random sample of SMs from all branches of service. A standardized DS questionnaire was used that was based on questionnaires used in previous military studies. The military medical database used contains virtually complete information on encounters with medical care providers, and the pharmacy database is also complete with regard to medications dispensed to SMs. However, there were some study limitations. First, DS data were self-reported and suffered the usual weaknesses associated with this method including recall bias, social desirability, errors in self-observation, and inadequate recall. Second, the FPMs examined in the present study were only those prescribed by medical care providers and obtained through pharmacy channels. Medications that SMs obtained over the counter without a prescription were not included. However, all prescriptions provided to active duty SMs (even those that can be obtained over the counter) are free so SMs are likely to use the medical care route to obtain these medications. Third, filling a prescription does not imply conformity with the prescription regimen and data on actual SM compliance were not available. Fourth, although the pharmacy database provided the exact date a SM obtained a prescription, the exact date the SMs ingested their DSs was not known. Thus, estimates of dual use could be improved by querying the exact dates of DS consumption in future studies.
binary; men/women) and all service branches were well represented. Finally, gender could only be reported as “male” or “female” on the questionnaire. Participants completing the questionnaire who identify as “nonbinary” or had other gender identities would have been misclassified and individuals in the sample with other gender identities may have felt excluded.

CONCLUSIONS
This study demonstrated for the first time in a representative military sample that 49% of SMs had dual use of DSs and FPMs in a 6-month period. Dual use was higher in some demographics including women; older SMs; those with more formal education, higher BMI, or higher amount of physical activity; American Indian SMs; and former tobacco users. Importantly, dual use was over 3 times higher among those with a CDMC compared with those without one (62% vs 19%), in agreement with a previous study in a civilian sample using self-reported medical conditions. Although this study quantified the prevalence of dual PM-DS use in a 6-month period, it did not determine the particular combinations of these substances that were harmful. Future studies should examine specific PM-DS interactions to determine the potential for adverse effects in this population.

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35. Street TD, Lacey SJ. Employee characteristics and health belief variables related to smoking cessation engagement attitudes. Work. 2018;60:75-83.


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STATEMENT OF POTENTIAL CONFLICT OF INTEREST
No potential conflict of interest was reported by the authors.

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ADDITIONAL INFORMATION
The questionnaire is available from the author on request.

AUTHOR CONTRIBUTIONS
J. J. Knapik designed the research, analyzed data, wrote the paper, and had responsibility for final content; D. W. Trone designed the research, conducted research, provided essential materials, and had responsibility for final content; R. A. Steelman analyzed data and had responsibility for final content; E. K. Farina designed research and had responsibility for final content; H. R. Lieberman conceptuized the study, designed the research plan and had responsibility for final content. All authors have read and approved the final manuscript.
Adverse Effects Associated with Multiple Categories of Dietary Supplements: The Military Dietary Supplement Use Study

Joseph J. Knapik, ScD; Daniel W. Trone, PhD; Ryan A. Steelman, MPH; Emily K. Farina, PhD, RD; Harris R. Lieberman, PhD

ABSTRACT

Background About 50% of Americans and 70% of US military service members (SMs) regularly use dietary supplements (DSs) and some are associated with adverse effects (AEs). SMs are more likely to use unsafe DSs than civilians.

Objective The aim of this investigation was to examine the prevalence of, and factors associated with, AEs.

Design Cross-sectional.

Participants A stratified random sample of 200,000 US SMs from the Air Force, Army, Marine Corps, and Navy were obtained from military workforce records. Eighteen percent (n = 26,681) of successfully contacted SMs (n = 146,365) volunteered to participate between December 2018 and August 2019. Participants completed a detailed online questionnaire on demographic characteristics, lifestyle factors, and AEs associated with DS use.

Main outcome measure Prevalence of, and factors associated with, AEs among DS users.

Statistical analysis Prevalence of AEs was calculated by DS categories. Linear trends, χ² statistics, and multivariable logistic regression examined associations between AEs and demographic characteristics, lifestyle factors, and number DSs consumed.

Results Proportion of DS users (≥1 time /week) reporting ≥1 AE was 18% overall, 20% for combination products (ie, weight loss, muscle building, and before/after workout supplements), 8% for purported prohormones, 6% for protein/amino acid products, 6% for multivitamin/multiminerals, 6% for individual vitamins/minerals, 4% for herbal products, and 2% for joint health products. Combination products are very popular in military personnel with nearly half of SMs regularly taking them. In multivariable analysis, reporting AEs were independently associated with female gender, younger age, higher body mass index, smoking, higher alcohol intake, service in the Army, Navy, or Marine Corps (compared with Air Force), and consumption of a greater number of DSs.

Conclusions A large proportion of SMs report experiencing AEs, especially users of combination products and purported prohormone supplements. This study presents contemporary data collected from a very large at-risk population on potentially hazardous categories of DSs.


Dietary supplements (DSS) are commercially available products consumed as an addition to the usual diet and include vitamins, minerals, amino acids, herbs (botanicals), and a variety of other products. The Dietary Supplement Health and Education Act of 1994 established the regulatory framework for DSs in the United States. Under the Dietary Supplement Health and Education Act, the Food and Drug Administration (FDA) has limited authority to regulate DSs. Manufacturers must notify the FDA 75 days before marketing a new DS, but FDA approval is not required for retailing a DS product. The FDA has the burden of demonstrating a specific product is unsafe either in the pre- or post-marketing phase before they can take action, although since 2007 manufacturers are required to notify the FDA when serious adverse effects (AEs) are reported to them. However, it is estimated that only 2% of AEs experienced by consumers are reported. The FDA has banned or warned consumers about specific DS products in the past and case reports and case series of AEs associated with DSs are common among US military service members (SMs) and civilians. DS consumers may experience AEs because of excessive intake, allergic reactions to ingredients, poor quality control in production resulting in contamination, interactions with prescribed...
medications, dangerous compounds present in the DS, and/or the inclusion of unlisted or illegal compounds. However, self-reported AEs might also result from symptoms that are not related to DS intake.

There have been two prior studies of AEs among military DS users, but these used different methods for recruiting participants, different procedures for collecting self-reported AE data, and analyzed the data in considerably different ways. The purpose of this study was to conduct a large, comprehensive examination of AEs experienced by DS users in all US military services, identify potentially dangerous categories of DSs, and examine demographic and lifestyle factors associated with AEs.

MATERIALS AND METHODS

This study was a cross-sectional survey of a stratified random sample of US active duty military SMs. The Naval Health Research Center’s Institutional Review Board approved the study protocol and participants signed an informed consent document. Investigators adhered to policies and procedures for protection of human subjects as prescribed by Department of Defense Instruction 3216.01 and the research was conducted in adherence with provisions of 32 Code of Federal Regulations Part 219.

Sampling Frame

Details of the sampling frame, solicitation of SMs, subject flow through the study, sample size determination, number of participants by demographics and lifestyle factors, and response bias have been previously reported. Briefly, the Department of Defense’s Defense Manpower Data Center provided a list of a random sample of 200,000 active duty SMs stratified by sex (88% male and 12% female) and branch of service (Army 36%, Air Force 24%, Marines 15%, and Navy 25%), based on military demographics as of June 2018. Recruitment of SMs from this random sample into the study involved a maximum of 12 contacts with each SM. The prospective participant was initially sent an introductory postal letter with a $1 incentive to increase response rate. The letter described the survey, included a link to a secure website, and provided a unique login that could be used to access the survey and electronically sign the consent form. A follow-up e-mail message after 10 days and postcard after 3 weeks was sent as a reminder to those who did not initially complete the survey. If no response was received after sending the postcard, the subsequent contacts included up to seven e-mail messages and three postcard reminders evenly distributed over 8 months, after which contact with the SM ended. Responders were taken off the distribution list, so the reminders were sent only to those who did not respond. Recruitment began in December 2018, and no further recruitment was conducted or surveys accepted after August 2019.

Survey Description

The questionnaire was designed to: describe participants, obtain types and frequency of DSs used in the past 6 months, and determine AEs associated with DSs. To comprehensively describe participants, there were questions on demographic characteristics (e.g., gender, age, education, height, and weight), lifestyle characteristics (e.g., amount of exercise, tobacco use, and alcohol consumption), and military service branch. Supplement use questions included 96 generic DSs (e.g., multivitamins/multiminerals [MVM], individual vitamins and minerals, proteins/amino acids [AAs], and herbal products) and 67 brand-name products. The brand-name products listed were in many previous Armed Forces DS surveys, but were updated based on a review of DSs sold in the Army, Marine Corps, and Air Force Exchange Systems as well as General Nutrition Center stores on or near military installations. There were also open text fields on the questionnaire where SMs could include supplements not on the provided lists. SMs indicated whether or not they used a particular generic or specific DS, their frequency of use, and if believed they experienced any specific AE due to consuming that DS. For frequency of use there were five response categories, including “never,” “once a month,” “once a week,” “2 to 6 times/week,” or “daily.” AEs on the questionnaire were called “side effects,” and a list of AEs was located alongside each DS. The AE list included symptoms related to cardiovascular, gastrointestinal, muscular, sleep disturbance, and neurological symptoms. Specific symptoms listed on the questionnaire included “palpitations, racing heart,” “abdominal pain,” “nausea/vomiting,” “diarrhea,” “muscle cramps/pain/weakness,” “sleep disturbances/insomnia,” “dizzy/confusion/light-headed,” “tingling/numb in extremities,” “seizures/convulsions/tremors,” and “other.” If “other” was selected, a space was provided to explain the experienced AE. Table 1 provides DS category definitions used in this study.

Data Analysis

All statistical analyses were conducted using the Statistical Package for the Social Sciences. For each of the 163 listed DSs, users were defined as those who reported consuming the DS ≥ 1/week (i.e., responded “once a week,” “2 to 6 times/week,” or “daily” for that DS). Body mass index (BMI) was computed from the questionnaire responses as weight in kilograms / height in meters. Weekly duration of aerobic and resistance training (minutes per week) was calculated by multiplying reported weekly exercise frequency (sessions per week) by the reported duration of training (minutes per session). Alcohol consumption was quantified under the
<table>
<thead>
<tr>
<th>Category</th>
<th>Palpitations, Racing Heart</th>
<th>Abdominal Pain</th>
<th>Nausea, Vomiting</th>
<th>Diarrhea</th>
<th>Muscle Cramps, Pain, Weakness</th>
<th>Sleep Disturbances, Insomnia</th>
<th>Dizzy, Confused, Lightheaded</th>
<th>Tingling, Numbness</th>
<th>Seizures, Convulsions, Tremors</th>
<th>Other</th>
<th>≥ 1 AEs in Dietary Supplement Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combination product (n = 11,844)</td>
<td>9.3 ± 0.3 (1,103)</td>
<td>2.1 ± 0.1 (251)</td>
<td>2.3 ± 0.1 (268)</td>
<td>4.6 ± 0.2 (546)</td>
<td>1.1 ± 0.1 (134)</td>
<td>5.4 ± 0.2 (645)</td>
<td>2.8 ± 0.2 (327)</td>
<td>6.9 ± 0.2 (813)</td>
<td>0.5 ± 0.1 (60)</td>
<td>2.9 ± 0.2 (347)</td>
<td>20.0 ± 0.4 (2,371)</td>
</tr>
<tr>
<td>Purported prohormone (n = 1,299)</td>
<td>1.4 ± 0.3 (18)</td>
<td>1.3 ± 0.3 (17)</td>
<td>1.2 ± 0.3 (15)</td>
<td>1.0 ± 0.3 (13)</td>
<td>0.7 ± 0.2 (9)</td>
<td>2.1 ± 0.4 (27)</td>
<td>0.8 ± 0.2 (10)</td>
<td>0.8 ± 0.2 (10)</td>
<td>0.3 ± 0.2 (4)</td>
<td>3.2 ± 0.5 (41)</td>
<td>8.0 ± 0.8 (104)</td>
</tr>
<tr>
<td>Protein or amino acid (n = 11,146)</td>
<td>1.1 ± 0.1 (122)</td>
<td>0.9 ± 0.1 (104)</td>
<td>0.7 ± 0.1 (74)</td>
<td>2.2 ± 0.1 (245)</td>
<td>0.3 ± 0.1 (39)</td>
<td>0.8 ± 0.1 (90)</td>
<td>0.4 ± 0.1 (45)</td>
<td>0.8 ± 0.1 (89)</td>
<td>0.1 ± 0.0 (11)</td>
<td>1.7 ± 0.1 (195)</td>
<td>6.3 ± 0.2 (707)</td>
</tr>
<tr>
<td>Multivitamin/multimineral (n = 11,886)</td>
<td>1.2 ± 0.1 (140)</td>
<td>0.9 ± 0.1 (109)</td>
<td>1.4 ± 0.1 (172)</td>
<td>1.0 ± 0.1 (114)</td>
<td>0.6 ± 0.1 (73)</td>
<td>1.4 ± 0.1 (164)</td>
<td>0.6 ± 0.1 (70)</td>
<td>0.7 ± 0.1 (88)</td>
<td>0.1 ± 0.0 (9)</td>
<td>1.6 ± 0.1 (190)</td>
<td>6.0 ± 0.2 (718)</td>
</tr>
<tr>
<td>Individual vitamin or mineral (n = 8,226)</td>
<td>0.8 ± 0.1 (69)</td>
<td>0.8 ± 0.1 (78)</td>
<td>0.9 ± 0.1 (78)</td>
<td>1.1 ± 0.1 (87)</td>
<td>0.6 ± 0.1 (50)</td>
<td>0.8 ± 0.1 (62)</td>
<td>0.5 ± 0.1 (44)</td>
<td>0.6 ± 0.1 (52)</td>
<td>0.1 ± 0.0 (12)</td>
<td>2.0 ± 0.2 (166)</td>
<td>5.6 ± 0.3 (463)</td>
</tr>
<tr>
<td>Herbal substance (n = 5,332)</td>
<td>0.8 ± 0.1 (45)</td>
<td>0.7 ± 0.1 (39)</td>
<td>0.5 ± 0.1 (28)</td>
<td>1.0 ± 0.1 (55)</td>
<td>0.2 ± 0.1 (10)</td>
<td>0.7 ± 0.1 (37)</td>
<td>0.4 ± 0.1 (21)</td>
<td>0.2 ± 0.1 (13)</td>
<td>0.1 ± 0.0 (3)</td>
<td>1.7 ± 0.2 (89)</td>
<td>4.3 ± 0.3 (231)</td>
</tr>
<tr>
<td>Joint health product (n = 2,514)</td>
<td>0.1 ± 0.1 (2)</td>
<td>0.3 ± 0.1 (4)</td>
<td>0.2 ± 0.1 (12)</td>
<td>0.5 ± 0.1 (7)</td>
<td>0.3 ± 0.1 (7)</td>
<td>0.2 ± 0.1 (5)</td>
<td>0.0 ± 0.0 (1)</td>
<td>0.1 ± 0.1 (3)</td>
<td>0.0 ± 0.0 (0)</td>
<td>1.0 ± 0.2 (25)</td>
<td>2.0 ± 0.3 (51)</td>
</tr>
<tr>
<td>Other (n = 8,177)</td>
<td>0.2 ± 0.1 (17)</td>
<td>0.3 ± 0.1 (26)</td>
<td>0.3 ± 0.1 (28)</td>
<td>0.4 ± 0.1 (35)</td>
<td>0.1 ± 0.0 (9)</td>
<td>1.1 ± 0.1 (88)</td>
<td>0.5 ± 0.1 (38)</td>
<td>0.2 ± 0.0 (15)</td>
<td>0.0 ± 0.0 (1)</td>
<td>1.4 ± 0.1 (118)</td>
<td>3.7 ± 0.2 (299)</td>
</tr>
<tr>
<td>Combined AEs (n = 19,731)</td>
<td>6.7 ± 0.7 (1,325)</td>
<td>2.6 ± 0.7 (511)</td>
<td>2.9 ± 0.7 (574)</td>
<td>4.7 ± 0.7 (920)</td>
<td>1.4 ± 0.7 (276)</td>
<td>4.6 ± 0.7 (917)</td>
<td>2.5 ± 0.7 (492)</td>
<td>4.9 ± 0.7 (975)</td>
<td>0.4 ± 0.7 (84)</td>
<td>4.5 ± 0.7 (897)</td>
<td>18.5 ± 0.7 (2,514)</td>
</tr>
</tbody>
</table>
assumption that a “standard drink” contained 17.7 mL alcohol.28 “Standard drinks” included 12 oz regular beer or fermented fruit drink (5% alcohol), 8.5 oz higher-alcohol beer (7% alcohol), 5 oz wine (12% alcohol), 4 oz fortified wine (15% alcohol), and 1.5 oz of liquor (40% alcohol). Supplements and AEs that SMs placed in the “other” categories were individually examined and responses placed into their appropriate categories.

### Table 2. Proportion of dietary supplement users reporting adverse effects by number of dietary supplements consumed (≥1 time/wk) in a representative cohort of service members in the US Military Dietary Supplement Study

<table>
<thead>
<tr>
<th>Adverse effect</th>
<th>1-2 Dietary Supplements (n = 5,303)</th>
<th>3-4 Dietary Supplements (n = 3,741)</th>
<th>≥ 5 Dietary Supplements (n = 10,687)</th>
<th>Risk ratio (95% CI)a</th>
<th>P valueb</th>
<th>P valuec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palpitations, racing heart</td>
<td>3.1 ± 0.2 (166)</td>
<td>5.0 ± 0.4 (187)</td>
<td>9.1 ± 0.3 (972)</td>
<td>2.91 (2.47-3.41)</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>1.1 ± 0.1 (59)</td>
<td>2.1 ± 0.2 (80)</td>
<td>3.5 ± 0.2 (372)</td>
<td>2.48 (1.96-3.13)</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Nausea, vomiting</td>
<td>1.5 ± 0.2 (82)</td>
<td>2.2 ± 0.2 (83)</td>
<td>3.8 ± 0.2 (409)</td>
<td>2.48 (1.96-3.13)</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>2.0 ± 0.2 (104)</td>
<td>3.6 ± 0.3 (133)</td>
<td>6.4 ± 0.2 (683)</td>
<td>3.26 (2.66-4.00)</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Muscle cramps, pain, weakness</td>
<td>0.5 ± 0.1 (29)</td>
<td>1.0 ± 0.2 (39)</td>
<td>1.9 ± 0.1 (208)</td>
<td>3.56 (2.42-5.24)</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Sleep disturbances, insomnia</td>
<td>2.1 ± 0.2 (113)</td>
<td>3.4 ± 0.3 (129)</td>
<td>6.3 ± 0.2 (675)</td>
<td>2.96 (2.44-3.61)</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Dizzy, confused, lightheaded</td>
<td>1.2 ± 0.1 (65)</td>
<td>1.7 ± 0.2 (62)</td>
<td>3.4 ± 0.2 (365)</td>
<td>2.79 (2.15-3.62)</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Tingling, numbness</td>
<td>1.8 ± 0.2 (98)</td>
<td>3.3 ± 0.3 (124)</td>
<td>7.0 ± 0.2 (753)</td>
<td>3.81 (3.10-4.69)</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Seizures, convulsions, tremors</td>
<td>0.0 ± 0.0 (2)</td>
<td>0.3 ± 0.1 (10)</td>
<td>0.7 ± 0.1 (72)</td>
<td>17.86 (4.39-72.77)</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Other</td>
<td>2.5 ± 0.2 (132)</td>
<td>4.1 ± 0.3 (152)</td>
<td>5.7 ± 0.2 (613)</td>
<td>2.30 (1.92-2.77)</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Individuals reporting ≥ 1 adverse effects</td>
<td>10.3 ± 0.4 (546)</td>
<td>16.0 ± 0.6 (600)</td>
<td>23.3 ± 0.4 (2,486)</td>
<td>2.26 (2.07-2.46)</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

a≥ 5 per week/1 to 2 per week.
bBased on χ² test.
cLinear trend.
Table 3. Prevalence of adverse effects among dietary supplement category (DS\textsuperscript{c}) users (\geq 1 times/wk) by demographic and lifestyle characteristics in a representative cohort of service members in the US Military Dietary Supplement Study

<table>
<thead>
<tr>
<th>Variable</th>
<th>Strata</th>
<th>Any DS\textsuperscript{c} Users</th>
<th>Combination Users</th>
<th>Purposed Pro-hormone Users</th>
<th>Protein/ Amino Acid Users</th>
<th>MMV\textsuperscript{c} Users</th>
<th>Individual Vitamin/ Mineral Users</th>
<th>Herbal Users</th>
<th>Joint Health Product Users</th>
<th>Other DS\textsuperscript{c} Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>17.9 ± 0.3</td>
<td>19.4 ± 0.4</td>
<td>8.0 ± 0.8</td>
<td>5.9 ± 0.2</td>
<td>5.6 ± 0.2</td>
<td>4.9 ± 0.3</td>
<td>4.2 ± 0.3</td>
<td>1.9 ± 0.3</td>
<td>3.6 ± 0.2</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>21.3 ± 0.8</td>
<td>24.3 ± 1.1</td>
<td>10.0 ± 3.1</td>
<td>9.1 ± 0.8</td>
<td>8.3 ± 0.6</td>
<td>8.7 ± 0.7</td>
<td>4.6 ± 0.6</td>
<td>2.5 ± 0.8</td>
<td>3.9 ± 0.6</td>
</tr>
<tr>
<td>P value\textsuperscript{c}</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>0.68</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>0.57</td>
<td>0.49</td>
<td>0.58</td>
<td></td>
</tr>
<tr>
<td>Age (y)</td>
<td>18-24</td>
<td>20.8 ± 0.7</td>
<td>21.7 ± 0.9</td>
<td>9.6 ± 2.2</td>
<td>7.0 ± 0.6</td>
<td>6.3 ± 0.6</td>
<td>5.1 ± 0.6</td>
<td>3.5 ± 0.7</td>
<td>2.3 ± 1.1</td>
<td>4.7 ± 0.6</td>
</tr>
<tr>
<td></td>
<td>25-29</td>
<td>18.6 ± 0.6</td>
<td>19.5 ± 0.8</td>
<td>6.9 ± 1.7</td>
<td>5.8 ± 0.4</td>
<td>5.9 ± 0.5</td>
<td>5.1 ± 0.5</td>
<td>3.8 ± 0.6</td>
<td>1.4 ± 0.6</td>
<td>2.6 ± 0.4</td>
</tr>
<tr>
<td></td>
<td>30-39</td>
<td>18.3 ± 0.4</td>
<td>20.1 ± 0.6</td>
<td>8.1 ± 1.1</td>
<td>6.4 ± 0.4</td>
<td>5.5 ± 0.3</td>
<td>5.8 ± 0.4</td>
<td>4.5 ± 0.4</td>
<td>1.6 ± 0.4</td>
<td>3.3 ± 0.3</td>
</tr>
<tr>
<td></td>
<td>\geq 40</td>
<td>16.7 ± 0.6</td>
<td>18.8 ± 0.9</td>
<td>8.0 ± 1.5</td>
<td>5.6 ± 0.6</td>
<td>7.2 ± 0.5</td>
<td>6.1 ± 0.6</td>
<td>5.0 ± 0.6</td>
<td>3.2 ± 0.7</td>
<td>4.7 ± 0.5</td>
</tr>
<tr>
<td>P value\textsuperscript{c,d}</td>
<td>&lt; 0.01/ &lt; 0.01</td>
<td>0.13/0.06</td>
<td>0.80/0.75</td>
<td>0.22/0.21</td>
<td>0.04/0.35</td>
<td>0.51/0.15</td>
<td>0.32/0.06</td>
<td>0.07/0.11</td>
<td>&lt; 0.01/0.48</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Some HS/IHS graduate</td>
<td>19.7 ± 0.8</td>
<td>20.1 ± 1.0</td>
<td>8.8 ± 2.0</td>
<td>7.1 ± 0.6</td>
<td>6.9 ± 0.7</td>
<td>6.5 ± 0.8</td>
<td>4.5 ± 0.9</td>
<td>2.7 ± 1.2</td>
<td>4.0 ± 0.6</td>
</tr>
<tr>
<td></td>
<td>Some college</td>
<td>20.3 ± 0.4</td>
<td>21.0 ± 0.5</td>
<td>7.7 ± 1.1</td>
<td>6.9 ± 0.4</td>
<td>6.8 ± 0.4</td>
<td>5.7 ± 0.4</td>
<td>3.9 ± 0.4</td>
<td>2.0 ± 0.4</td>
<td>3.7 ± 0.3</td>
</tr>
<tr>
<td></td>
<td>College degree</td>
<td>16.1 ± 0.4</td>
<td>18.9 ± 0.6</td>
<td>8.0 ± 1.2</td>
<td>5.2 ± 0.3</td>
<td>5.2 ± 0.3</td>
<td>5.3 ± 0.4</td>
<td>4.6 ± 0.4</td>
<td>1.9 ± 0.4</td>
<td>3.4 ± 0.3</td>
</tr>
<tr>
<td>P value\textsuperscript{c,d}</td>
<td>&lt; 0.01/ &lt; 0.01</td>
<td>0.03/0.07</td>
<td>0.89/0.82</td>
<td>&lt; 0.01/ &lt; 0.01</td>
<td>&lt; 0.01/ &lt; 0.01</td>
<td>0.41/0.19</td>
<td>0.48/0.52</td>
<td>0.80/0.58</td>
<td>0.63/0.34</td>
<td></td>
</tr>
<tr>
<td>Body mass index</td>
<td>&lt; 25.0</td>
<td>16.5 ± 0.5</td>
<td>18.6 ± 0.7</td>
<td>11.1 ± 2.2</td>
<td>6.5 ± 0.5</td>
<td>5.2 ± 0.4</td>
<td>5.7 ± 0.5</td>
<td>3.5 ± 0.5</td>
<td>1.9 ± 0.6</td>
<td>4.3 ± 0.4</td>
</tr>
<tr>
<td></td>
<td>25.0-29.9</td>
<td>18.7 ± 0.4</td>
<td>20.2 ± 0.5</td>
<td>6.3 ± 0.9</td>
<td>6.2 ± 0.3</td>
<td>6.1 ± 0.3</td>
<td>5.2 ± 0.3</td>
<td>4.3 ± 0.4</td>
<td>2.2 ± 0.4</td>
<td>3.5 ± 0.3</td>
</tr>
<tr>
<td></td>
<td>\geq 30.0</td>
<td>20.7 ± 0.7</td>
<td>21.5 ± 0.9</td>
<td>8.9 ± 1.5</td>
<td>6.5 ± 0.6</td>
<td>6.9 ± 0.5</td>
<td>6.8 ± 0.6</td>
<td>5.3 ± 0.7</td>
<td>1.0 ± 0.4</td>
<td>3.2 ± 0.5</td>
</tr>
<tr>
<td>P value\textsuperscript{c,d}</td>
<td>&lt; 0.01/ &lt; 0.01</td>
<td>0.04/0.01</td>
<td>0.05/0.61</td>
<td>0.83/0.93</td>
<td>0.04/0.01</td>
<td>0.07/0.23</td>
<td>0.09/0.03</td>
<td>0.25/0.30</td>
<td>0.20/0.09</td>
<td></td>
</tr>
<tr>
<td>Aerobic exercise</td>
<td>\leq 90</td>
<td>19.0 ± 0.5</td>
<td>21.2 ± 0.7</td>
<td>7.0 ± 1.5</td>
<td>6.9 ± 0.5</td>
<td>5.5 ± 0.4</td>
<td>5.8 ± 0.5</td>
<td>5.2 ± 0.6</td>
<td>2.4 ± 0.6</td>
<td>4.3 ± 0.4</td>
</tr>
<tr>
<td></td>
<td>91-180</td>
<td>17.6 ± 0.5</td>
<td>21.1 ± 0.8</td>
<td>9.3 ± 1.7</td>
<td>5.9 ± 0.5</td>
<td>5.5 ± 0.4</td>
<td>5.1 ± 0.5</td>
<td>3.6 ± 0.5</td>
<td>1.1 ± 0.4</td>
<td>3.3 ± 0.4</td>
</tr>
<tr>
<td></td>
<td>181-300</td>
<td>18.1 ± 0.6</td>
<td>19.1 ± 0.8</td>
<td>8.5 ± 1.6</td>
<td>5.6 ± 0.5</td>
<td>6.2 ± 0.5</td>
<td>5.6 ± 0.5</td>
<td>4.1 ± 0.6</td>
<td>2.8 ± 0.7</td>
<td>3.4 ± 0.4</td>
</tr>
<tr>
<td>P value\textsuperscript{c,d}</td>
<td>0.23/0.98</td>
<td>0.02/ &lt; 0.01</td>
<td>0.75/0.94</td>
<td>0.17/0.57</td>
<td>0.07/0.01</td>
<td>0.65/0.70</td>
<td>0.23/0.42</td>
<td>0.20/0.98</td>
<td>0.32/0.24</td>
<td></td>
</tr>
<tr>
<td>Resistance training</td>
<td>\leq 45</td>
<td>17.1 ± 0.5</td>
<td>21.9 ± 0.9</td>
<td>7.2 ± 2.1</td>
<td>7.3 ± 0.7</td>
<td>7.6 ± 0.5</td>
<td>6.4 ± 0.5</td>
<td>5.1 ± 0.6</td>
<td>2.0 ± 0.7</td>
<td>5.4 ± 0.6</td>
</tr>
<tr>
<td></td>
<td>46-135</td>
<td>16.4 ± 0.6</td>
<td>20.6 ± 0.9</td>
<td>9.8 ± 2.3</td>
<td>5.3 ± 0.5</td>
<td>5.3 ± 0.4</td>
<td>5.3 ± 0.5</td>
<td>3.9 ± 0.6</td>
<td>1.8 ± 0.6</td>
<td>3.5 ± 0.5</td>
</tr>
<tr>
<td></td>
<td>136-300</td>
<td>19.1 ± 0.5</td>
<td>19.6 ± 0.7</td>
<td>8.0 ± 1.5</td>
<td>6.3 ± 0.4</td>
<td>5.4 ± 0.4</td>
<td>5.7 ± 0.5</td>
<td>3.8 ± 0.5</td>
<td>2.4 ± 0.6</td>
<td>3.2 ± 0.4</td>
</tr>
<tr>
<td>P value\textsuperscript{c,d}</td>
<td>&lt; 0.01/ &lt; 0.01</td>
<td>0.07/ &lt; 0.01</td>
<td>0.80/0.78</td>
<td>0.11/0.80</td>
<td>&lt; 0.01/0.01</td>
<td>0.26/0.10</td>
<td>0.33/0.43</td>
<td>0.84/0.99</td>
<td>&lt; 0.01/ &lt; 0.01</td>
<td></td>
</tr>
</tbody>
</table>

(continued on next page)
Table 3. Prevalence of adverse effects among dietary supplement category (DS) users (≥ 1 times/wk) by demographic and lifestyle characteristics in a representative cohort of service members in the US Military Dietary Supplement Study (continued)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Strata</th>
<th>Any DS Users</th>
<th>Combination Product Users</th>
<th>Purported Pro-hormone Users</th>
<th>Protein/Amino Acid Users</th>
<th>MVM Users</th>
<th>Individual Vitamin/Mineral Users</th>
<th>Herbal Users</th>
<th>Joint Health Product Users</th>
<th>Other DS Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>Never smoked</td>
<td>17.0 ± 0.3</td>
<td>18.8 ± 0.5</td>
<td>8.9 ± 1.1</td>
<td>6.0 ± 0.3</td>
<td>5.8 ± 0.3</td>
<td>5.6 ± 0.3</td>
<td>4.3 ± 0.3</td>
<td>2.2 ± 0.4</td>
<td>3.7 ± 0.3</td>
</tr>
<tr>
<td></td>
<td>Smoked but quit</td>
<td>19.7 ± 0.7</td>
<td>20.9 ± 0.8</td>
<td>6.9 ± 1.5</td>
<td>6.3 ± 0.5</td>
<td>6.2 ± 0.5</td>
<td>5.2 ± 0.6</td>
<td>5.5 ± 0.7</td>
<td>1.8 ± 0.6</td>
<td>3.6 ± 0.5</td>
</tr>
<tr>
<td></td>
<td>Smoker</td>
<td>21.7 ± 0.7</td>
<td>23.0 ± 0.9</td>
<td>7.4 ± 1.6</td>
<td>6.9 ± 0.6</td>
<td>6.8 ± 0.6</td>
<td>5.9 ± 0.7</td>
<td>2.9 ± 0.6</td>
<td>1.6 ± 0.6</td>
<td>3.6 ± 0.5</td>
</tr>
<tr>
<td>P value</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>0.52</td>
<td>0.29</td>
<td>0.21</td>
<td>0.70</td>
<td>0.02</td>
<td>0.70</td>
<td>0.96</td>
<td></td>
</tr>
<tr>
<td>Smokeless tobacco use</td>
<td>Never used</td>
<td>17.8 ± 0.3</td>
<td>19.8 ± 0.4</td>
<td>8.4 ± 0.9</td>
<td>6.1 ± 0.3</td>
<td>5.8 ± 0.2</td>
<td>5.7 ± 0.3</td>
<td>4.4 ± 0.3</td>
<td>2.0 ± 0.3</td>
<td>3.6 ± 0.2</td>
</tr>
<tr>
<td></td>
<td>Used but quit</td>
<td>19.5 ± 1.0</td>
<td>20.3 ± 1.2</td>
<td>5.3 ± 1.9</td>
<td>6.9 ± 0.8</td>
<td>5.4 ± 0.7</td>
<td>4.1 ± 0.8</td>
<td>3.4 ± 0.9</td>
<td>0.9 ± 0.6</td>
<td>3.9 ± 0.7</td>
</tr>
<tr>
<td></td>
<td>User</td>
<td>21.2 ± 0.8</td>
<td>21.3 ± 1.0</td>
<td>8.8 ± 1.8</td>
<td>6.5 ± 0.6</td>
<td>7.1 ± 0.7</td>
<td>5.9 ± 0.8</td>
<td>4.6 ± 0.8</td>
<td>3.0 ± 0.9</td>
<td>3.7 ± 0.6</td>
</tr>
<tr>
<td>P value</td>
<td>&lt; 0.01</td>
<td>0.33</td>
<td>0.42</td>
<td>0.47</td>
<td>0.13</td>
<td>0.23</td>
<td>0.60</td>
<td>0.21</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>Alcohol intake</td>
<td>0</td>
<td>16.6 ± 0.5</td>
<td>17.6 ± 0.7</td>
<td>7.3 ± 1.4</td>
<td>6.3 ± 0.4</td>
<td>5.7 ± 0.4</td>
<td>5.9 ± 0.5</td>
<td>4.5 ± 0.5</td>
<td>1.5 ± 0.5</td>
<td>3.7 ± 0.4</td>
</tr>
<tr>
<td>(mL/wk)</td>
<td>0.23-24.85</td>
<td>17.9 ± 0.6</td>
<td>19.1 ± 0.8</td>
<td>9.1 ± 1.8</td>
<td>6.0 ± 0.5</td>
<td>6.0 ± 0.5</td>
<td>5.9 ± 0.5</td>
<td>3.6 ± 0.5</td>
<td>1.8 ± 0.5</td>
<td>3.5 ± 0.4</td>
</tr>
<tr>
<td></td>
<td>24.86-71.69</td>
<td>18.2 ± 0.6</td>
<td>19.6 ± 0.7</td>
<td>6.8 ± 1.4</td>
<td>6.0 ± 0.4</td>
<td>5.6 ± 0.4</td>
<td>5.2 ± 0.5</td>
<td>3.9 ± 0.5</td>
<td>2.5 ± 0.6</td>
<td>3.3 ± 0.4</td>
</tr>
<tr>
<td></td>
<td>≥ 71.70</td>
<td>21.4 ± 0.6</td>
<td>24.0 ± 0.8</td>
<td>9.0 ± 1.5</td>
<td>6.7 ± 0.5</td>
<td>7.0 ± 0.5</td>
<td>5.3 ± 0.5</td>
<td>5.1 ± 0.6</td>
<td>2.3 ± 0.6</td>
<td>4.0 ± 0.4</td>
</tr>
<tr>
<td>P value</td>
<td>&lt; 0.01/&lt; 0.01</td>
<td>&lt; 0.01/&lt; 0.01</td>
<td>0.62/0.60</td>
<td>0.66/0.53</td>
<td>0.08/0.06</td>
<td>0.61/0.25</td>
<td>0.26/0.44</td>
<td>0.54/0.21</td>
<td>0.66/0.68</td>
<td></td>
</tr>
<tr>
<td>Service</td>
<td>Air Force</td>
<td>14.7 ± 0.4</td>
<td>16.8 ± 0.6</td>
<td>8.0 ± 1.5</td>
<td>5.4 ± 0.4</td>
<td>4.6 ± 0.3</td>
<td>4.0 ± 0.4</td>
<td>3.1 ± 0.4</td>
<td>1.7 ± 0.4</td>
<td>2.8 ± 0.3</td>
</tr>
<tr>
<td></td>
<td>Army</td>
<td>19.8 ± 0.5</td>
<td>20.3 ± 0.7</td>
<td>6.5 ± 1.1</td>
<td>6.2 ± 0.4</td>
<td>6.2 ± 0.4</td>
<td>6.0 ± 0.5</td>
<td>5.2 ± 0.5</td>
<td>2.2 ± 0.5</td>
<td>3.9 ± 0.4</td>
</tr>
<tr>
<td></td>
<td>Marine Corps</td>
<td>22.3 ± 0.9</td>
<td>23.0 ± 1.0</td>
<td>9.1 ± 2.0</td>
<td>6.8 ± 0.6</td>
<td>7.7 ± 0.7</td>
<td>5.8 ± 0.8</td>
<td>3.9 ± 0.8</td>
<td>2.9 ± 1.0</td>
<td>3.9 ± 0.6</td>
</tr>
<tr>
<td></td>
<td>Navy</td>
<td>20.5 ± 0.6</td>
<td>23.0 ± 0.9</td>
<td>10.3 ± 1.9</td>
<td>7.5 ± 0.6</td>
<td>7.6 ± 0.5</td>
<td>7.2 ± 0.6</td>
<td>4.9 ± 0.6</td>
<td>1.9 ± 0.6</td>
<td>4.5 ± 0.5</td>
</tr>
<tr>
<td>P value</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>0.28</td>
<td>0.01</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>0.01</td>
<td>0.63</td>
<td>0.03</td>
<td></td>
</tr>
</tbody>
</table>

*DS = dietary supplement.
*MVM = multivitamin/multimineral.
*Based on $\chi^2$ test.
*Based on $\chi^2$ test for trend.
*HS = high school.
Prevalence (as a percent) and its standard error were calculated for each AE. Differences across various strata of demographic factors, lifestyle characteristics, and military services were examined with \( \chi^2 \) statistics. Where variables were ordinal (ie, age, education, BMI, aerobic training duration, resistance training duration, alcohol intake, and number of DSs), Mantel-Haenszel tests for linear trend were also performed. Multivariable logistic regression examined associations between independent variables involving demographic, lifestyle, military characteristics, and number of different DSs consumed and dependent variables that included AEs in each DS category (see the Figure). Logistic regression produced odds ratios and 95% CI reported in the tables. Statistical significance was set at \( P < .05 \) for all statistics. Some participants did not complete all questions and the number of SMs responding is provided for variables in the Tables.

**RESULTS**

From the initial sample frame of 200,000 SMs, 73% (n = 146,365) were successfully contacted (ie, no returned postal mail), and of these, 26,681 (18.2%) signed the informed consent and completed the survey.

**Prevalence of Self-Reported AEs**

Table 1 presents the overall prevalence of AEs reported by SMs in each DS category. The overall proportion of DS users reporting \( \geq 1 \) AEs was 18.4% \( \pm \) 0.3%. In descending order, AEs were most often reported for combination products, purported prohormones, protein/AAs, MVM, individual vitamins/minerals, herbal substances, other DSs, and joint health products. If combination products and purported prohormones were not included, 10.0% \( \pm \) 0.7% of SMs reported \( \geq 1 \) AE; if only MVM, individual vitamins/minerals and herbs were included, 6.4% \( \pm \) 0.7% of SMs reported \( \geq 1 \) AE.

Table 2 presents AEs by the number of DSs consumed and compares the risk of an AE when consuming \( \geq 5 \) different DSs per week to that when consuming 1 to 2 different DSs per week. As the number of DSs increased, the prevalence of all types of AEs increased in all DS categories. The risk of an AE was 2.3 to 17.9 times higher among those consuming \( \geq 5 \) DSs compared with those consuming 1 to 2 DSs.

**Factors Associated with AEs (Univariable Analyses)**

Table 3 presents the prevalence of AEs in each DS category by demographic, lifestyle, and military characteristics. Women were more likely than men to report AEs among users of any DS, combination products, protein/AAs, MVM, and individual vitamins/minerals. As age increased, users of any DS were less likely to report AEs and the youngest and oldest were more likely to report AEs among users of MVM and other DSs. SMs with less formal education were more likely to report AEs among users of any DS, combination products, protein/AAs, and MVM. Reporting of AEs increased with an increase in BMI among users of any DSs, combination products, MVM, and herbals. As aerobic exercise duration increased, reporting of AEs decreased for combination product users, but increased for MVM users. As resistance training duration increased, reporting of AEs increased among users of any DS, but decreased among users of combination products, MVM, and other DSs. Smokers and former smokers were more likely to report AEs among users of any DS and combination products; among herbal users, smokers were less likely to report AEs than nonsmokers or former smokers. Smokeless tobacco users or former users were more likely to report AEs for any DS, but not for any of the other DS categories. As alcohol intake increased, reporting of AEs increased for users of any DS and combination products. Among the military services, those serving in the Air Force had the lowest risk of reporting AEs in all DS categories except purported prohormones. Marine Corps and Navy personnel had the highest reporting of AEs among users of any DS, combination products, proteins/AAs, and MVM.

**Factors Independently Associated with AEs (Multivariable Analyses)**

Table 4 presents multivariable analyses examining the associations between AEs reported by users of each DS category and the demographic factors, lifestyle characteristics, military service, and number of supplements. Among users of any DS, reporting of AEs was higher among women, smokers, and former smokers, and those serving in the Army, Marine Corps, or Navy (compared with the Air Force); reporting decreased as age increased, and reporting increased with an increase in BMI, alcohol consumption, or number of supplements consumed. Among users of combination products, reporting of AEs was higher among women, those with some college, smokers, and those serving in the Army, Marine Corps, or Navy (compared with the Air Force); reporting increased with an increase in BMI, alcohol intake, or number of supplements consumed; reporting generally decreased with an increase in age, aerobic exercise duration, or resistance training duration. None of the variables was independently associated with AEs among purported prohormone users.

Among users of proteins/AAs, reporting of AEs was higher among women, Navy and Army personnel (compared with the Air Force) and increased as the number of DSs consumed increased. Among MVM users, reporting of AEs was higher among women, those with less formal education, and those serving in the Army, Marine Corps, or Navy (compared with the Air Force); reporting increased with an increase in BMI, aerobic training duration, alcohol intake, or number of DSs consumed; reporting decreased as resistance training duration increased. Among individual vitamins/minerals users, risk of reporting AEs was higher among those serving in the Army (compared with the Air Force) and reporting increased as BMI increased. Among herbal substances users, risk of reporting AEs was higher among women, but was not associated with any other factor. Among users of other DSs, risk of reporting AEs was higher in the Army, Marine Corps, or Navy (compared with the Air Force) and decreased as resistance training duration increased.

**DISCUSSION**

The present study found that a substantial proportion (18%) of a large random sample of military personnel who use DSs reported experiencing \( \geq 1 \) AE over a 6-month period, with
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Variable

Strata

Purported
Combination Prohormone
Any DSb Users Product Users Users
(n [ 18,522) (n [ 11,120) (n [ 1,221)

Gender

Male

1.00

Female

1.49 (1.34-1.67) 1.48 (1.29-1.72) 0.98 (0.27-3.50) 1.73 (1.37-2.20) 1.79 (1.46-2.22) 2.09 (1.65-2.65) 1.25 (0.88-1.79) 2.23 (1.00-5.01) 1.07 (0.75-1.52)

Age (y)

18-24

1.00

25-29

0.81 (0.71-0.92) 0.80 (0.69-0.93) 0.76 (0.35-1.68) 0.84 (0.65-1.09) 0.97 (0.73-1.29) 1.04 (0.71-1.51) 1.00 (0.59-1.72) 0.43 (0.09-1.71) 0.54 (0.35-0.83)

30-39

0.82 (0.72-0.92) 0.81 (0.70-0.94) 0.99 (0.48-2.03) 1.01 (0.79-1.28) 0.90 (0.67-1.19) 1.32 (0.93-1.87) 1.18 (0.71-1.97) 0.76 (0.22-2.58) 0.71 (0.48-1.04)

 40

0.76 (0.65-0.88) 0.74 (0.61-0.89) 0.86 (0.37-1.98) 0.90 (0.65-1.23) 1.18 (0.87-1.62) 1.37 (0.92-2.05) 1.19 (0.67-2.10) 2.02 (0.55-7.49) 0.93 (0.60-1.44)

Multivitamin/
Protein/Amino Multimineral
Acid Users
Users
(n [ 10,630) (n [ 11,165)

Individual
Vitamin/
Mineral Users Herbal Users
(n [ 7,704)
(n [ 5,057)

Joint Health Other DS
Product Users Users
(n [ 2,375)
(n [ 7,707)

Odds ratio (95% CI)!

Education

HSc/HS
1.00
graduate

1.00
1.00

1.00

1.00
1.00

1.00

1.00
1.00

1.00

1.00
1.00

1.00

1.00
1.00

1.00

1.00
1.00

1.00

1.00

1.00

1.00

1.00

1.00

1.00

Some
college

1.12 (0.99-1.28) 1.17 (1.00-1.36) 0.92 (0.47-1.79) 1.00 (0.78-1.28) 0.96 (0.73-1.26) 0.79 (0.56-1.11) 0.78 (0.47-1.27) 0.95 (0.29-3.13) 1.10 (0.72-1.66)

College
degree

0.90 (0.78-1.03) 1.04 (0.88-1.23) 0.92 (0.44-1.92) 0.71 (0.76-1.26) 0.67 (0.49-0.90) 0.67 (0.46-0.95) 0.90 (0.54-1.51) 0.52 (0.15-1.85) 0.88 (0.56-1.39)

< 25.0
25.0-29.9

1.00
1.00
1.00
1.00
1.00
1.00
1.00
1.00
1.00
1.16 (1.05-1.27) 1.16 (1.03-1.31) 0.50 (0.29-0.88) 0.98 (0.81-1.18) 1.25 (1.03-1.53) 1.02 (0.80-1.29) 1.24 (0.88-1.75) 1.16 (0.55-2.44) 0.83 (0.63-1.10)

 30.0

1.28 (1.13-1.44) 1.26 (1.08-1.45) 0.72 (0.39-1.33) 0.98 (0.76-1.25) 1.37 (1.07-1.75) 1.33 (1.00-1.67) 1.48 (0.98-2.24) 0.39 (0.12-1.28) 0.75 (0.52-1.10)

Aerobic
exercise
duration
(min/wk)

 90
91-180
181-300
> 300

1.00
1.00
0.95 (0.85-1.06) 0.98 (0.86-1.11)
0.94 (0.84-1.05) 0.87 (0.76-1.00)
0.91 (0.81-1.01) 0.87 (0.76-0.99)

1.00
1.00
1.26 (0.66-2.40) 0.87 (0.69-1.09)
1.22 (0.64-2.33) 0.79 (0.62-1.00)
1.12 (0.60-2.10) 0.96 (0.77-1.20)

1.00
1.00
1.08 (0.86-1.37) 0.88 (0.66-1.17)
1.30 (1.02-1.65) 0.97 (0.72-1.30)
1.55 (1.23-1.96) 1.07 (0.80-1.42)

1.00
1.00
0.67 (0.45-1.00) 0.46 (0.18-1.20)
0.75 (0.51-1.12) 0.84 (0.37-1.89)
0.80 (0.54-1.18) 0.75 (0.32-1.77)

1.00
0.76 (0.54-1.06)
0.81 (0.57-1.15)
0.93 (0.66-1.31)

Resistance
training
duration
(min/wk)

 45
46-135
136-300
> 300

1.00
1.00
0.92 (0.82-1.04) 0.91 (0.77-1.06)
0.94 (0.84-1.05) 0.84 (0.72-0.97)
0.92 (0.81-1.04) 0.79 (0.68-0.92)

1.00
1.00
1.15 (0.49-2.71) 0.74 (0.55-1.00)
0.85 (0.39-1.87) 0.88 (0.68-1.15)
0.82 (0.38-1.78) 0.78 (0.60-1.03)

1.00
1.00
0.69 (0.54-0.87) 0.88 (0.66-1.19)
0.61 (0.48-0.77) 0.96 (0.72-1.29)
0.56 (0.43-0.72) 0.86 (0.63-1.18)

1.00
1.00
0.83 (0.55-1.23) 1.12 (0.40-3.10)
0.81 (0.54-1.21) 1.52 (0.60-3.84)
0.89 (0.58-1.36) 1.26 (0.45-3.55)

1.00
0.64 (0.45-0.91)
0.59 (0.41-0.84)
0.55 (0.38-0.80)

Smoking

Never
1.00
smoked

1.00

1.00

1.00

1.00

Body mass
index

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1.00

1.00

1.00

1.00

Smoked
1.12 (1.00-1.24) 1.12 (0.98-1.27) 0.82 (0.44-1.50) 0.95 (0.76-1.18) 1.03 (0.83-1.28) 0.96 (0.72-1.27) 1.30 (0.91-1.86) 0.79 (0.34-1.79) 0.97 (0.70-1.35)
but quit
Smoker

1.23 (1.11-1.37) 1.23 (1.09-1.40) 0.75 (0.42-1.33) 1.10 (0.89-1.36) 1.13 (0.90-1.41) 1.08 (0.81-1.44) 0.63 (0.40-0.99) 0.62 (0.24-1.60) 0.93 (0.66-1.33)
(continued on next page)

RESEARCH

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Table 4. Associations of self-reported adverse effects by demographic and lifestyle characteristics among users of speciﬁc dietary supplement categories in a
representative cohort of service members in the US Military Dietary Supplement Study (Multivariable Logistic Regression)a


Table 4. Associations of self-reported adverse effects by demographic and lifestyle characteristics among users of specific dietary supplement categories in a representative cohort of service members in the US Military Dietary Supplement Study (Multivariable Logistic Regression) (continued)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Strata</th>
<th>Any DS Users (n = 18,522)</th>
<th>Combination Product Users (n = 11,120)</th>
<th>Purported Prohormone Users (n = 1,221)</th>
<th>Protein/Amino Acid Users (n = 10,630)</th>
<th>Multivitamin/ Multimineral Users (n = 11,165)</th>
<th>Individual Vitamin/ Mineral Users (n = 7,704)</th>
<th>Herbal Users (n = 5,057)</th>
<th>Joint Health Product Users (n = 2,375)</th>
<th>Other DS Users (n = 7,707)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smokeless tobacco use</td>
<td>Never used</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Used but quit</td>
<td>1.01 (0.90-1.13)</td>
<td>0.97 (0.84-1.11)</td>
<td>1.15 (0.67-1.98)</td>
<td>1.02 (0.81-1.29)</td>
<td>1.13 (0.88-1.44)</td>
<td>1.10 (0.80-1.52)</td>
<td>1.07 (0.69-1.67)</td>
<td>2.14 (0.95-4.81)</td>
<td>1.05 (0.72-1.52)</td>
</tr>
<tr>
<td>Alcohol intake (mL/wk)</td>
<td>0 (0.23-24.85)</td>
<td>1.16 (1.04-1.29)</td>
<td>1.10 (0.96-1.27)</td>
<td>1.24 (0.66-2.34)</td>
<td>0.98 (0.77-1.23)</td>
<td>1.14 (0.91-1.43)</td>
<td>1.01 (0.78-1.32)</td>
<td>0.83 (0.55-1.23)</td>
<td>1.68 (0.64-4.43)</td>
<td>0.97 (0.69-1.36)</td>
</tr>
<tr>
<td></td>
<td>24.86-71.69</td>
<td>1.16 (1.04-1.30)</td>
<td>1.14 (1.00-1.31)</td>
<td>1.05 (0.56-1.97)</td>
<td>1.06 (0.84-1.32)</td>
<td>1.13 (0.90-1.43)</td>
<td>0.97 (0.74-1.28)</td>
<td>0.95 (0.64-1.41)</td>
<td>2.20 (0.90-5.88)</td>
<td>0.94 (0.67-1.32)</td>
</tr>
<tr>
<td></td>
<td>≥ 71.70</td>
<td>1.38 (1.23-1.53)</td>
<td>1.43 (1.25-1.63)</td>
<td>1.27 (0.71-2.26)</td>
<td>1.14 (0.91-1.43)</td>
<td>1.42 (1.13-1.78)</td>
<td>0.97 (0.72-1.29)</td>
<td>1.27 (0.87-1.85)</td>
<td>1.88 (0.70-5.06)</td>
<td>1.08 (0.77-1.51)</td>
</tr>
<tr>
<td>Service branch</td>
<td>Air Force</td>
<td>1.47 (1.33-1.62)</td>
<td>1.35 (1.19-1.53)</td>
<td>0.89 (0.49-1.60)</td>
<td>1.24 (1.01-1.53)</td>
<td>1.27 (1.03-1.57)</td>
<td>1.70 (1.31-2.21)</td>
<td>1.61 (1.12-2.32)</td>
<td>1.49 (0.67-3.30)</td>
<td>1.56 (1.13-2.16)</td>
</tr>
<tr>
<td></td>
<td>Marine Corps</td>
<td>1.57 (1.38-1.78)</td>
<td>1.59 (1.36-1.85)</td>
<td>1.40 (0.70-2.79)</td>
<td>1.25 (0.96-1.61)</td>
<td>1.65 (1.25-2.17)</td>
<td>1.76 (1.21-2.54)</td>
<td>1.25 (0.73-2.12)</td>
<td>2.02 (0.76-5.37)</td>
<td>1.54 (1.01-2.33)</td>
</tr>
<tr>
<td></td>
<td>Navy</td>
<td>1.49 (1.34-1.65)</td>
<td>1.44 (1.26-1.64)</td>
<td>1.45 (0.78-2.70)</td>
<td>1.42 (1.13-1.77)</td>
<td>1.54 (1.24-1.90)</td>
<td>1.80 (1.37-2.36)</td>
<td>1.43 (0.98-2.09)</td>
<td>1.22 (0.49-3.26)</td>
<td>1.59 (1.14-2.22)</td>
</tr>
<tr>
<td>No. of DS Consumed per week</td>
<td>1-2</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>2-4</td>
<td>1.64 (1.44-1.86)</td>
<td>1.21 (1.01-1.45)</td>
<td>1.40 (0.70-4.61)</td>
<td>1.73 (1.16-2.59)</td>
<td>1.11 (0.82-1.52)</td>
<td>0.77 (0.52-1.14)</td>
<td>0.75 (0.43-1.29)</td>
<td>0.70 (0.43-1.36)</td>
<td>0.64 (0.41-1.00)</td>
</tr>
<tr>
<td></td>
<td>≥ 5</td>
<td>2.59 (2.32-2.88)</td>
<td>1.33 (1.14-1.55)</td>
<td>1.45 (0.78-2.70)</td>
<td>2.09 (1.46-2.99)</td>
<td>1.67 (1.29-2.15)</td>
<td>0.86 (0.62-1.18)</td>
<td>0.76 (0.49-1.17)</td>
<td>0.71 (0.21-2.44)</td>
<td>0.71 (0.42-1.00)</td>
</tr>
</tbody>
</table>

aModels are adjusted for all variables presented in the table: gender, age, education, body mass index, aerobic exercise duration, resistance exercise duration, smoking, smokeless tobacco use, alcohol intake, service branch, and number of supplements consumed per week.

bDS = dietary supplement.

hHS = high school.
the largest proportion of users reporting AEs for combination products (20%) and prohormones (8%). Reports of all types of AEs increased as the number of DSs consumed increased. In multivariable analysis, reporting AEs among any DS users were independently associated with female gender; younger age; higher BMI; smoking or former smoking; higher alcohol intake; service in the Army, Navy, or Marine Corps (compared with the Air Force); and consumption of a greater number of DSs.

Prevalence of AEs

In previous studies of DS use in military populations, self-reported AEs have been reported by 8% to 29% of SMs surveyed.19,20,29-34 The 18% reported in this study falls in the middle of this range. In civilian populations, AEs were reported by only 3% to 9% of individuals surveyed.15,35-37 The difference in AE prevalence between civilian and military studies is likely because civilians primarily use MVM, individual vitamins/minerals, and herbal substances,24,38,39 whereas SMs frequently report consumption of combination products, prohormones, and protein/AAs.20,24,26 When only MVM, individual vitamins/minerals, and herbal substances were examined in the present study, only 6% of SMs reported ≥ 1 AEs, similar to the prevalence of AEs in civilian studies.

In the current study, the DS category (see the Figure) with the highest incidence of AEs was combination products, which was in agreement with two past military investigations.19,20 Marine Corps personnel had the highest proportion of reported AEs in the current study, and were the highest users of combination products and consumers of ≥ 5 DSs in past investigations.20,22 Combination products include supplements used for weight loss, pre- and post-workout substances, and DSs purported to increase muscle mass or muscle strength. They can contain a wide variety of substances that have or are claimed to have specific physiological effects (eg, caffeine and nitric oxide agents)40 and may interact with other substances in DSs or with medications SMs might be taking. For example, in a study involving 2005-2008 National Health and Nutrition Examination Survey, more than one-third of all adults reported concomitant use of prescription medications and DSs; individuals with a clinically diagnosed medical condition were more than two- and a-half times more likely to concomitantly use prescription medications and DSs compared with those without clinically diagnosed medical conditions.41 In 2013-2014 National Health and Nutrition Examination Survey data, 49% of DS users were taking common medications that had potential interactions with specific DSs.30 It has been estimated that 20% of liver injuries in the United States were attributable to DSs during 2013 and 2014 and about half of these were associated with combination products.42 It is difficult to attribute direct causality to self-reported AEs because self-reports could be incorrectly reported by the individual (eg, due to other causes) and/or have alternative explanations. Nonetheless, the proportion of SMs reporting AEs for combination products was very high and a matter of considerable concern.

As the number of DSs increased, so did the proportion of SMs reporting AEs in all AE categories. This was reported in a previous study of SMs,19 but the relationship between AEs and number of DSs consumed has not been addressed in studies of civilian populations. As a greater number of DSs are consumed, individuals could be exposed to more potentially unsafe substances, the possibility of interactions among compounds in these supplements increases, and there are more possible interactions with medications individuals may be taking.

Factors Associated with AEs in DS Categories

Female gender was a robust demographic characteristic associated with AEs. Women were more likely to report AEs in most DS categories in both univariable and multivariable analyses. Women typically report more somatic symptoms than men.43-45 Hypotheses advanced to account for this difference include socialization that encourages women to disclose illness, distress, and discomfort compared with men; differences in brain function and peripheral processing of noxious sensations; greater vigilance and awareness of bodily symptoms; and seeking of more medical attention.46-50

More formal education was generally associated with less symptoms reporting for some DS categories in univariable analyses, but these relationships were considerably attenuated in the multivariable analyses. Conversely, higher BMI was associated with more symptoms reporting for any DSs, combination products, MVM, and herbal substances in both univariable and multivariable analyses. The military has strict weight for height and body fat limitations and there are unfavorable career consequences for those exceeding these limitations.41-54 SMs with higher BMI may believe using combination products marketed as weight loss supplements, and vitamins/minerals, are a way to reduce weight and/or fat to meet military standards and improve overall health. This may increase their exposure to substances in those supplements that may have harmful effects or are perceived as harmful.

In the multivariable analyses, as the amount of resistance training increased, reports of AEs decreased. This was surprising because previous studies have shown that as the amount of resistance training increases, so does the consumption of most DSs, especially combination products.20,21,55 Thus, more AEs might be expected among SMs who participate in resistance training because they are using more supplements, especially those with more AEs. One hypothesis is that those who participate in resistance training and experienced AEs with a particular DS discontinue use of that product. They search for products that they believe will improve their resistance training performance while not resulting in AEs. Knapik and colleagues17 previously showed in this same cohort that 44% of SMs used combination products. Some of the extensive use of combination products could be related to the requirement in the military for a high level of physical fitness to assist in the performance of military occupational tasks. Each military service has physical fitness testing requirements,50 and like the requirement for body weight/body fat described above, SMs who do not pass the testing standards can adverse performance reports and be discharged from service for repeated failures. Thus, some individuals may use specific combination products because they are marketed to increase physical fitness or physical performance.
Smoking, having been a smoker, and higher alcohol intake were also associated with more symptom reporting for any DS and combination products. Numerous interactions have been described between alcohol, cigarette smoke, and other substances.\textsuperscript{57,58} For example, cigarette smoke is a heterogeneous aerosol containing at least 3,800 constituents in both particulate and gaseous form. The gaseous phase contains carbon dioxide, carbon monoxide, nitrogen oxides, ammonia, hydrogen cyanide, hydrazine, formaldehyde, acetone, and aerolein. Substances in the particulate phase include nicotine, toluene, phenol, and catechol. Carbon dioxide, nicotine, and carbon monoxide are by far the major components of cigarette smoke.\textsuperscript{59,60} Nicotine is a bioactive substance that increases circulating norepinephrine, epinephrine, vasopressin, growth hormone, cortisol, adrenocorticotropic hormone, and beta-endorphins\textsuperscript{61,62} that could interact with substances in DSs, especially combination products that contain multiple ingredients.

Air Force personnel reported the lowest prevalence of AEs among all the military services for most DS categories. This is likely because among all the services, Air Force personnel were among those with lowest use of combination products and purported prohormones,\textsuperscript{63} which were the two categories that had the highest incidence of AEs in the current study. Marine Corps personnel had the highest overall self-reporting of AEs and Knapik and colleagues\textsuperscript{64} previously showed in this same cohort that Marine Corps personnel had the highest use of combination products and second highest use of prohormones.

Strengths and Limitations

The questionnaire used in the current study was standardized and based on questionnaires used in previous military studies,\textsuperscript{63} but updated to include more DSs currently on the market and accessible to military personnel. The demographic characteristics and lifestyle factors examined in this study were similar to those of other civilian and military investigations, allowing for reasonable comparisons across studies. Although SMs reported the frequency of DS use, they did not report amounts (ie, doses) of DSs, so these could not be related to AEs. To adequately analyze the extensive data collected in this study a large number of statistical tests examining relationships between AEs and the demographic, lifestyle, and military factors were conducted. The more effects investigated, the greater the chance of making a Type 1 error where the null hypothesis will be incorrectly accepted.

All data were self-reported and had the usual weaknesses associated with this method, including recall bias, social desirability, errors in self-observation, and inadequate recall.\textsuperscript{64,65} Self-reported AEs could have misinterpreted in the case that, for example, a particular symptom caused by another event was associated with a DS taken in close proximity to the other event. Gender could only be reported as “male” or “female” on the questionnaire and there could have been participants who identify as nonbinary or have other gender identifications. Finally, it is important to note the perception that specific DSs are dangerous could bias individuals to report that a DS they are taking caused AEs when it actually did not. This may be considered a nocebo effect\textsuperscript{66} because the symptoms are induced or associated with use of a DS by negative information on that DS, not consumption of the DS.

CONCLUSIONS

Clinicians should advise clients that DSs are not regulated by the FDA for their efficacy or safety and a number of these have been associated with AEs, especially those marketed for weight control, before/after workout, bodybuilding, and hormone enhancement. If clients choses to use DSs they need to be aware of the potential for AEs and to monitor themselves after consumption. Data in this study provide useful quantitative information that can assist in this regard: In this stratified random sample of more than 26,000 SMs from all military services, the prevalence of self-reported AEs was 18%. AE incidence was particularly high for combination products (20% of users) and purported prohormones (8% of users). Women, younger individuals, those with higher BMI, smokers, those with higher alcohol intake, and those consuming a greater number of DSs are at higher risk. Further research on the AEs of DSs might link specific DS to adverse medical events recorded in medical records rather than relying only on self-reported AEs. This could further improve the understanding of the association of DSs with their actual AEs.

References


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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

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AUTHOR CONTRIBUTIONS

J. J. Knapik designed the research, analyzed data, wrote the paper, and had responsibility for final content. D. W. Trone designed the research, conducted research, provided essential materials, and had responsibility for final content. R. A. Steelman analyzed data and had responsibility for final content. E. K. Farina designed the research and had responsibility for final content. H. R. Lieberman conceptualized the study, designed the research plan, and had responsibility for final content. All authors read and approved the final manuscript.
State and Local Healthy Kids’ Meal Laws in the United States: A Review and Content Analysis

Crystal L. Perez, MPH; Alyssa Moran, ScD; Gabby Headrick, MSPH, RDN; Julia McCarthy, JD; Angie L. Cradock, ScD, MPE; Keshia M. Pollack Porter, PhD

ABSTRACT

Background To address unhealthy restaurant food intake among children, localities and states are passing healthy restaurant kids’ meal laws. However, there is limited knowledge of what these policies require and how they compare with expert and industry nutrition standards.

Objectives The aim of this study was to develop a research instrument to evaluate healthy kids’ meal laws and assess their alignment with expert and industry nutrition standards.

Design The study team conducted a content analysis of healthy kids’ meal laws passed between January 2010 and August 2020 in the United States. Using a structured codebook, two researchers abstracted policy elements and implementation language from laws, regulations, fiscal notes, and policy notes. Nutritional criteria for kids’ beverages and meals were compared with existing expert and industry nutrition standards for meals and beverages.

Main outcome measures Measures included law characteristics, implementation characteristics, enforcement characteristics, definitions of key terms, and nutritional requirements for meals and default beverage options and alignment with expert and industry nutrition standards.

Statistical analyses performed Interrater reliability of the coding tool was estimated using the Cohen kappa statistic, and researchers calculated descriptive statistics of policy elements.

Results Twenty laws were identified. Eighteen were healthy default beverage policies, two were toy restriction policies, and one was a nutrition standards policy. The nutrition standards, default beverage offerings, and implementation characteristics varied by location. No law met the expert nutrition standards for kids’ meals or beverages.

Conclusions The variations in policy specifications may influence how restaurants implement the policies and, consequently, the policies’ influences on children’s consumption. Future policies could use expert nutrition standards to inform the standards set for kids’ meals and specify supports for implementation.

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OVER THE PAST THREE DECADES, KIDS’ RESTAURANT food intake has increased dramatically.1-4 In the United States, more than one in three kids eat fast food on any given day, and fast food comprises 13.8% of kids’ daily energy intake.5 Among young kids, fast-food consumption is associated with excess weight gain5,6 and poorer diet quality, including higher daily intake of calories, added sugars, and sugary drinks.5,7

One reason fast-food consumption is associated with weight gain and poorer diet quality is that most restaurants offer unhealthy items on kids’ menus. In 2013, the Center for Science in the Public Interest (CSPI) examined menu offerings from the top 50 restaurant chains and found that 97% of kids’ meal combinations did not meet the National Alliance for Nutrition and Activity’s Model Local School Wellness Policies on Physical Activity and Nutrition.8,9 Approximately 86% of kids’ meal combinations contained excess calories (> 430 kcal), 66% contained excess sodium (> 1,200 mg), and 55% contained excess saturated fat (> 10% of calories from saturated fat), compared with what nutrition experts recommend.9 In addition, kids’ meals often include a sugary drink like soda. In 2019, CSPI found that 61% of the top 50 restaurant chains and 83% of the top 200 restaurant chains that offered a kids’ menu included sugary drinks as the default, or automatic, beverage option.10

Within the past decade, the restaurant industry has made voluntary commitments to improve the nutritional quality of kids’ meals.11 In 2011, the National Restaurant Association (NRA), the largest restaurant industry trade association, launched their Kids Live Well (KLW) program, which sets nutrition standards for kids’ entrées and sides, expanding to include beverages in 2019. In addition, several restaurant chains made voluntary changes to increase the healthfulness of their kids’ meals.12 For example, Jack-in-the-Box
Toys from their kids’ meals and replaced french fries with options like fresh apples. Although such voluntary commitments are promising, researchers found that chain restaurants that made public commitments to improve the nutritional composition of kids’ meals made no significant changes compared with restaurants that had not made these commitments. Therefore, despite fast-food intake being one crucial modifiable risk factor for childhood obesity, voluntary initiatives to improve the nutritional quality of kids’ meals have not led to widespread, meaningful change.

To address unhealthy restaurant food intake among children, cities, counties, and states are passing healthy kids’ meal policies. These policies aim to improve the nutritional quality of restaurant kids’ meals by setting nutrition standards for meals or meal components. For example, some policies require that restaurants offer only healthy beverages, such as water or milk as the default beverage options in kids’ meals. Other policies require kids’ meals sold with a toy or incentive item to meet nutrition standards.

This research seeks to understand how states and localities use policy to improve child nutrition in restaurant settings. First, the study team identified all healthy kids’ meal policies passed between January 2010 and August 2020. Second, the study team developed a coding instrument to evaluate healthy kids’ meal policies. Third, the study team summarized key provisions of this legislation, including nutrition standards, beverage options, and enforcement mechanisms. Fourth, the study team compared the nutrition standards for beverages and meals in healthy kids’ meal legislation to expert and industry nutrition guidelines. Understanding the policy landscape is important for explaining why these policies’ effects on dietary behaviors may differ across jurisdictions and for informing future advocacy and policy development.

**METHODS**

This study used a modified legal mapping approach to identify all jurisdictions in the United States with healthy kids’ meal policies passed into law between January 2010 and August 2020. Healthy kids’ meal policies were defined as laws that targeted the nutritional quality of restaurant kids’ meals and could address kids’ meals using one or more of at least three provisions. The first was a healthy default beverage provision, which requires restaurants to offer only healthy beverages (eg, water or low-fat milk) as the default option in kids’ meals. The second was a nutrition standards provision, which requires that kids’ meals meet certain nutrient thresholds (eg, limits on sodium) or food group requirements (eg, minimum number of servings of fruits and vegetables). The third was a toy restriction provision, which requires restaurants to meet certain nutrient thresholds to offer toys or giveaways with kids’ meals.

**Identifying Healthy Kids’ Meal Policies**

Relevant policies were identified using several sources. First, a list of healthy kids’ meal policies was obtained from CSPI, a national nutrition advocacy organization. Second, legal and policy databases, including Westlaw, Legiscan, National Conference of State Legislatures, the Healthy Food Policy Project database, the World Cancer Research Fund International’s NOURISHING database, and the Growing Food Connections database, the Rudd Center for Food Policy Legislation database, and the Center for Public Health Law Research Law Atlas at Temple University database were searched and cross-referenced. Finally, each state legislature’s website was searched along with a Google search for a healthy kids’ meal law in each state. The phrases “children’s meals, kids’ meal policies, default beverage, and toys” were used for search queries in the databases, and the search string “kids meal policies AND (default beverage OR toys) AND [state name]” was used in Google searches.

Connections database were collected from government websites when publicly available. Regulations were defined as the accompanying rules written by the agency responsible for implementing the law. Fiscal notes were defined as short reports that provide an estimate of a bill’s fiscal influence on the state, local governments, and small businesses, whereas policy notes described the current state of the law and provided background analysis of the law. Jurisdictions with documents that were not publicly available were acquired directly from government officials (n = 8) per the direct request of one researcher.

**Measure Development: The Healthy Kids’ Meal Policy Assessment Tool**

**Step 1: Identification of Policy Elements.** To identify the policy components of the various healthy kids’ meal laws, one researcher read the full text of all policy documents and identified key elements of healthy kids’ meal laws. These measures were organized under five domains: law characteristics, such as effective dates and jurisdiction; implementation characteristics, such as communication of the policy to the community; enforcement characteristics, such as penalties for noncompliance; definitions of key terms, such as children’s menu or default beverage; and nutritional requirements for meals and default beverage options. A 130-item structured coding instrument was created to capture and describe the content of healthy kids’ meal policies. Measures were dichotomous to capture the presence of
RESEARCH

characteristics (eg, “Is water allowed?”) or open-ended to capture specific information that could not be captured in a yes/no format (eg, “What is the anticipated impact of this policy on revenues?”). The study team reviewed the coding instrument for completeness and updated it accordingly. The operationalization of the measures in each domain is defined in Figure 1 (available at www.jandonline.org).

Step 2: Coding Policy Text. Two trained graduate student researchers piloted the coding instrument on a sample of four policies that included each type of kids’ meal policy and type of jurisdiction. Interrater agreement was calculated for each item using the Cohen kappa statistic, which ranges in value from −1 to 1.25 Items with poor agreement ($k < 0.60; n = 23$) were discussed among the study team and additional clarification for the item definitions was added to the final codebook.

Once the coding instrument was finalized, two researchers independently reviewed each law and associated documents. Data were abstracted using Qualtrics,50 an electronic data collection tool. Open-ended responses were analyzed in-depth, coded, and organized into themes when appropriate. Discrepancies between coders were discussed and resolved among the study team. In the case that no consensus was reached, experts in healthy kids’ meal policies were consulted as needed to resolve any discrepancies.

Step 3: Comparing Food and/or Beverage Specifications with Expert and Industry Nutrition Standards. The 2019 Healthy Eating Research (HER) Beverage Consumption Guidelines in Early Childhood27 were used to assess the extent to which healthy kids’ beverage policies aligned with expert nutrition standards. To meet the expert standards, beverages on the kids’ menu must be: water (plain, unsweetened, and unflavored), plain nonfat or low-fat (1%) milk, plain soy milk, 100% juice in a package size of 6 fl oz or less, or 100% juice combined with water or sparkling water in a package size of 6 fl oz or less. The study team decided that the recommendation of only plain nonfat or low-fat (1%) milk for 2- to 5-year-old children was consistent with HER recommendations given that kids’ meals are packaged and marketed by restaurants for children aged 2 to 11 years.43 The NRA KLW voluntary criteria29 were used to assess the extent to which policies met industry standards. To meet the industry standards, kids’ meals must include no more than: 550 kcal, 700 mg sodium, 10% of calories from saturated fat, and 15 g added sugars. In addition, the meal must include at least two of the four components: $\frac{1}{2}$ c fruits and/or vegetables, 1 c fluid milk, and at least half of the grains offered must be whole grain-rich ($\geq 51\%$ whole grain).

Statistical Analyses

Interrater agreement was calculated for each item using the Cohen kappa statistic to assess consensus among the coders. In addition, the number and proportion of laws containing each policy component and meeting expert and industry nutrition standards were calculated using Stata version 15.31 This study was deemed not human subjects research by the Johns Hopkins University Bloomberg School of Public Health Institutional Review Board under federal regulation 45 46.101 (b) CFR.

RESULTS

A total of 20 healthy kids’ meal laws within nine states were identified.32-51 Eighteen laws contained provisions for healthy default beverages, two laws contained provisions for toy restrictions, and one law contained provisions for nutrition standards. Louisville’s law included a healthy default beverage provision and a nutrition standards provision (Tables 1 and 2, available at www.jandonline.org).

Psychometric Properties of the Coding Instrument

Interrater agreement analyses of the coding instrument suggested that the instrument was adequately reliable, with kappa values of 0.61 or higher (Table 3, available at www.jandonline.org).

General Characteristics

Fourteen laws (70%) were passed at the city level (Table 4). Three laws (15%) were passed at the state level, and of these, only California included preemptive language. Most jurisdictions were led by a Democratic local executive (71%) or state governor (75%) at the time of passage. Seven laws (35%) passed unanimously. Nine laws (45%) included a purpose statement, such as supporting the health of children (56%), promoting healthy lifestyles and habits in children (33%), combatting childhood obesity (33%), providing healthy meal options (11%), and supporting parents’ efforts to feed their children nutritious foods (11%). Half (50%) of the codified bills had a fiscal note attached, and all fiscal notes reported no influence on revenue or expenditures or negligible costs to administer the new law. Enactment dates ranged from May 11, 2010, to July 29, 2020, and effective dates ranged from August 11, 2010, to January 29, 2021.

Implementation and Enforcement Provisions

Seventeen laws (85%) specified penalties for violations, with eight laws (40%) imposing a maximum fine of $500 (Table 5).
Table 4. Descriptive characteristics of healthy kids’ meal laws enacted in the United States from January 2010 through August 2020 (N = 20a)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Overall</th>
<th>Default Beverage (n = 18)</th>
<th>Nutrition Standards (n = 1)</th>
<th>Toy Restriction (n = 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jurisdictionb</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>City</td>
<td>14 (70)</td>
<td>14 (78)</td>
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<td>0 (0)</td>
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<tr>
<td>County</td>
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<td>1 (6)</td>
<td>0 (0)</td>
<td>2 (100)</td>
</tr>
<tr>
<td>State</td>
<td>3 (15)</td>
<td>3 (17)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Political affiliation of state governor</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Democrat</td>
<td>15 (75)</td>
<td>15 (83)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Republican</td>
<td>5 (25)</td>
<td>3 (17)</td>
<td>1 (100)</td>
<td>2 (100)</td>
</tr>
<tr>
<td>Other</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Political affiliation of local executivec</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Democrat</td>
<td>12 (71)</td>
<td>10 (67)</td>
<td>1 (100)</td>
<td>2 (100)</td>
</tr>
<tr>
<td>Republican</td>
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<td>1 (7)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Other</td>
<td>4 (24)</td>
<td>4 (26)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Political affiliation of bill sponsor</td>
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<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
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<td>13 (72)</td>
<td>1 (100)</td>
<td>2 (100)</td>
</tr>
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<td>1 (6)</td>
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</tr>
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<td>4 (20)</td>
<td>4 (22)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Decision-making bodyd</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>State health department</td>
<td>3 (15)</td>
<td>3 (17)</td>
<td>0 (0)</td>
<td>0 (0)</td>
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<tr>
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<td>0 (0)</td>
<td>2 (100)</td>
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<td>City health department</td>
<td>5 (25)</td>
<td>5 (28)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>City council</td>
<td>4 (20)</td>
<td>4 (22)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>City board of health</td>
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<td>2 (11)</td>
<td>1 (100)</td>
<td>0 (0)</td>
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<td>City department of licenses and inspections</td>
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<td>1 (6)</td>
<td>0 (0)</td>
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<td>City health initiative</td>
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<td>0 (0)</td>
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<td>City housing and human services</td>
<td>1 (5)</td>
<td>1 (6)</td>
<td>0 (0)</td>
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<tr>
<td>Preemptive language useded</td>
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<td>1 (33)</td>
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<td>7 (39)</td>
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</tr>
<tr>
<td>Time from enactment to effective date (mo)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>&lt; 1</td>
<td>2 (10)</td>
<td>2 (11)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>1</td>
<td>5 (25)</td>
<td>5 (28)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>3</td>
<td>6 (30)</td>
<td>5 (28)</td>
<td>1 (100)</td>
<td>1 (50)</td>
</tr>
<tr>
<td>5</td>
<td>1 (5)</td>
<td>1 (6)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>6</td>
<td>3 (15)</td>
<td>3 (17)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>12</td>
<td>3 (15)</td>
<td>2 (11)</td>
<td>0 (0)</td>
<td>1 (50)</td>
</tr>
</tbody>
</table>

(continued on next page)
In most cases (70%), the state or local health department is responsible for monitoring and enforcing the law. Twelve laws (60%) are enforced via restaurant inspections. Ten laws (50%) detailed a plan for communication of the policy to the community once passed. Only three laws (15%) specifically stated that educational outreach and/or technical assistance must be provided to restaurants in the community. All policies affect restaurants as defined by their jurisdiction’s respective code; Santa Clara County’s policies apply only to restaurants located in the county’s unincorporated areas.52

All healthy default beverage laws defined “children’s meals,” with most (83%) defining these meals as a combination of food and beverage primarily intended for consumption by children sold at a single unit price (Table 6, available at www.jandonline.org). Only New York City expanded the definition to include any food items alongside words like child or kid; a cartoon, puzzle, or game; accompanied with a toy or kids’ game; or with a maximum age (as set by the restaurant).50 Only Wilmington and Baltimore excluded prepackaged food items from kids’ meals (eg, sandwiches prepared in a facility other than the restaurant).51 Both toy restriction laws defined “meals” as a combination of food and/or beverages offered together for a single price.

Fourteen (78%) of the healthy default beverage laws defined “default beverage” as any beverage that is automatically included or offered as a part of a kid’s meal, absent a specific request by the purchaser of the kid’s meal for an alternative beverage. Five laws (28%) stated that default beverages, but not other beverages, could be listed/displayed on kids’ menus and/or menu boards, and one law (6%) stated that default beverages, but not other beverages, could be listed/displayed on an advertisement. All laws allowed alternative beverages to be provided upon customer request, but only 16 laws (89%) explicitly allowed a substitution at no charge. New York City’s was the only policy to define a “menu” or “menu board” as a printed list of the names or images of food items and the primary writing of a covered establishment from which a customer makes an order selection.56 No state or locality explicitly addressed whether the law applied to online menus or online ordering.

Santa Clara County and San Francisco included different wording to implement their toy restriction laws. The San Francisco law prohibited restaurants from giving away a “free” incentive item with the purchase of a meal unless the meal met specific nutritional requirements.50 However, the Santa Clara County law did not include the word “free” and prohibited restaurants from offering a toy or incentive item with the purchase of a single food item or meal unless that food item or meal met specific nutritional requirements.51

Alignment of Healthy Default Beverage Provision and Nutrition Standards Provision with Nutrition Guidelines

All 18 healthy default beverage laws allowed for plain, flavored, or sparkling water with no added sweeteners and nonfat or low-fat (1%) milk. Thirteen laws (72%) allowed for both whole or 2% milk and flavored milk. Seventeen laws (94%) allowed for nondairy milk alternatives. Four laws (22%) required the nondairy milk alternative to be nutritionally equivalent to milk or soy milk. Ten laws (56%) allowed for 100% fruit or vegetable juice. Eight laws (44%) allowed 100% juice mixed with water. One law (6%) specified that any low-calorie beverage, which was defined as any drink with fewer than 25 kcal per 8-oz serving and no artificial sweeteners (Table 7), could be considered a healthy default option. None of the healthy default beverage laws met the 2019 HER Beverage Consumption Guidelines in Early Childhood, and only two (11%) met the industry standards for default beverage options.

None of the nutrition standards laws or toy restriction laws met the standards from the National School Lunch Program or industry (Table 8). The laws of Santa Clara County and San Francisco included similar specifications for nutrients but offered few, if any, specifications for food groups. Louisville’s law covered multiple food components to be included in the kids’ meal but required fewer servings than the expert standards and did not cover specific nutrients.

DISCUSSION

This study systematically identified and compared policy elements of all healthy kids’ meal laws in the United States and compared these policies against expert and industry nutrition standards. This research filled an important gap in knowledge.
because there is limited understanding of these variations in policies. This research showed that as of August 2020, 20 jurisdictions had enacted healthy kids’ meal laws. Most of the healthy kids’ meal laws were passed at the local level under Democratic leadership and enforced by local and state health departments via restaurant inspections with violation fines for noncompliance. There was variation in the implementation provisions, particularly regarding requirements for educational outreach and technical assistance to restaurants, descriptions of key policy elements, and nutritional requirements for kids’ beverages and meals. No laws fully

<table>
<thead>
<tr>
<th>Variable</th>
<th>Laws n (%)</th>
<th>Variable</th>
<th>Laws n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring and enforcement agency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State health department</td>
<td>3 (15)</td>
<td>Kids’ meals exclude foods prepackaged elsewhere</td>
<td>2 (11)</td>
</tr>
<tr>
<td>Local health department</td>
<td>11 (55)</td>
<td>Kids’ meals must be listed on the menu or menu board</td>
<td>1 (6)</td>
</tr>
<tr>
<td>City manager</td>
<td>2 (10)</td>
<td>Default beverages are defined as any beverage</td>
<td>14 (78)</td>
</tr>
<tr>
<td>City attorney</td>
<td>1 (5)</td>
<td>Automatically included or offered as part of a kids’ meal, absent a specific request by the purchaser of the children’s meal for an alternative beverage</td>
<td>12 (67)</td>
</tr>
<tr>
<td>City health initiative</td>
<td>1 (5)</td>
<td>Only default beverages can be offered on the menu or menu board</td>
<td>5 (28)</td>
</tr>
<tr>
<td>City administrative services department</td>
<td>1 (5)</td>
<td>Only default beverages can be offered on advertisements of kids’ meals</td>
<td>1 (6)</td>
</tr>
<tr>
<td>City department of licenses and inspections</td>
<td>1 (5)</td>
<td>Only default beverages can be offered on online menus or ordering platforms</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Enforcement method</td>
<td></td>
<td>Substitute beverage can be requested at no cost</td>
<td>16 (89)</td>
</tr>
<tr>
<td>Inspections</td>
<td>12 (60)</td>
<td>Toy restriction provision (n = 2)</td>
<td></td>
</tr>
<tr>
<td>Self-certification</td>
<td>6 (30)</td>
<td>Meal is defined as a combination of single food items and/or beverages offered together for a single price</td>
<td>2 (100)</td>
</tr>
<tr>
<td>Self-reporting, customer-reporting</td>
<td>1 (5)</td>
<td>Incentives include food incentives</td>
<td>1 (50)</td>
</tr>
<tr>
<td>Pending rulemaking</td>
<td>1 (5)</td>
<td>Mandates a restaurant can give away a “free” incentive if the kids’ meal meets minimum nutrition standards</td>
<td>1 (50)</td>
</tr>
<tr>
<td>Maximum violation fines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No fine</td>
<td>2 (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$50</td>
<td>1 (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$100</td>
<td>2 (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$200</td>
<td>2 (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$250</td>
<td>1 (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$500</td>
<td>8 (40)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$1,000</td>
<td>3 (15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pending rulemaking</td>
<td>1 (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restaurants and community must be notified of policy adoption(^a)</td>
<td>10 (50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education or technical assistance must be provided to restaurants and community</td>
<td>3 (15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only applies to unincorporated regions of a jurisdiction(^b)</td>
<td>2 (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy default beverage and nutritional standards provisions (N=18)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kids’ meal is defined as a combination of food and beverage that is prepared by and offered for purchase at a food service establishment as a unit at a single price intended to be consumed by children</td>
<td>3 (17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kids’ meal is defined as a combination of food and beverage primarily intended for consumption by children sold at a single unit price</td>
<td>15 (83)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Decision-making body or monitoring/enforcement agency is listed as responsible for notifying the community and restaurant of the policy adoption such as posting the policy in a distinct number of conspicuous places for the public.

\(^b\) An unincorporated region is a geographic area with a common social identity that is not governed by a local municipal corporation.
Table 7. Default beverage options permitted by healthy kids’ meal laws enacted in the United States from January 2010 through August 2020 (N = 18)

<table>
<thead>
<tr>
<th>Default beverage option</th>
<th>Law</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>18 (100)</td>
<td></td>
</tr>
<tr>
<td>Flavored water</td>
<td>18 (100)</td>
<td></td>
</tr>
<tr>
<td>Sparkling water</td>
<td>18 (100)</td>
<td></td>
</tr>
<tr>
<td>Contains caloric sweeteners</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Contains noncaloric sweeteners</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Contains artificial colors/flavors</td>
<td>18 (100)</td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td>18 (100)</td>
<td></td>
</tr>
<tr>
<td>Low-fat or 1% milk</td>
<td>18 (100)</td>
<td></td>
</tr>
<tr>
<td>Whole or 2% milk</td>
<td>13 (72)</td>
<td></td>
</tr>
<tr>
<td>Flavored milk</td>
<td>13 (72)</td>
<td></td>
</tr>
<tr>
<td>Caloric sweeteners</td>
<td>12 (67)</td>
<td></td>
</tr>
<tr>
<td>Noncaloric sweeteners</td>
<td>12 (67)</td>
<td></td>
</tr>
<tr>
<td>Artificial colors/flavors</td>
<td>13 (72)</td>
<td></td>
</tr>
<tr>
<td>100% Juice</td>
<td>17 (94)</td>
<td></td>
</tr>
<tr>
<td>Flavor juice</td>
<td>10 (56)</td>
<td></td>
</tr>
<tr>
<td>Vegetable juice</td>
<td>6 (33)</td>
<td></td>
</tr>
<tr>
<td>Juice combined with water</td>
<td>8 (44)</td>
<td></td>
</tr>
<tr>
<td>Caloric sweeteners</td>
<td>1 (6)</td>
<td></td>
</tr>
<tr>
<td>Noncaloric sweeteners</td>
<td>1 (6)</td>
<td></td>
</tr>
<tr>
<td>Artificial colors/flavors</td>
<td>9 (50)</td>
<td></td>
</tr>
<tr>
<td>Nutritionally equivalent to milk</td>
<td>4 (22)</td>
<td></td>
</tr>
<tr>
<td>100% Juice</td>
<td>10 (56)</td>
<td></td>
</tr>
<tr>
<td>Fruit juice</td>
<td>10 (56)</td>
<td></td>
</tr>
<tr>
<td>Meets expert nutrition standards</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Meets industry nutrition standards</td>
<td>2 (11)</td>
<td></td>
</tr>
<tr>
<td>Meets nutrition guidelines</td>
<td>1 (6)</td>
<td></td>
</tr>
<tr>
<td>Low-calorie beverage</td>
<td>1 (6)</td>
<td></td>
</tr>
<tr>
<td>Defined as any beverage with &lt; 25 kcal/8 oz.</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>See reference 27.</td>
<td>2 (11)</td>
<td></td>
</tr>
</tbody>
</table>

Although nearly all laws included a definition of kids’ meals, there was variation in this definition in regard to which beverages can be offered as a healthy default and how the default is to be implemented. Understanding these variations in policy language is important because restaurants can choose to comply with the letter of the law but not necessarily the spirit of the law, as was seen in San Francisco where restaurants were able to bypass its policy by charging a small fee for incentive items that came with kids’ meals due to the policy language used. Another example is that if a kids’ meal is defined as a combination (package) of food and beverage items, restaurants that offer food and beverage components for sale separately may not be obligated to comply with the beverage or nutrition standards. In addition, no policy addressed kids’ meals or their nutrition standards in online menus or ordering and delivery platforms. Given the recent increase in revenue and users of online food delivery options during the COVID-19 pandemic, future policies could look to include specifications for these types of online food sources.

Few policies included provisions that required educational outreach or technical assistance to help restaurants implement the law. This gap is concerning given early findings from Ritchie and colleagues, which found limited awareness of an existing healthy default beverage policy in their jurisdictions among restaurant managers (29% in California and 0% in Wilmington), and found that most managers were interested in receiving implementation support. Previous evidence suggests that lack of awareness of policy changes among those responsible for execution can inhibit implementation and compliance, potentially diminishing the policy’s impact. Policies may be strengthened by specification of the types and sources of outreach to restaurants to support implementation. For instance, Cleveland states in their policy that “...the Director of Public Health or a designee shall make available educational material regarding the nutritional and health reasons to limit a child’s consumption of sugared beverages.”

None of the nutrition standards specified in the laws met expert nutrition standards for kids’ beverages and meals. No healthy default beverage laws met the expert nutrition guidelines because they allowed the wrong types of beverages (eg, whole milk) and the wrong sizes of beverages (eg, juice size larger than 8 fl oz). The healthy default beverage laws of Hawai’i and New York City did meet the industry standards for healthy beverage options. The remaining 16 healthy default beverage laws did not meet the industry nutritional guidelines in their entirety due to the allowance of whole milk, nondairy alternatives that are not nutritionally equivalent to milk, and juice sizes larger than the 8 fl oz. Most healthy default beverage laws allowed for the wrong types of beverages (eg, 17 laws included the whole milk and/or flavored milk) and the wrong sizes of beverages (eg, 17 laws included juice sizes that were larger than 8 fl oz or 40 kcal). Flavored milk includes caloric sweeteners and can include added sodium, artificial colors, and artificial flavors, all of which have adverse effects on kids’ health. Similarly, frequent consumption of 100% juice in sizes greater than 6 fl oz/day may lead to excess weight gain in kids. The beverage industry has pushed for a size limit of 8 fl oz for juice and milk, arguing that this size is “readily available in the restaurant channel” compared with the proposed 6 fl
Table 8. Comparison of nutrient standards specified by healthy kids’ meal laws (N = 3) enacted in the United States from January 2010 through August 2020 to expert and industry nutrition guidelines for meals

<table>
<thead>
<tr>
<th>Nutrient/food group</th>
<th>NSLP® Meal Standards</th>
<th>NRA KLW® Kids’ Meal Standards</th>
<th>Santa Clara County standards</th>
<th>San Francisco standards</th>
<th>Louisville standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview</td>
<td>Lunch meals for kids in kindergarten through grade 5 must adhere to the guidelines below</td>
<td>Kids’ meals must adhere to the guidelines below</td>
<td>The Santa Clara County toy restriction prohibits restaurants in the unincorporated parts of the county from giving away toys and other incentives, such as games, trading cards, and admission tickets, or other consumer products (physical or digital), with any foods, beverages, or meals that exceed any of the nutrient criteria below</td>
<td>The San Francisco toy restriction prohibits restaurants from distributing any free toy, game, trading card, admission ticket, or any other consumer product, whether digital or physical, with kids’ meals or with foods and beverages unless they meet the nutrient requirements below</td>
<td>The Louisville nutrition requirements and healthy default beverage law mandates that restaurants that provide kids’ meals are required to provide at least 1 healthy default beverage option and at least 1 of the menu options listed below</td>
</tr>
<tr>
<td>Sodium</td>
<td>≤ 935 mg ≤ 700 mg</td>
<td>Meals: 600 mg Single food items: 480 mg</td>
<td>Meals: ≤ 640 mg</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Total fat</td>
<td>– –</td>
<td>Meals: 35% of total kcal from fat Single food items: 35% of total kcal from fat Beverages: 35% of total kcal from fat</td>
<td>Meals: ≤ 35% of total kcal from fat Single food items: &lt; 35% of total kcal from fat Beverages: &lt; 35% of total kcal from fat</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Saturated fat</td>
<td>&lt; 10% of kcal ≤ 10% of kcal</td>
<td>Meals: 10% of total kcal from saturated fat Single food items: 10% of total kcal from saturated fat</td>
<td>Meals: &lt; 10% of total calories from saturated fats</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Trans fat</td>
<td>0% of kcal 0% of kcal</td>
<td>Meals: 0.5 g trans fat Single food items: 0.5 g trans fat</td>
<td>Meals: &lt; 0.5 g trans fats</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Added sugars</td>
<td>– ≤ 15 g</td>
<td>Meals: 10% of kcal from added caloric sweeteners Single food items: 10% of kcal from added caloric sweeteners Beverages: 10% of kcal from added caloric sweeteners</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td>½ c At least ½ c</td>
<td>–</td>
<td>Meals: ½ c or more of fruit</td>
<td>Meals: At least ¼ c unfried fruit</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>¾ c At least ½ c</td>
<td>–</td>
<td>Meals: ¾ c or more of vegetables</td>
<td>Meals: At least ¼ c unfried vegetables, excluding white potatoes</td>
<td></td>
</tr>
</tbody>
</table>

(continued on next page)
Table 8. Comparison of nutrient standards specified by healthy kids’ meal laws (N = 3) enacted in the United States from January 2010 through August 2020 to expert and industry nutrition guidelines for meals (continued)

<table>
<thead>
<tr>
<th>Nutrient/food group</th>
<th>NSLP Meal Standards</th>
<th>NRA KLW Kids’ Meal Standards</th>
<th>Santa Clara County standards</th>
<th>San Francisco standards</th>
<th>Louisville standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonfat/low-fat dairy</td>
<td>–</td>
<td>At least 1 c</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Whole grains</td>
<td>–</td>
<td>Half of all grains offered must be at least 50% whole grain</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Meat/meat alternates</td>
<td>At least 1 oz (not to exceed 10 oz)</td>
<td>At least 1 oz</td>
<td>–</td>
<td>–</td>
<td>A lean protein, defined as a food containing &lt; 10 g fat, ≤ 4.5 g saturated fat, and &lt; 95 mg cholesterol/100 g and per labeled serving</td>
</tr>
<tr>
<td>Milk</td>
<td>1 c</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Additives:</td>
<td>Beevages: No caffeine or added nonnutritive sweeteners</td>
<td>–</td>
<td>Single food items: &lt; 10% of calories from added caloric sweeteners</td>
<td>Beverages: &lt; 10% of calories from added caloric sweeteners</td>
<td>–</td>
</tr>
</tbody>
</table>

Meets NSLP standards
Under offer vs serve, students must select:
1. At least 1/2 c fruits and/or vegetables AND
2. At least 2 of 5 food components:
   a. 1/2 c serving fruits
   b. 3/4 c serving vegetable
   c. 1-oz serving meats/meat alternates
   d. 1-oz serving grains
   e. 1 c serving milk

No, did not meet the standards for food components required because it failed to include any food components
No, did not meet the standards for certain food components because it failed to include specifications for whole grains and meat/meat alternates, thereby making it impossible to select at least 3 distinct food components
No, did not meet the standards for calories, sodium, saturated fat, trans fat, and some food components because it either did not include them or served less than the recommended serving sizes

(continued on next page)
**Table 8.** Comparison of nutrient standards specified by healthy kids’ meal laws (N = 3) enacted in the United States from January 2010 through August 2020 to expert and industry nutrition guidelines for meals (continued)

<table>
<thead>
<tr>
<th>Nutrient/food group</th>
<th>NRA KLWb Standards</th>
<th>KS Meal Standards</th>
<th>Santa Clara County51 standards</th>
<th>San Francisco59 standards</th>
<th>Louisville58 standards</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meets NRA KLW voluntary criteria</strong></td>
<td>No, did not meet the standards for added sugars and food components because it failed to include them</td>
<td>No, did not meet the standards for meal calories, added sugars, and certain food components such as nonfat/low-fat dairy, whole grains, and meat/meat alternates</td>
<td>No, did not meet the standards for meal calories, added sugars, and certain food components such as nonfat/low-fat dairy, whole grains, and meat/meat alternates</td>
<td>No, did not meet the standards for meal calories, added sugars, and certain food components because it failed to include them</td>
<td>No, did not meet the standards for calories, sodium, saturated fat, trans fat, added sugars, and some food components because it either did not include them or served less than the recommended serving sizes</td>
</tr>
</tbody>
</table>


*Except for fat contained in nuts, seeds, peanut butter, or other nut butters, or an individually served or packaged egg or individually served or packaged low-fat or reduced-fat cheese.*

*This was not evaluated as part of the nutrition standards because it has been evaluated using beverage standards (evaluated separately in Table 7).*


**CONCLUSIONS**

This study identified and classified the content of and nutrition standards used in healthy kids meal policies in the United States as of August 2020. The findings have implications for future policies intended to improve kids’ health. The results should be interpreted with caution because the study was limited to the content of and nutrition standards used in healthy kids meal policies. The findings from this study can inform how jurisdictions design future healthy kids’ meal policies.


17. Westlaw Next Campus Research. Thomson Reuters; Minnesota City, MN: 2020


50. Ordinance Amending Article 8 of the San Francisco Health Code by Adding Sections 471.1 through 471.9, to Set Nutritional Standards for Restaurant Food Sold Accompanied by Toys or Other Youth
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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

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AUTHOR CONTRIBUTIONS

C. L. Perez was involved in conceptualizing the study, defining the methodology, collecting the data, analyzing findings, and drafting and editing the manuscript to prepare for submission. A. Moran and K. M. P. Porter were involved in conceptualizing the study, defining the methodology, and reviewing and editing the manuscript for important intellectual content. G. Headrick was involved in collecting the data and reviewing and editing the manuscript. J. McCarthy and A. L. Cradock were involved in conceptualizing the study and reviewing and editing the manuscript for important intellectual content. All authors have read and agreed to the published version of the manuscript.


<table>
<thead>
<tr>
<th>Domain</th>
<th>Component</th>
<th>Operational definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Locality</td>
<td>Location where policy will take effect</td>
<td>New York City, NY</td>
</tr>
<tr>
<td>characteristics</td>
<td>Title of legislation</td>
<td>Title of legislation</td>
<td>A local law to amend the administrative code of the city of New York, in relation to selections for beverages included in children's meals</td>
</tr>
<tr>
<td></td>
<td>Jurisdiction</td>
<td>What level of jurisdiction was the bill introduced at (city or county or state)?</td>
<td>City</td>
</tr>
<tr>
<td></td>
<td>Type of policy</td>
<td>Is the policy a piece of legislation or an executive order (legislation, executive order, regulation)?</td>
<td>Legislation</td>
</tr>
<tr>
<td></td>
<td>Decision-making authority</td>
<td>Which body is responsible for the rule-making of the policy?</td>
<td>City health department</td>
</tr>
<tr>
<td></td>
<td>Focus of policy</td>
<td>What is the focus of this policy (nutrition standards, default beverage, toy restriction)?</td>
<td>Default beverage</td>
</tr>
<tr>
<td></td>
<td>State law</td>
<td>Has a HKM policy been passed at the state level? If yes, please include the type of state HKM policy (nutritional standards, default beverage, toy restriction)</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Preemption&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Is there preemptive language in the policy? This only applies to state laws. Please mark NA&lt;sup&gt;b&lt;/sup&gt; for non-state laws. Please see below for examples of preemptive language</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Vote</td>
<td>Breakdown of voting results (number in favor-number opposed-number absent-number abstained)</td>
<td>43-4-3-0</td>
</tr>
<tr>
<td></td>
<td>Date enacted</td>
<td>What date was the policy passed and adopted (signed into approval by executive)?</td>
<td>04/28/2019</td>
</tr>
<tr>
<td></td>
<td>Date effective</td>
<td>What date does the policy go into effect? This is usually included in the form of “ordinance is operable X days after its passage.” Please note that sometimes this date will be based off the executive’s approval date</td>
<td>04/28/2020</td>
</tr>
</tbody>
</table>

<sup>a</sup> This only applies to state laws. Please mark NA<sup>b</sup> for non-state laws. Please see below for examples of preemptive language.

Figure 1. Domains and operational definitions of policy elements in Healthy Kids’ Meal (HKM) Policy Assessment Tool.
<table>
<thead>
<tr>
<th>Domain</th>
<th>Component</th>
<th>Operational definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bill sponsor</td>
<td>What is the name and title of person(s) who introduced the policy</td>
<td>Council Member Ben Kallos</td>
</tr>
<tr>
<td></td>
<td>Party of sponsor</td>
<td>What is the political party of legislator responsible for policy?</td>
<td>Democrat</td>
</tr>
<tr>
<td></td>
<td>Dominant party of the local executive</td>
<td>What is the party of the mayor or county executive?</td>
<td>Democrat</td>
</tr>
<tr>
<td></td>
<td>Dominant party of the state</td>
<td>What is the party of the governor?</td>
<td>Democrat</td>
</tr>
<tr>
<td></td>
<td>Fiscal note</td>
<td>Does the policy have a fiscal note attached?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Influence on revenues</td>
<td>What is the anticipated influence of this policy on revenues?</td>
<td>It is anticipated that the proposed legislation would have no impact on revenues despite the allowance for civil penalties because full compliance with the law is anticipated.</td>
</tr>
<tr>
<td></td>
<td>Influence on expenditures</td>
<td>What is the anticipated influence of this policy on expenditures?</td>
<td>It is anticipated that there would be no impact on expenditures resulting from the enactment of this legislation because DOHMH would utilize existing resources to implement the requirements of the legislation.</td>
</tr>
<tr>
<td></td>
<td>Committee report</td>
<td>Does the codified bill have a committee report attached?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Committee assigned</td>
<td>What committee was the codified bill referred to?</td>
<td>Committee on Health</td>
</tr>
<tr>
<td></td>
<td>Policy note</td>
<td>Does the policy have a policy note attached?</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Purpose</td>
<td>Is the purpose of the policy explicitly described in the codified bill?</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If yes, what is the purpose of the policy?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>If the policy doesn’t have a background/preamble or committee report and a purpose is not stated, please mark NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disparities†</td>
<td>Is there specific mention of disparities or differences in race, SES, or geography in the policy?</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Inequities†</td>
<td>Is there specific mention of inequity or injustice in the policy?</td>
<td>NA</td>
</tr>
</tbody>
</table>

Figure 1. (continued) Domains and operational definitions of policy elements in Healthy Kids’ Meal (HKM) Policy Assessment Tool.
<table>
<thead>
<tr>
<th>Domain</th>
<th>Component</th>
<th>Operational definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Economic implications</td>
<td>Is there specific mention of the economic costs of sugary beverage consumption, poor diet or obesity in the policy?</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Implementation characteristics</td>
<td>Communication</td>
<td>Is there specification about how to communicate the new policy once it is passed and/or is enforced?</td>
</tr>
<tr>
<td></td>
<td>Technical assistance</td>
<td>Is there specification about whether the administrative agency must provide technical assistance?</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Default beverage offering</td>
<td>What language is used around offering/publishing/listing default beverages? Please mark NA for toy requirement policies</td>
<td>The selection of beverages listed as part of the children’s meal shall be limited to the following:</td>
</tr>
<tr>
<td></td>
<td>Incentive offering</td>
<td>What language is used around giving away of free toys or other incentives? Please mark NA for nutritional standards or healthy default beverage policies</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Enforcement characteristics</td>
<td>Monitoring/compliance agency</td>
<td>Which agency is responsible for monitoring the roll out of the policy and restaurant compliance?</td>
</tr>
<tr>
<td></td>
<td>Enforcement mechanism</td>
<td>How is the policy enforced?</td>
<td>Inspections</td>
</tr>
<tr>
<td></td>
<td>Violation fines</td>
<td>Will restaurants be fined for violating the policy?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Fine amount</td>
<td>What is the maximum penalty for violating the policy?</td>
<td>$200</td>
</tr>
<tr>
<td></td>
<td>Definitions</td>
<td>Definitions included and used: child, kids’ meals, food, sugary drinks, restaurants/food service establishments, menu, and incentive</td>
<td>Children’s meal, food, food service establishment, menu/menu board</td>
</tr>
<tr>
<td></td>
<td>What definitions were specified for use in the policy?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. (continued) Domains and operational definitions of policy elements in Healthy Kids’ Meal (HKM) Policy Assessment Tool.
<table>
<thead>
<tr>
<th>Domain</th>
<th>Component</th>
<th>Operational definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Children’s meal definition</td>
<td>How is “children’s meal” defined? Please enter NA for those policies without this definition</td>
<td>Children’s meal. The term “children’s meal” means a food or combination of food items listed on a menu or menu board and intended for consumption by children to which the presumption described in subdivision e attaches.</td>
</tr>
<tr>
<td></td>
<td>Any additional specification of what constitutes a children’s meal</td>
<td>The policy has specific text referencing how a children’s meal may be perceived such as food items appearing alongside the word “kids”</td>
<td>It shall be a rebuttable presumption that a food item or combination of food items on a menu or menu board is intended for consumption by children if the item or items are shown on the menu or menu board in any one of the following ways:</td>
</tr>
<tr>
<td></td>
<td>Restaurant definition (also referred to as food service establishment)</td>
<td>How is “restaurant” defined? Please enter NA for those policies without this definition</td>
<td>Foodservice establishment. The term “foodservice establishment” means any establishment inspected pursuant to the restaurant grading program established pursuant to subdivision a of section 81.51 of the New York City Health Code. (s) Foodservice establishment means a place where food is provided for individual portion service directly to the consumer whether such food is provided free of charge or sold, and whether consumption occurs on or off the premises or is provided from a pushcart, stand or vehicle.</td>
</tr>
</tbody>
</table>

Figure 1. (continued) Domains and operational definitions of policy elements in Healthy Kids’ Meal (HKM) Policy Assessment Tool.
<table>
<thead>
<tr>
<th>Domain</th>
<th>Component</th>
<th>Operational definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Food definition</td>
<td>How is “food” defined? Please note if the definition was acquired from an existing health code and not stated directly in the policy. Please acquire definition from appropriate code. Please enter NA for those policies without this definition.</td>
<td>Food. The term “food” has the same meaning as in article 71 of the New York City Health Code. Food means any raw, cooked or processed edible substances, beverages, ingredients, chewing gum, ice, or water used or intended for use or for sale in whole or in part for human consumption.</td>
</tr>
<tr>
<td></td>
<td>Menu definition</td>
<td>How is “menu” defined? Please enter NA for those policies without this definition.</td>
<td>Menu or menu board. The term “menu or menu board” has the same meaning as in section 81.49 of the New York City Health Code. (5) Menu or menu board means a printed list of the names or images of a food item or items, and the primary writing of a covered establishment from which a customer makes an order selection. Menus include breakfast, lunch, and dinner menus; dessert menus; beverage menus; children’s menus; other specialty menus; electronic menus; and menus on the Internet, and may be in various forms, including booklets, pamphlets, single sheets of paper, or electronic screens. Determining whether a writing is or is part of the primary writing of a covered establishment depends on a number of factors, including whether the writing lists the name of a standard menu item (or an image depicting the standard menu item) and the price of the standard menu item, and whether the writing can be used by a customer to make an order selection at the time the customer is viewing the writing. Menu boards include menu boards inside the establishment as well as drive-through menu boards outside the establishment.</td>
</tr>
</tbody>
</table>

*Figure 1. (continued) Domains and operational definitions of policy elements in Healthy Kids’ Meal (HKM) Policy Assessment Tool.*
<table>
<thead>
<tr>
<th>Domain</th>
<th>Operational definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children’s menu definition</td>
<td>How is “children’s menu” defined? Please enter NA for those policies without this definition</td>
<td>NA</td>
</tr>
<tr>
<td>Online menu definition</td>
<td>How is “online menu” defined? Please enter NA for those policies without this definition</td>
<td>NA</td>
</tr>
<tr>
<td>Incentive item definition</td>
<td>How is “incentive item” defined? Please enter NA for those policies without this definition</td>
<td>NA</td>
</tr>
<tr>
<td>Default beverage definition</td>
<td>How is “default beverage” defined? Please enter NA for those policies without this definition</td>
<td>NA</td>
</tr>
<tr>
<td>Nondairy beverage definition</td>
<td>How is “nondairy beverage” defined? Please enter NA for those policies without this definition</td>
<td>NA</td>
</tr>
<tr>
<td>Add in any additional definitions</td>
<td>Free text</td>
<td>NA</td>
</tr>
<tr>
<td>Restaurant type</td>
<td>Does this policy apply only to certain types of food service establishments? This can include information such as the size of chain and number of outlets</td>
<td>No</td>
</tr>
<tr>
<td>Nutrition standards</td>
<td>Water</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is water allowed?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Is flavored water allowed?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Is sparkling water allowed?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Are caloric sweeteners in water allowed?</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Are noncaloric sweeteners in water allowed?</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Are artificial flavors or colors in water allowed?</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Is there a beverage size specification for water? If yes, what size?</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Is there a caloric limit specified for water? If yes, what is it?</td>
<td>No</td>
</tr>
</tbody>
</table>

Figure 1. (continued) Domains and operational definitions of policy elements in Healthy Kids’ Meal (HKM) Policy Assessment Tool.
<table>
<thead>
<tr>
<th>Domain</th>
<th>Component</th>
<th>Operational definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>Is milk allowed?</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is nonfat (fat-free) milk allowed?</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is low-fat (1%) milk allowed?</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is whole/2% milk allowed?</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is flavored (sweetened) milk allowed?</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are caloric sweeteners in milk allowed?</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are noncaloric sweeteners in milk allowed?</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are artificial flavors or colors in milk allowed?</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is there a beverage size specification for milk?</td>
<td>Yes, 8 oz or less</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is there a caloric limit specified for milk?</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Nondairy beverages</td>
<td>Are nondairy beverages (milk substitutes) allowed?</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are flavored nondairy beverages (milk substitutes) allowed?</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are caloric sweeteners in nondairy beverages (milk substitutes) allowed?</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are non-caloric sweeteners in nondairy beverages (milk substitutes) allowed?</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are artificial flavors or colors in nondairy beverages (milk substitutes) allowed?</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does the nondairy beverage (milk substitutes) need to be nutritionally equivalent to fluid milk (eg, fortified soy milk)?</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is there a beverage size specification for nondairy beverage (milk substitutes)?</td>
<td>Yes, 8 oz or less</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is there a caloric limit specified for nondairy beverage (milk substitutes)?</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Juice</td>
<td>Is 100% fruit juice allowed?</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is 100% vegetable juice allowed?</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. (continued) Domains and operational definitions of policy elements in Healthy Kids’ Meal (HKM) Policy Assessment Tool.
<table>
<thead>
<tr>
<th>Domain</th>
<th>Component</th>
<th>Operational definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Is a combination of fruit and vegetable juice allowed?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Is juice combined with water (carbonated or not) allowed?</td>
<td>Yes</td>
</tr>
<tr>
<td>Other beverages</td>
<td></td>
<td>Are caloric sweeteners in juice allowed?</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Are noncaloric sweeteners in juice allowed?</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Are artificial flavors or colors in juice allowed?</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Is there a beverage size specification for the juice?</td>
<td>Yes, 8 oz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Is there a caloric limit specified for juice?</td>
<td>No</td>
</tr>
<tr>
<td>Nutrition requirements</td>
<td></td>
<td>Are any additional beverage types allowed?</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Description of nutritional requirements for children’s meals. This is specific only to food items included in the children’s meal Please mark NA for default beverage policies.</td>
<td>NA</td>
</tr>
<tr>
<td>Additional meal standards</td>
<td></td>
<td>Is there specification for nutritional standards for items other than children’s meals?</td>
<td>No</td>
</tr>
</tbody>
</table>

Preemption occurs when the state or federal government body passes a law or issues agency rules that eliminate or restrict the authority of local governments to regulate a certain issue. When local laws are preempted, they usually have no force or effect.

NA = not applicable.

DOHMH = New York City Department of Health and Mental Hygiene.

Defined as “differences that occur by gender, race or ethnicity, education or income, disability, geographic location, or sexual orientation” such as differences in the incidence, prevalence, mortality, and burden of diseases.

SES = socioeconomic status.

Defined as “systematic conditions and factors operating on a systems/individual-level limiting equal access and opportunities.” Examples can include a lack of geographic access to resources, lack of resource availability, vulnerability to certain exposures, and powerlessness.

Defined here as the direct and indirect economic costs of diet-related illness such as costs to the health care system.

Figure 1. (continued) Domains and operational definitions of policy elements in Healthy Kids’ Meal (HKM) Policy Assessment Tool.
### 2019 HER Beverage Consumption Guidelines in Early Childhood

- **Water** — 4-5 y (37-60 mo): 1.5 to 5 c (12-40 oz) per day of plain, fluoridated drinking water

> If the bill offers water (plain, unflavored), it meets the water recommendation

- **Milk** — 2-5 y: At age 2 y (24 mo), children should transition to plain, pasteurized fat-free (skim) or low-fat (1%) milk. Total daily milk intake may be up to 2 c/d (16 oz) for children aged 2-3 y and up to 2.5 c/d (20 oz) for children aged 4-5 y
  - Flavored milk is not recommended
  - 1-5 y (12-60 mo): Plant milks/nondairy beverages are not recommended for exclusive consumption in place of dairy milk (with the exception of soy milk); consume only when medically indicated or to meet specific dietary preferences

> If the bill offers plain nonfat or low-fat (1%) milk, it meets the milk recommendation

> If the bill offers “milk” with no specification, whole/2% milk, it does not meet the milk recommendation

> If the bill offers flavored and plain milk, it does not meet the milk recommendations

> If the bill offers plain nondairy milk alternatives that are of equivalent nutritional value to milk (plain soy milk), it meets the nondairy milk alternative recommendation

> If the milk alternative is flavored, it does not meet the recommendation

- **Juice** — 4-5 y (37-60 mo): No more than 4-6 oz 100% juice per day. These recommendations also extend to 100% fruit and vegetable juice blends

> If the bill just says “juice”, it does NOT meet the recommendation

> If the bill just says “100% juice,” it meets the recommendation

> If the bill includes 100% juice combined with water or sparkling water, it meets the recommendation

> However, if the size (or calories) is specified in the bill and is greater than 6 ounces (or 40 kcal), it does not meet the recommendation

  ➢ If the size limit or calorie limit are not specified in the bill, it does not meet the recommendation

  ➢ A caloric limit of 40 kcal or less is equivalent to what is expected from a 6-oz juice box

### NRA Kids Live Well 2019 Beverage Recommendations

- **Water** — Options include water, sparkling water or flavored water, with no added natural or artificial sweeteners

> If the bill offers water (plain, carbonated, flavored) with no added natural or artificial sweeteners, it meets the recommendation

> If no added natural or artificial sweeteners are specified but all other specifications are met, it meets the recommendation

> However, if the size is specified in the bill and is greater than 8 oz, it does not meet the recommendation

- **Milk** — Options include flavored or unflavored nonfat or low-fat (1%) dairy milk or nondairy beverage that is nutritionally equivalent to fluid milk (eg, fortified soymilk) in a serving size of 8 oz or less

> If the bill offers plain/flavored nonfat or low-fat (1%) milk, it meets this recommendation

> If the bill offers “milk” with no specification, whole/2% milk, it does not meet this recommendation

> If the bill offers plain/flavored nondairy milk alternatives that are of equivalent nutritional value to milk, it meets this recommendation

> However, if the size is specified in the bill and is greater than 8 oz, it does not meet the recommendation

- **Juice** — Options include 100% fruit or vegetable juice, or fruit and/or vegetable juice combined with water or carbonated water, with no added natural or artificial sweeteners, in a serving size of 8 oz or less

> If the bill just says “Juice,” it does not meet the recommendation

> If the bill just says “100% Juice” with no added natural or artificial sweeteners, it meets the recommendation

> If the bill includes 100% juice combined with water or sparkling water, it meets the recommendation

> However, if the size is specified in the bill and is greater than 8 oz, it does not meet the recommendation

  ➢ If the size is not specified in the bill, it does not meet the recommendation

---

**Figure 2.** Operationalization of nutrition standards for beverages and meal components using the 2019 Healthy Eating Research (HER) Beverage Consumption Guidelines in Early Childhood, National Restaurant Association (NRA) Kids Live Well 2019 Beverage Recommendations.
<table>
<thead>
<tr>
<th>Location</th>
<th>Legislative bill</th>
<th>Title</th>
<th>Jurisdiction</th>
<th>Rulemaking body</th>
<th>Type of policy</th>
<th>Preemptive language used</th>
<th>Vote: Favor-oppose-absent-abstain</th>
<th>Enactment date</th>
<th>Effective date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleveland, OH</td>
<td>ORD 524-2020</td>
<td>An Emergency Ordinance to Supplement the Codified Ordinances of Cleveland, Ohio, 1976, by Enacting New Section 241.43 Relating to Sale of Beverages Offered with Children’s Meals by Food Service Operations</td>
<td>City</td>
<td>City health department</td>
<td>Default beverage</td>
<td>NA</td>
<td>14-0-2-1</td>
<td>07/29/2020</td>
<td>01/29/2021</td>
</tr>
<tr>
<td>Philadelphia, PA</td>
<td>ORD 190505</td>
<td>Amending Title 6 of the Philadelphia Code, Entitled “Health Code,” by Adding A New Chapter 6-311, Entitled “Children’s Meals at Food Service Establishments”</td>
<td>City</td>
<td>City board of health</td>
<td>Default beverage</td>
<td>NA</td>
<td>16-0-0-0</td>
<td>10/02/2019</td>
<td>04/01/2020</td>
</tr>
<tr>
<td>Delaware</td>
<td>HB79</td>
<td>An Act to Amend Title 16 of the Delaware Code Regarding Default Beverages in Children’s Meals in Restaurants</td>
<td>State</td>
<td>State health department</td>
<td>Default beverage</td>
<td>No</td>
<td>28-11-2-0</td>
<td>07/17/2019</td>
<td>07/17/2020</td>
</tr>
<tr>
<td>Hawaii</td>
<td>SB549</td>
<td>A Bill for an Act Relating to Healthy State Beverages for Children</td>
<td>State</td>
<td>State health department</td>
<td>Default beverage</td>
<td>No</td>
<td>24-1-0-0</td>
<td>06/28/2019</td>
<td>01/01/2020</td>
</tr>
<tr>
<td>New York City, NY</td>
<td>ORD 1064-B</td>
<td>A Local Law to Amend the Administrative Code of the City of New York, in Relation to Selections for Beverages Included in Children’s Meals</td>
<td>City</td>
<td>City health department</td>
<td>Default beverage</td>
<td>NA</td>
<td>43-4-3-0</td>
<td>04/28/2020</td>
<td>05/01/2020</td>
</tr>
<tr>
<td>Wilmington, DE</td>
<td>ORD 18-046</td>
<td>An Ordinance to Amend Chapter 5 of the City Code Regarding Beverages Offered in Children’s Meals</td>
<td>City</td>
<td>City department of licenses and inspection</td>
<td>Default beverage</td>
<td>NA</td>
<td>10-0-3-0</td>
<td>10/08/2018</td>
<td>01/06/2019</td>
</tr>
<tr>
<td>California</td>
<td>SB1192</td>
<td>An Act to Add Chapter 12.8 (Commencing with Section 114379) to Part 7 of Division 104 of the Health and Safety Code, Relating to Children’s Health</td>
<td>State</td>
<td>State health department</td>
<td>Default beverage</td>
<td>Yes</td>
<td>29-9-0-2</td>
<td>09/20/2018</td>
<td>01/01/2019</td>
</tr>
</tbody>
</table>

(continued on next page)
Table 1. Key characteristics of healthy kid’s meal policies: location, bill number, title, jurisdiction, rulemaking body, type, preemptive language, vote, and key dates (continued)

<table>
<thead>
<tr>
<th>Location</th>
<th>Legislative bill</th>
<th>Title</th>
<th>Jurisdiction</th>
<th>Rulemaking body</th>
<th>Type of policy</th>
<th>Preemptive language used</th>
<th>Vote: Favor-oppose-absent-abstain</th>
<th>Enactment date</th>
<th>Effective date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Louisville, KY</td>
<td>O-064-18</td>
<td>An Ordinance Amending Chapter 118 of the Louisville Metro Code of Ordinances Regarding Establishing the Nutrition Requirements and Default Beverages Offered with Children’s Meals (as Amended)</td>
<td>City</td>
<td>City board of health</td>
<td>Nutrition standards, default beverage</td>
<td>NA</td>
<td>13-11-1-1</td>
<td>06/07/2018</td>
<td>10/05/2018</td>
</tr>
<tr>
<td>Baltimore, MD</td>
<td>COUNCIL BILL 17-0152</td>
<td>An Ordinance Concerning Food Service Facilities - Healthy Beverages for Children’s Meals</td>
<td>City</td>
<td>City health department</td>
<td>Default beverage</td>
<td>NA</td>
<td>7-0-0-0</td>
<td>04/19/2018</td>
<td>07/18/2018</td>
</tr>
<tr>
<td>Daly City, CA</td>
<td>ORD 1415</td>
<td>An Ordinance of the City Council of City the City of Daly City Adding Chapter 8.72 to Title 8 of the Daly City Municipal Code Re: Establishing Healthy Default Beverages Offered with Children’s Meals</td>
<td>City council</td>
<td>Default beverage</td>
<td>NA</td>
<td>5-0-0-0</td>
<td>01/08/2018</td>
<td>06/01/2018</td>
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</tr>
<tr>
<td>Long Beach, CA</td>
<td>ORD-17-0027</td>
<td>An Ordinance of the City Council of City the City of Long Beach Amending the Long Beach Municipal Code by Adding Chapter 8.17 Relating to Default Beverages Offered with Children’s Meals</td>
<td>City health department</td>
<td>Default beverage</td>
<td>NA</td>
<td>7-0-2-0</td>
<td>11/16/2017</td>
<td>12/17/2017</td>
<td></td>
</tr>
<tr>
<td>Cathedral City, CA</td>
<td>ORD 803</td>
<td>An Ordinance of the City Council of City the City of Cathedral City California Adding Cathedral City Municipal Code Chapter 5.92 Requiring Healthy Beverages to be the Default Beverage Offering by Restaurants for Children’s Meals</td>
<td>City council</td>
<td>Default beverage</td>
<td>NA</td>
<td>3-2-0-0</td>
<td>11/08/2017</td>
<td>12/08/2017</td>
<td></td>
</tr>
</tbody>
</table>
Table 1. Key characteristics of healthy kid’s meal policies: location, bill number, title, jurisdiction, rulemaking body, type, preemptive language, vote, and key dates (continued)

<table>
<thead>
<tr>
<th>Location</th>
<th>Legislative bill</th>
<th>Title</th>
<th>Jurisdiction</th>
<th>Rulemaking body</th>
<th>Type of policy</th>
<th>Preemptive language used</th>
<th>Vote: Favor-oppose-absent-abstain</th>
<th>Enactment date</th>
<th>Effective date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lafayette, CO</td>
<td>44 ORD 2017-40</td>
<td>An Ordinance of the City Council of City the City of Lafayette, Colorado, Enacting a New Article IX of Chapter 55 Establishing the Default Beverages Offered with Children’s Meals within the City of Lafayette, Colorado</td>
<td>City health department</td>
<td>Default beverage</td>
<td>NA</td>
<td>6-1-0-0</td>
<td>10/17/2017</td>
<td>10/27/2017</td>
<td></td>
</tr>
<tr>
<td>Santa Clara County, CA</td>
<td>NS300.908</td>
<td>An Ordinance of the Board of Supervisors of the County of Santa Clara Renaming Chapter XXII and Amending and Adding Sections to Chapter XXII of Division A18 of the Santa Clara County Ordinance Code Relating to Beverages in Restaurant Meals for Children</td>
<td>County</td>
<td>Local board of supervisors</td>
<td>Default beverage</td>
<td>NA</td>
<td>4-0-0-1</td>
<td>05/09/2017</td>
<td>08/07/2017</td>
</tr>
<tr>
<td>Berkeley, CA</td>
<td>46 ORD 7560</td>
<td>Healthy Default Beverages Offered with Children’s Meals; Adding Berkeley Municipal Code Chapter 12.72</td>
<td>City council</td>
<td>Default beverage</td>
<td>NA</td>
<td>9-0-0-0</td>
<td>07/18/2017</td>
<td>07/01/2017</td>
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<tr>
<td>Perris, CA</td>
<td>47 ORD 1340</td>
<td>An Ordinance of the City Council of City the City of Perris, County of Riverside, State of California, Adding Chapter 7.46 to Title 7 of the Perris Municipal Code Establishing Default Beverages Offered in Children’s Meals</td>
<td>Live Well Initiative from the City of Perris</td>
<td>Default beverage</td>
<td>NA</td>
<td>5-0-0-0</td>
<td>03/14/2017</td>
<td>04/14/2017</td>
<td></td>
</tr>
<tr>
<td>Stockton, CA</td>
<td>48 ORD 2016-06-07-1502</td>
<td>An Ordinance Amending Stockton Municipal Code Title 5 by Adding Chapter 5.70 Regarding Establishing the Default Beverages Offered with Children’s Meals</td>
<td>City council</td>
<td>Default beverage</td>
<td>NA</td>
<td>7-0-0-0</td>
<td>06/07/2016</td>
<td>07/07/2016</td>
<td></td>
</tr>
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</table>

(continued on next page)
<table>
<thead>
<tr>
<th>Location</th>
<th>Legislative bill</th>
<th>Title</th>
<th>Jurisdiction</th>
<th>Rulemaking body</th>
<th>Type of policy</th>
<th>Preemptive language used</th>
<th>Vote: Favor-oppose-absent-abstain</th>
<th>Enactment date</th>
<th>Effective date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davis, CA</td>
<td>ORD 2451</td>
<td>Ordinance of the City Council of the City of Davis Adding Article 17.02 To Chapter 17 of the Davis Municipal Code Establishing Default Beverages Offered with Children’s Meals</td>
<td>City of Davis Housing &amp; Human Services</td>
<td>Default beverage</td>
<td>NA</td>
<td>5-0-0-0</td>
<td>06/02/2015 07/02/2015</td>
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<tr>
<td>San Francisco, CA</td>
<td>ORD 290-10</td>
<td>Ordinance Amending Article 8 of the San Francisco Health Code by Adding Sections 471.1 through 471.9, to Set Nutritional Standards for Restaurant Food Sold Accompanied by Toys or Other Youth Focused Incentive Items</td>
<td>County Local board of supervisors</td>
<td>Toy</td>
<td>NA</td>
<td>8-3-0-0</td>
<td>11/23/2010 12/01/2011</td>
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<tr>
<td>Santa Clara County, CA</td>
<td>NS300.820</td>
<td>An Ordinance of the Board of Supervisors of the County of Santa Clara Adding Chapter XXII of Division A18 to the County of Santa Clara Ordinance Code Relating to Toys and Other Incentives with Restaurant Food</td>
<td>County Local board of supervisors</td>
<td>Toy</td>
<td>NA</td>
<td>3-2-0-0</td>
<td>05/11/2010 08/11/2010</td>
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<tr>
<td>Location</td>
<td>Political affiliation of bill sponsor(s)</td>
<td>Political affiliation of local government</td>
<td>Political affiliation of governor</td>
<td>Fiscal note</td>
<td>Policy note</td>
<td>Enforcement agency</td>
<td>Enforcement method</td>
<td>Fine amounts</td>
<td>Communication of policy</td>
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<tr>
<td>-------------------------------</td>
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<tr>
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<td>Inspections</td>
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<tr>
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<td>No</td>
<td>No</td>
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<td>No</td>
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<td>State health department</td>
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<td>No</td>
<td>City attorney</td>
<td>Self-certification</td>
<td>$250-$1,000</td>
<td>Yes</td>
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<td>Long Beach, CA</td>
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<tr>
<td>Santa Clara County, CA</td>
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<td>Inspections</td>
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<tr>
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<td>Democrat</td>
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<td>No</td>
<td>City health department</td>
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<tr>
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<td>Democrat</td>
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<td>Live Well Team of Perris</td>
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<tr>
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<td>Democrat</td>
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<td>City administrative services department</td>
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<tr>
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<td>Democrat</td>
<td>Yes</td>
<td>Yes</td>
<td>City manager</td>
<td>Self-certification</td>
<td>$100-$500</td>
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<tr>
<td>San Francisco, CA</td>
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<td>Republican</td>
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<td>City health department</td>
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<tr>
<td>Santa Clara County, CA</td>
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<td>Republican</td>
<td>Democrat</td>
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<td>No</td>
<td>County health department</td>
<td>Inspections</td>
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</tbody>
</table>

*NA = not available.
Table 3. Item-level and overall level of agreement of policy elements in Healthy Kids’ Meal Policy Assessment Tool

<table>
<thead>
<tr>
<th>Item</th>
<th>Kappa&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which locality are you reviewing?</td>
<td>1</td>
</tr>
<tr>
<td>Which policy are you reviewing?</td>
<td>1</td>
</tr>
<tr>
<td>What is the title of the legislation?</td>
<td>1</td>
</tr>
<tr>
<td>What area of jurisdiction was the policy introduced at?</td>
<td>1</td>
</tr>
<tr>
<td>For local policies, has a healthy kids’ meal policy been passed at the state level?</td>
<td>1</td>
</tr>
<tr>
<td>For local policies, what type of healthy kids’ meal policy been passed at the state level?</td>
<td>1</td>
</tr>
<tr>
<td>Was the policy passed as a piece of legislation or via executive order?</td>
<td>Too few categories</td>
</tr>
<tr>
<td>Which body is responsible for the rulemaking (lawmaking) of the policy?</td>
<td>0.0286 Insufficient observations</td>
</tr>
<tr>
<td>What is the focus of this kids’ meal policy (nutritional standards, default beverage, toy)?</td>
<td>0.8571</td>
</tr>
<tr>
<td>Is this bill a law?</td>
<td>Too few categories</td>
</tr>
<tr>
<td>What was the breakdown of the vote to pass this policy? - Number in favor</td>
<td>0.8916</td>
</tr>
<tr>
<td>What was the breakdown of the vote to pass this policy? - Number opposed</td>
<td>1</td>
</tr>
<tr>
<td>What was the breakdown of the vote to pass this policy? - Number absent</td>
<td>1</td>
</tr>
<tr>
<td>What was the breakdown of the vote to pass this policy? - Number abstained</td>
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</tr>
<tr>
<td>What date was the policy enacted? (MM/DD/YYYY)</td>
<td>0.8953</td>
</tr>
<tr>
<td>What date does the policy go into effect? (MM/DD/YYYY)</td>
<td>0.9475</td>
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<tr>
<td>Who sponsored the bill?</td>
<td>0.6867</td>
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<tr>
<td>What was the political party of the bill sponsor?</td>
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<tr>
<td>What was the political party of the bill sponsor? Text entry</td>
<td>Insufficient observations</td>
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<tr>
<td>What is the party of the mayor or county executive?</td>
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<td>What is the party of the mayor or county executive? Text entry</td>
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<tr>
<td>What is the political party of the governor?</td>
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<tr>
<td>What is the political party of the governor? Text entry</td>
<td>Insufficient observations</td>
</tr>
<tr>
<td>Does the policy have a fiscal note attached?</td>
<td>0.4</td>
</tr>
<tr>
<td>What is the anticipated impact of this policy on revenues?</td>
<td>0.5455</td>
</tr>
<tr>
<td>What is the anticipated impact of this policy on expenditures?</td>
<td>0.4915</td>
</tr>
<tr>
<td>Does the policy have a policy note attached?</td>
<td>0.3182</td>
</tr>
<tr>
<td>What committee was the bill referred to?</td>
<td>0.7872</td>
</tr>
<tr>
<td>Does the bill have a committee report attached?</td>
<td>0.6117</td>
</tr>
<tr>
<td>Which agency is responsible for monitoring the roll out of the policy and restaurant compliance?</td>
<td>0.7315</td>
</tr>
<tr>
<td>Which agency is responsible for monitoring the roll out of the policy and restaurant compliance? Text entry</td>
<td>0.7619</td>
</tr>
<tr>
<td>How is the policy enforced?</td>
<td>1</td>
</tr>
<tr>
<td>How is the policy enforced? Text entry</td>
<td>1</td>
</tr>
<tr>
<td>Will restaurants be fined for violating the policy?</td>
<td>0.8347</td>
</tr>
<tr>
<td>What is the maximum penalty for violating the policy?</td>
<td>0.8945</td>
</tr>
</tbody>
</table>

(continued on next page)
Table 3. Item-level and overall level of agreement of policy elements in Healthy Kids’ Meal Policy Assessment Tool (continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Kappaa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there specification about how to communicate the new policy once it is passed and/or is enacted?</td>
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</tr>
<tr>
<td>Is there specification about how to communicate the new policy once it is passed and/or is enacted? Text entry</td>
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</tr>
<tr>
<td>Is there specification about whether the administrative agency/body must provide technical assistance? - Selected choice</td>
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</tr>
<tr>
<td>Is there specification about whether the administrative agency/body must provide technical assistance? Text entry</td>
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</tr>
<tr>
<td>Is the purpose of the policy explicitly described in the codified bill?</td>
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</tr>
<tr>
<td>What is the purpose of the policy (explicitly described in the codified bill)?</td>
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<tr>
<td>Is there specific mention of disparities or differences in race, socioeconomic status, or geography in the policy?</td>
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</tr>
<tr>
<td>Is there specific mention of disparities or differences in race, socioeconomic status, or geography in the policy? Text entry</td>
<td>0.5714</td>
</tr>
<tr>
<td>Is there specific mention of inequity or injustice in the policy?</td>
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</tr>
<tr>
<td>Is there specific mention of inequity or injustice in the policy? Text entry</td>
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</tr>
<tr>
<td>Is there specific mention of economic implications of sugary beverage consumption or obesity?</td>
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</tr>
<tr>
<td>Is there specific mention of economic implications of sugary beverage consumption or obesity? Text entry</td>
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</tr>
<tr>
<td>What definitions are included in the policy?</td>
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</tr>
<tr>
<td>How is “children’s (kids’) meal” defined?</td>
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</tr>
<tr>
<td>Are there any additional specifications of what constitutes a children’s meal beyond the definition?</td>
<td>1</td>
</tr>
<tr>
<td>Are there any additional specifications of what constitutes a children’s meal beyond the definition? Text entry</td>
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</tr>
<tr>
<td>How is “restaurant” or “foodservice establishment” defined?</td>
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</tr>
<tr>
<td>How is “food” defined?</td>
<td>1</td>
</tr>
<tr>
<td>How is “menu” defined?</td>
<td>0.6491</td>
</tr>
<tr>
<td>How is “children’s (kids’) menu” defined?</td>
<td>Too few categories</td>
</tr>
<tr>
<td>How is “online menu” defined?</td>
<td>Too few categories</td>
</tr>
<tr>
<td>How is “incentive item” defined?</td>
<td>1</td>
</tr>
<tr>
<td>How is “default beverage” defined?</td>
<td>1</td>
</tr>
<tr>
<td>How is “non-dairy beverage” defined?</td>
<td>1</td>
</tr>
<tr>
<td>Include any other terms and definitions here.</td>
<td>1</td>
</tr>
<tr>
<td>Does this policy apply only to certain types of food service establishments?</td>
<td>0.0909</td>
</tr>
<tr>
<td>Does this policy apply only to certain types of food service establishments? Text entry</td>
<td>Insufficient observations</td>
</tr>
<tr>
<td>What language is used around offering/publishing/listing default beverages?</td>
<td>1</td>
</tr>
<tr>
<td>What language is used around giving away of free toys or other incentives?</td>
<td>1</td>
</tr>
<tr>
<td>Please list the nutritional requirements for food components of the children’s meal if included.</td>
<td>1</td>
</tr>
<tr>
<td>Is there specification for nutrition standards for meals other than children’s meals?</td>
<td>1</td>
</tr>
</tbody>
</table>

(continued on next page)
Table 3. Item-level and overall level of agreement of policy elements in Healthy Kids’ Meal Policy Assessment Tool (continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Kappa&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there specification for nutrition standards for meals other than children’s meals? Text entry</td>
<td>1</td>
</tr>
<tr>
<td>Is water allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Is flavored water allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Is sparkling water allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Are caloric sweeteners in water allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Are noncaloric sweeteners in water allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Are artificial flavors or colors in water allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Is there a beverage size specification for water?</td>
<td>1</td>
</tr>
<tr>
<td>Is there a beverage size specification for water? Text entry</td>
<td>Insufficient observations</td>
</tr>
<tr>
<td>Is there a caloric limit specified for water?</td>
<td>1</td>
</tr>
<tr>
<td>Is there a caloric limit specified for water? Text entry</td>
<td>Insufficient observations</td>
</tr>
<tr>
<td>Is milk allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Is nonfat (fat-free) milk allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Is low-fat (1%) milk allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Is whole/2% milk allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Is flavored (sweetened) milk allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Are caloric sweeteners in milk allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Are noncaloric sweeteners in milk allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Are artificial flavors or colors in milk allowed?</td>
<td>0.7778</td>
</tr>
<tr>
<td>Is there a beverage size specification for milk?</td>
<td>1</td>
</tr>
<tr>
<td>Is there a beverage size specification for milk? Text entry</td>
<td>1</td>
</tr>
<tr>
<td>Is there a caloric limit specified for milk?</td>
<td>1</td>
</tr>
<tr>
<td>Is there a caloric limit specified for milk? Text entry</td>
<td>1</td>
</tr>
<tr>
<td>Are nondairy beverages (milk substitutes) allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Are nondairy beverages (milk substitutes) allowed? Text entry</td>
<td>1</td>
</tr>
<tr>
<td>Are flavored nondairy beverages (milk substitutes) allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Are caloric sweeteners in non-dairy beverages (milk substitutes) allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Are noncaloric sweeteners in nondairy beverages (milk substitutes) allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Are artificial flavors or colors in nondairy beverages (milk substitutes) allowed?</td>
<td>0.8374</td>
</tr>
<tr>
<td>Does the nondairy beverage (milk substitutes) need to be nutritionally equivalent to fluid milk (eg, fortified soy milk)?</td>
<td>0.8851</td>
</tr>
<tr>
<td>Is there a beverage size specification for nondairy beverage (milk substitutes)?</td>
<td>1</td>
</tr>
<tr>
<td>Is there a beverage size specification for nondairy beverage (milk substitutes)? Text entry</td>
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</tr>
<tr>
<td>Is there a caloric limit specified for nondairy beverage (milk substitutes)?</td>
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</tr>
<tr>
<td>Is there a caloric limit specified for nondairy beverage (milk substitutes)? Text entry</td>
<td>1</td>
</tr>
<tr>
<td>Is 100% fruit juice allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Is 100% vegetable juice allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Is a combination of fruit and vegetable juice allowed?</td>
<td>0.9203</td>
</tr>
<tr>
<td>Is juice combined with water (carbonated or not) allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Are caloric sweeteners in juice allowed?</td>
<td>1</td>
</tr>
</tbody>
</table>

(continued on next page)
Table 3. Item-level and overall level of agreement of policy elements in Healthy Kids’ Meal Policy Assessment Tool (continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Kappaa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are noncaloric sweeteners in juice allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Are artificial flavors or colors in juice allowed?</td>
<td>1</td>
</tr>
<tr>
<td>Is there a beverage size specification for the juice?</td>
<td>0.913</td>
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<tr>
<td>Is there a beverage size specification for the juice? Text entry</td>
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<tr>
<td>Is there a caloric limit specified for the juice?</td>
<td>1</td>
</tr>
<tr>
<td>Is there a caloric limit specified for the juice? Text entry</td>
<td>Insufficient observations</td>
</tr>
<tr>
<td>Were there any additional beverage types included?</td>
<td>1</td>
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<tr>
<td>Were there any additional beverage types included? Text entry</td>
<td>Insufficient observations</td>
</tr>
<tr>
<td>Overall level of agreement</td>
<td>0.9269</td>
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</table>
Table 6. Definitions included in healthy kids’ meal laws enacted in the United States through August 2020 (N = 20)

<table>
<thead>
<tr>
<th>Locality</th>
<th>Kids’ meal</th>
<th>Kids&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Default beverage&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Restaurant&lt;sup&gt;e&lt;/sup&gt;</th>
<th>100% Fruit juice, vegetable juice&lt;sup&gt;i&lt;/sup&gt;</th>
<th>Menu, menu board&lt;sup&gt;d&lt;/sup&gt;</th>
<th>Food&lt;sup&gt;f&lt;/sup&gt;</th>
<th>Milk substitute&lt;sup&gt;h&lt;/sup&gt;</th>
<th>Lean protein&lt;sup&gt;i&lt;/sup&gt;</th>
<th>Incentive item&lt;sup&gt;j&lt;/sup&gt;</th>
<th>Meal&lt;sup&gt;k&lt;/sup&gt;</th>
<th>Single food item&lt;sup&gt;l&lt;/sup&gt;</th>
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<tr>
<td>Cleveland, OH</td>
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<td>Philadelphia, PA</td>
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<td>Delaware</td>
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<td>Hawaii</td>
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<td>New York City, NY</td>
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<td>Wilmington, DE</td>
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<td>California</td>
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<td>Louisville, KY</td>
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<td>Daly City, CA</td>
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<td>Long Beach, CA</td>
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<td>Cathedral City, CA</td>
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<td>Lafayette, CO</td>
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<td>Santa Clara County, CA</td>
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<tr>
<td>Berkeley, CA</td>
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<tr>
<td>Perris, CA</td>
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<tr>
<td>Stockton, CA</td>
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<tr>
<td>Davis, CA</td>
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<tr>
<td>San Francisco, CA</td>
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<tr>
<td>Santa Clara County, CA</td>
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<tr>
<td><strong>Totals</strong></td>
<td>18</td>
<td>1</td>
<td>14</td>
<td>17</td>
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<td>1</td>
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<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

<sup>a</sup>One example of a definition for kids is “a combination of food and a beverage, sold together at a single price by a restaurant, primarily intended for consumption by children.”

<sup>b</sup>One example of a definition for kids meal is “A combination of food and a beverage, sold together at a single price by a restaurant, and designed primarily for consumption by children.”

<sup>c</sup>One example of a definition for default beverage is “A beverage automatically included or offered as part of a children’s meal, absent a specific request for a substitute or alternate beverage by the purchaser of the children’s meal.”

<sup>d</sup>One example of a definition for restaurant is “A food establishment that serves food to customers for consumption on or off the premises, including fast-food and full-service dining establishments. ‘Restaurant’ includes but is not limited to drive-through or walk-up counters, coffee shops, cafes, pizza parlors, food stands, movie theater concession stands, and dine-in establishments. For purposes of this definition, a restaurant may provide alcoholic beverage sales for drinking on premises; provided that such sales are ancillary to foodservice.”

<sup>e</sup>One example of a definition for menu or menu board is “A printed list of the names or images of a food item or items, and the primary writing of a covered establishment from which a customer makes an order selection. Menus include breakfast, lunch, and dinner menus; dessert menus; beverage menus; children’s menus; other specialty menus; electronic menus; and menus on the Internet, and may be in various forms, including booklets, pamphlets, single sheets of paper, or electronic screens. Determining whether a writing is or is part of the primary writing of a covered establishment depends on a number of factors, including whether the writing lists the name of a standard menu item (or an image depicting the standard menu item) and the price of the standard menu item, and whether the writing can be used by a customer to make an order selection at the time the customer is viewing the writing. Menu boards include menu boards inside the establishment as well as drive-through menu boards outside the establishment.”

<sup>f</sup>One example of a definition for food is “Any raw, cooked, or processed edible substances, beverages, ingredients, chewing gum, ice, or water used or intended for use or for sale in whole or in part for human consumption.”

<sup>g</sup>One example of a definition for milk substitute is “A non-dairy plant-based drink served in place of milk, including but not limited to soy milk, almond milk, or rice milk.”

<sup>h</sup>One example of a definition for lean protein is “A food containing < 10 g fat, < 4.5 g saturated fat, and < 95 mg cholesterol per 100 g and per labeled serving.”

<sup>i</sup>One example of a definition for incentive item is “(1) any toy, game, trading card, admission ticket or other consumer product, whether physical or digital, with particular appeal to children and teens but not including ‘Single Use Articles’ as defined in California Health & Safety Code Section 113914 as of January 1, 2009; or (2) any coupon, voucher, ticket, token, code, or password redeemable for or granting digital or other access to an item listed in (a)(1). If the incentive item consists of a food product, the food product shall be considered as part of the Meal under Section 417.4 for purposes of determining whether the Meal meets the nutritional standards.”

<sup>j</sup>One example of a definition for meal is “Any combination of food items offered together for a single price. ‘Meal’ means any combination of single food items and/or beverages offered together for a single price.”

<sup>k</sup>One example of a definition for single food item is “The complete contents of any food offered for individual sale by a restaurant, not including beverages.”
Moving Dietetics Forward with Queer Pedagogy: A Post-Structural Qualitative Study Exploring the Education and Training Experiences of Canadian Dietitians for LGBTQ Care

Phillip Joy, PhD, RD; Jill Marie McSweeney-Flaherty, PhD

ABSTRACT

Background Lesbian, gay, bisexual, trans, and other sexually and gender diverse (LGBTQ) people often experience health disparities and disparities in accessing safe health care. Yet dietetics curriculum and training opportunities for LGBTQ care are limited.

Objective The objective of this research was to explore the perspectives and professional training experiences within LGBTQ-focused topics of Canadian dietitians in order to inform future curriculum and pedagogy.

Design This research is framed within poststructuralist philosophies. Semi-structured qualitative interviews were conducted.

Participants/setting To be eligible, participants needed to be dietitians within Canada who had an interest in discussing gender and sexual diversity within the profession. Although the research call was open to all Canadian dietitians who wanted to discuss gender and sexual diversity within the profession, only dietitians who self-identified as allies to LGBTQ groups ended up participating in this project. Of the 16 dietitians who participated, 11 participants self-identified as members of LGBTQ groups and 5 self-identified as straight. All participants took part in online interviews done in private locations of their choosing from September 2020 to January 2021.

Analysis A systematic thematic analysis was conducted.

Results Three themes, including understanding the ethics of dietetics education, recognizing the cis- and hetero-normativity of dietetics education, and moving forward with queer pedagogy, were noted from the data.

Conclusions Participants explored the lack of LGBTQ focus and content during their professional training and believed such gaps were problematic to the caring philosophies of dietetics. Participants offered insights into how dietetics educators can disrupt ingrained cis- hetero-normativity and rigid binary gender norms within dietetics education and curriculum.

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non-LGBTQ identifying individuals. It has been noted that cis-gendered sexual minorities had between 1.9% and 3.6% higher odds of receiving diagnoses for anorexia nervosa, bulimia nervosa, and binge-eating disorders than cis-gendered straight people in the United States.\(^\text{11}\) Many health care professionals, regardless of discipline, do not feel prepared to address LGBTQ health concerns and report being uncomfortable when providing care to LGBTQ people.\(^\text{2}\) If the dietetics profession aims to provide safe, inclusive and affirming care to LGBTQ people, then the dietetics profession must work at building confidence and competency within its professionals and consider the use of a queer pedagogical perspective to address nutritional health disparities.

Queer is a contested term. Although it can be used as a derogatory epithet for LGBTQ people, it has been reclaimed by many within the LGBTQ communities as a positive and socially subversive label for identity. The term queer has been philosophically connected to social disruptions of gender, sexual orientation, and other constructs and systems used to marginalize the LGBTQ community. Queer pedagogy, as DePalma\(^\text{12}\) suggests, is a “a kind of critical pedagogy, which questions the neutrality of knowledge and renders teaching a political act. Drawing on queer studies, it (ie, queer pedagogy) remains strategically poised on a series of important contradictions between constructing and deconstructing, defining and undoing.” In other words, queer pedagogy is about the critical examination of contradictions and the deconstruction or undoing of taken-for-granted knowledge, assumptions, beliefs, values, and practices, especially in relation to gender and sexual orientation. As such, queer pedagogy can disrupt ingrained notions of cis-hetero-normativity within health care, working to facilitate safe, inclusive, and affirming practices.

Work within other health care professions has examined how queer pedagogy can be integrated into the curriculum. For example, it was found that educational interventions, such as LGBTQ-focused teaching sessions, may improve clinical confidence of medical students.\(^\text{12}\) Other researchers found that training on specific issues affecting older LGBTQ adults can lead to greater knowledge and skills for health care workers, resulting in LGBTQ patients experiencing fewer acts of discrimination by health care workers.\(^\text{14}\) However, despite the connections between education and improved health care for marginalized groups, few dietetics programs within Canada offer consistent and improved courses in cultural competency and cultural safety,\(^\text{15}\) fewer still offer LGBTQ-focused education.\(^\text{10}\) Data for nutrition and dietetics programs regarding the amount, content, and pedagogical strategies for LGBTQ topics are lacking, and other professions, such as physical therapy, have struggled to know how and where to include LGBTQ topics within their curriculum, despite its importance.\(^\text{16}\) As Fraser and Brady\(^\text{18}\) noted, Canadian-accredited dietitian training programs are focused on nutrition science and are often limited in content surrounding issues of equity, diversity, and social justice. Zamora and colleagues\(^\text{17}\) noted that the social determinants of health are not even included as part of the standards for the Accreditation Council for Education in Nutrition and Dietetics, meaning dietetic educators, who create and implement programmatic curricula, within the United States are not required to provide training in important facets of health care, such as gender and sexual orientation.\(^\text{19}\)

### RESEARCH SNAPSHOT

**Research Question:** What were the perspectives and experiences of Canadian dietitians during their professional training relating to lesbian, gay, bisexual, trans, and other sexually and gender diverse (LGBTQ) content?

**Key Findings:** This qualitative study revealed that LGBTQ-focused curriculum and content during dietitian professional training was often lacking for the participants and resulted in dietetics programming that often did not meet the ethical ethos of a caring profession or adequately prepare dietitians to practice safe, inclusive, and affirming care for LGBTQ people. A queer pedagogical lens within dietetics programs is recommended.

Principles and practices of queer pedagogy are, therefore, critical to dietetics training programs and should be incorporated into dietetics curriculum. Classrooms and curriculum should provide opportunities for dietetics students to deeply reflect on, and to disrupt, the political and social meanings of genders and sexualities, and understand how systems and structures contribute to the lives of their clients, including the care they provide. By doing this, students will have to opportunity to learn to safely care for their LGBTQ clients in ways that encourage equitable, inclusive, and affirming experiences. This research was part of a larger study exploring gender and sexual orientation priorities within the dietetics profession. The aim of this subsection of the study was to explore the socially constructed perspectives (ie, beliefs) and the professional training experiences (ie, undergraduate degrees, internships, and other training opportunities) in LGBTQ-focused topics, skills, and knowledge of Canadian dietitians to inform future curriculum and pedagogy.

### METHODOLOGY

#### Theoretical Perspectives

This research was guided by a poststructuralist lens. Poststructuralism is a theory of language, discourses, and knowledge\(^\text{20}\) and can be a framework for health researchers to challenge the ways in which people live and experience the world by deconstructing “regimes of truth” on which health care institutions and practices are constructed.\(^\text{21}\) Poststructuralists are concerned about exploring the ways people’s perspectives, values, beliefs, assumptions, and experiences are socially constructed. Researchers using a poststructuralist approach are also interesting in exploring the way knowledge is produced, who gets to know or not know, who can say certain things and who cannot.\(^\text{20-24}\) This approach allows for alternative ways of knowing and thinking to be explored, as well as critiquing relations of discourse, knowledge, and power.\(^\text{21}\) The use of poststructuralism can allow dietetics researchers to explore the social, political, cultural, and historical contexts shaping dietetics curriculum and pedagogical practices, as well as the way dietitians come to know things.\(^\text{22-24}\) The use of poststructuralism as a theoretical approach is also well suited to studies involving queer pedagogy, as both question the neutrality of knowledge; critically explore social constructions of identities and institutions; and can deconstruct
assumptions, beliefs, values, and practices, especially in relation to gender and sexual orientation.

Positionality of Research Team

In qualitative research, it is epistemologically important to reflect on the researchers’ position to the topic and contexts being explored.25 The research team consists of a PhD registered dietitian as the principal investigator (PI) formally trained in qualitative research methodologies and post-structural approaches (P.J.) and a mixed-methodologist PhD pedagogical and curriculum expert within the area of higher education (J.M.M.F.). The PI (P.J.) has lived experiences as a gay man and considers himself an “insider” or a person who identifies within the LGBTQ communities. LaSala and colleagues,26 noted that insiders have knowledge that can help with the development and facilitation of ethically appropriate research by having critical insight into the impact of the selection of research methods on participants’ experiences engaging in the research, and greater awareness of participants’ voices during data collection, analysis, and dissemination.25 Having an insider on the research team can help to ensure the perspectives and lived experiences of those participating in the study are prioritized and represented justly and equitably.25,26 All team members are dedicated to the health of LGBTQ groups and believe that health curriculum should promote the inclusion of LGBTQ voices.

Recruitment and Data Collection

This research was approved by the research ethics board at Mount Saint Vincent University. Social media (eg, Facebook dietetics groups and pages, Twitter) platforms were used to recruit Canadian dietitians who expressed an interest in discussing sexual orientation and gender diversity in the profession. The PI shared the recruitment call with his professional dietetics networks and asked them to share it within their professional networks (“snowball sampling”). The PI’s e-mail address was provided in the recruitment ads. Sixteen potential participants were sent an informed consent document with the aims and reasons for the research. Once the signed consent was returned, the participants were scheduled for an online interview.

A semi-structured interview guide was developed (Figure). Interview questions were framed through a post-structural theoretical lens and guided by the insider knowledge of the PI as both a dietitian and LGBTQ member.25,26 Questions focused on the belief, values, and practices of participants relating to gender and sexual orientation priorities within the Canadian dietetics profession and their experiences of LGBTQ training within their dietetics degree. Open-ended interview questions were designed to allow participants to reflect and discuss their professional training experiences in relation to LGBTQ topics and care, both during their degree programs and within their subsequent careers. Additional questions were developed to allow participants to share their views on how the dietetics profession can better support the training of professionals to provide safe, inclusive, and affirming health care for LGBTQ clients. Demographic questions relating to gender, sexual orientation, race, age, and years of dietetics practice were added as part of the interview guide. The demographic questions were also open-ended to allow participants to self-identify.

Figure. Semi-structured interview guide for exploring the lesbian, gay, bisexual, trans, and other sexually and gender diverse (LGBTQ) training perspectives and experiences of Canadian dietitians.

Participants took part in 60- to 90-minute online semi-structured interviews with the PI within private locations of their choosing (ie, home or offices) from September 2020 to January 2021. Interview guides were not provided before participating. All interviews were recorded using Microsoft Teams; the PI took notes during the interviews to supplement the recording. Participants were given an honorarium ($25 CAN) for participating in the study. Interview recordings were transcribed by an independent professional transcriber and anonymized for analysis. Participants reviewed and approved their transcripts.

Data Analysis

The theoretical approach of poststructuralism that framed the design of this study, also framed the approach to data collection and analysis. Richardson,27 as noted within Creswell,28 suggested that researchers who use a poststructural approach also apply a “multiple angles of approach,” which allows for a greater representation of the “multidimensionalities” of our lived experiences. For example, one angle of approach within this research is the varied background of the 16 participants providing a diversity of insight and perspectives into the realities of dietetics training, practice, and experience. Another angle of approach was the utilization of field notes to reflect the researchers’ personal thoughts, ideas, and queries regarding the interviews.28 These field notes were reviewed and used during the coding and analysis process as an angle of approach that situates insider experiences.20

A systematic thematic analysis was used to derive themes from the data. Thematic analysis29,30 can be used within studies that use different theoretical approaches, including poststructuralism. This process involved the team reviewing the data and creating initial codes independently. This specifically involved paying particular attention to language, discourses, and knowledge production, as well as how
participants’ perspectives and experiences were constructed, as per the poststructuralism. The team then met to collectively discuss codes and repeated this process once more to ensure a robust review of the data. Once coding was completed, the team met on several occasions to develop overarching themes that arose out of the coding process. The team met until a consensus on themes was reached. Conflicts about codes and themes that arose during this process were discussed between members of the team and resulted in a return to the interviews for independent review. Within poststructuralism, the coding and analysis process also provides opportunities for multiple angles of approach to provide a more fulsome interpretation of the data. Firstly, participants were asked to check their transcripts to ensure the accuracy and authenticity of their responses. The authors note that no corrections to transcripts were identified by participants during this process. Secondly, thick quotes that describe the perspectives and experiences of the participants were used to support and supplement inferences made through the analysis.

RESULTS

Sixteen Canadian dietitians who had an interest in discussing gender and sexual diversity within the profession took part in the study. No participants dropped out during the course of the study. The participants ranged in age (20 through 61 years) with dietetics careers that spanned from recent graduates (1 year or less) to those with more than 30 years of experience. Participants self-identified their genders as cis men (n = 4), cis women (n = 8), and gender-fluid or nonbinary (n = 4) individuals. Within the cohort, 11 participants self-identified as members of LGBTQ groups and 5 self-identified as straight. Eleven participants self-identified as White, 4 participants self-identified as Asian, and 1 participant self-identified as Middle Eastern. Participants lived in varied provinces of Canada, including Ontario, Nova Scotia, British Columbia, and Alberta. All participants self-identified as allies to LGBTQ groups. Several participants interviewed had experience as dietetics educators within accredited programs.

The following 3 themes emerged in the participants’ interviews: understanding the ethics of dietetics education, recognizing the cis- and hetero-normativity of dietetics education, and moving forward with queer pedagogy. These themes reflected the participants’ experiences of learning LGBTQ content within their professional training and their beliefs on how dietetics educators can effectively prepare students to integrate LGBTQ content into teaching practices and curriculum.

Theme 1: Understanding the Ethics of Dietetics Education

All participants acknowledged the nature of the profession as being care-centric, as exemplified by 1 participant who said, “...it’s part of who we are right. When you’re working in dietetics you’re in a helping profession...” (participant [P]3). However, many participants saw the lack of LGBTQ content in the curriculum and training to be in direct opposition to the helping principles and ethos of the profession.

When asked to describe their training experiences in relation to LGBTQ content, all of the participants stated that they received very little or no training about providing safe and affirming care to LGBTQ clients.

In my courses, not really a lot of it or not directly. The exception would be having my food class ... the instructor always brought up things and so we talk about everybody. But getting very brief, like nothing in depth and definitely not in clinical classes or assessments where it was very general, ask open-ended questions, don’t make assumptions about people's family or whatever. But that’s more general. —(P4)

This participant revealed that they received very little LGBTQ content in their courses, particularly clinically focused courses, and what was presented was a general breadth of information rather than specifics that focused on the unique identities of, within, and across the LGBTQ community. A few participants noted that they received limited LGBTQ-focused content and professional training opportunities. These experiences were largely through electives outside of the core dietetics curriculum (such as gender studies), occurred by happenstance (such as working with LGBTQ clients in internship), or were left to them, as students, to independently explore within their own course work. As one participant described, “I did a lot of my own like whenever the projects were more flexible in terms of sexual and gender diverse groups, I focused on that a bit” (P1). Other participants noted similar experiences of exploring LGBTQ topics on their own and believed that it was unethical to place the burden of self-directed learning onto students. “It seems unfair to leave that (training for LGBTQ care) up to the students to figure out. I think there should be a little bit more from these educational institutions where you know we’re spending our money and doing our training” (P2). This participant believed that it was the ethical responsibility of dietetics institutions and educators to ensure students have programming that includes LGBTQ content. Another participant questioned why such LGBTQ-focused education was not a part of professional training opportunities. “Why is it not part of our base level dietitian training?” (P12). This participant further explored how this lack of LGBTQ-focused education was a disservice to their training as a dietitian, stating:

And so, the training having been entrenched in the heteronormative society, was all about the heterosexual experience.... It’s only now looking back that I would say to myself like “wow, what a disservice” or “wow, they could have done better” but in the moment I didn’t know any better because I’m the student, they’re the teacher. You look to the systems as the authority on this and think they’ll tell me what I need to know, I’m here to learn from them.—(P12)

This participant believed the cis- and hetero-normative nature of the program and the curriculum taught by the “authorities” left graduates lacking skills needed to work with a diversity of people within their dietetics practices.

Several participants discussed learning during their professional practice, mostly from specialized conferences or other allergy programs offered by their employers. A few participants, however, discussed learning from their clients. For
example, participant 5 related their experience about learning from a trans client. “I had a client who had to teach me like what the proper pronouns were, and I was like ‘... I need to learn some things.’” This participant further described how the lack of education within dietetics programs about the lives of LGBTQ people was particularly problematic and potentially harmful to their clients.

I think there’s just things that I’m constantly trying to learn to prevent (burdening or harming clients) but it’s not built into the education system or the fabric of our way of being until you encounter something, make a mistake and then try to fix it. I’m like “oh I wish you (the client) didn’t have to help me fix that.”—(P5)

This participant recognized that their mistakes around gender identity during practice placed their clients at increased harm and placed a burden on the clients to take the role of a teacher during their care. It was noted by one self-identifying LGBTQ participant that even LGBTQ people need professional training experiences for providing safe, inclusive, and affirming care for other LGBTQ people. The participant related an incident that occurred as they began their practice:

I had to now talk and serve LGBTQ people and I had no idea how to do it. I didn’t actually know how to talk to gay people if you believe it or not, right, like how do I do this, I wasn’t trained to do this. So there was actually quite a bit of a discomfort when I had another (LGBTQ person) sitting in front of me as my patient. I actually didn’t know what to do, I was so uncomfortable because there was so much of me being reflected to me. I was like “oh maybe I can refer this person to someone else. I didn’t want to be there . . . I got pronouns wrong during the whole thing. I noticed these things and I realized “oh boy I have no idea how to do this.”—(P5)

This participant, who self-identified as LGBTQ, noted that they did not feel that they had the skills needed to work within LGBTQ communities. This quote highlights the complex issues that can arise during practice when LGBTQ safe, inclusive, and affirming care training is not provided within accredited programs, and that the impact of this can be felt by both dietitians and clients. It is the ethical and professional responsibility of caring health professions, like dietetics, to minimize harm and negative impacts and many participants recognized the discrepancy between a lack of LGBTQ curriculum in training programs and the ethos of their profession and the care they provide.

Theme 2: Recognizing the Cis- and Hetero-Normativity of Dietetics Education

All participants discussed how most of the curriculum they experienced during their professional training reflected and reproduced cis- and hetero-normative societal norms, including concepts of the nuclear family, binary gender roles, and the historical erasure and medical pathologization of LGBTQ lives.

It’s still a very female White woman kind of program and I don’t think that we really cater to any other perspective or opinion a lot of the times and I don’t know if that’s maybe from a place of like not wanting to do it wrong and not knowing and not really being certain how to approach the topic.—(P2)

For this participant, professional training programs for dietitians are still very much rooted in the historical context of being a discipline for White women. The participant believed that although this may be unintentional, either coming from a place of not wanting to do harm or not knowing the best approaches to use, it still perpetuates such norms and erases LGBTQ perspectives and lives from the curriculum. “Even like learning about nutrition in pregnancy, and family nutrition and children, it was like the imagery, readings, and language was very, very heteronormative” (P3). Often the examples provided by the participants reflected medical discourses and cis-binary gender assumptions of the clinical tools, practices, and knowledge of dietetics, such as energy and weight equations and food guidelines. “Like the way we calculate energy needs using a very binary equation and never questioning if that is the only way to do it . . . it was just a gap” (P4). Other participants also commented on such gaps created from the cis- and hetero-normative assumptions found within dietetics education.

We’re still thinking about men and women you know in the biomedical sense, especially when you talk about things like development and pregnancy and it’s very much that kind of stuff . . . we’re not talking about things like masculinity and femininity and those kinds of things, we’re talking about like you know male and female and so I think that if you don’t talk about these things then you’re not getting to the complexity of what it means to work with queer people.—(P16)

Like this participant, many other participants believed that cis- and hetero-normativity within their education was detrimental to their training as dietitians because it did not allow for the complexities of genders and sexualities to be explored. As one participant said, “it’s part of who we are right so when you’re working in dietetics . . . you can’t disconnect on identity and sexual orientation . . . it’s all important.” For these participants, ignoring the complexities of people’s lives within curriculum can negatively impact safe, inclusive, and affirming care to all clients, not just to those who openly identify as LGBTQ.

Theme 3: Moving Forward with Queer Pedagogy

Participants believed LGBTQ content and curriculum should be intentionally disruptive to cis- and hetero-normative practices and beliefs—in other words to be political or queer with the goal of subverting longstanding structures of oppression and marginalization. “I think we have to show that dietetics is also complex so I believe the way we could start the conversation is by queering up curriculum and queering up spaces” (P10). This participant saw queer pedagogy as a means by which to start new conversations to challenge existing knowledge and practices within the profession. Many participants saw this “queering up of curriculum” as taking an intersectional lens to critique the broader systemic issues of homophobia, transphobia, racism, poverty, and other social injustices. “We must have the conversations about intersecting identities, acknowledge that we have sexualities and genders, and the isms” (P16). Another
participant stated that “I feel like that's a very large gap in terms of racial inequities, gender inequities, sexual orientation inequities, and I think we need definitely a more intersectional approach” (P4).

Some participants saw “queering” dietetics curriculum as moving beyond biomedical models even when the topic is about LGBTQ health.

I think the other piece that is important to really look (when talking about training) at is our biomedical thinking . . . I think what happens is that we go to places where we are comfortable so when we’re talking about LGBTQ health, we’re always like tell us what is different medically. But we need to actually talk about these issues as social issues rather than medical issues. We tend to go to places that we’re comfortable with like nutrients. So, when we talk about LGBTQ health it’s, “oh, let’s talk about hormone replacement therapy,” it’s so medical. Let’s talk about body image disorders for gay people and I mean we know it’s there but it’s such a medical gaze at it from a straight point of view.—(P16)

The participant believed that even when LGBTQ health is discussed it is within the lens of the biomedical gaze, which can often be othering and from a “straight point of view.” Trauma-informed and compassionate care models were also discussed as components of queer pedagogy by participants:

I think dietitians underestimate the way people’s adverse childhood experiences or adverse life experiences impact them nutritionally. . . . And no shocker, people with the higher number of adverse childhood experiences are more likely to experience food insecurity and that’s linked to poverty, they’re all linked right? So dietitians are like what? I’m like “yah most of the people that you’re seeing with obesity have been completely traumatized and you’re glossing over that.” I’m not saying you have to dig into the trauma but we have to have a very different model of how we’re going to approach people in the LGBTQ community cause I don’t know if you really understand what it’s like to be told from a very young age there’s something wrong with you. And something wrong with you in a very fundamental piece of who you are, it’s who you love that’s wrong right? And humans love period. So that’s a huge trauma. It’s not like you’re being told your nose is too big, which can be traumatizing, I mean I get that but it’s not the same thing as being told your eyes are too squinty or your hair is a gross colour: it’s oh who you fall in love with is completely wrong and you’re going to go to hell or whatever. That’s a massive, massive undertaking for someone to work through in their lifetime.—(P8)

This participant recognized the unique trauma many LGBTQ people go through and how many straight people struggle to really understand the implications of being told your love is wrong. In this case, trauma-informed and compassionate approaches to curriculum were viewed as ways to create deeper understandings to experiences of cis-hetero-normativity.

Specific pedagogical activities noted by participants included creating partnership with LGBTQ communities and having LGBTQ guest speakers share their experiences. “I think it would have been great if there were more partnerships available with LGBTQ-focused organizations. . . . I think that that would really be incredible in terms of getting that kind of experience for dietitians that are just starting out . . . because that definitely wasn’t something open to me during my internship” (P2). Talks from people with lived experiences in LGBTQ communities were thought to be a very powerful pedagogical approach.

I think that if you have someone from the LGBT or the queer community come and speak to the students about their experiences in health, it is incredibly riveting. . . . I think teaching through storytelling in this realm is very powerful because it’s teaching students to be engaged, to listen and not only to listen, but to analyze what they’re hearing and to understand that if they’re faced with a similar situation how would they go about interacting with an individual in a compassionate way.—(P13)

Inviting LGBTQ people into the classroom was seen as a means for students to engage, reflect, and analyze experiences of clients in a compassionate way. Relating to this, some participants felt that having more LGBTQ educators would be beneficial to moving the profession forward. “I actually think one of the tactics I would argue is that we should have more LGBTQ dietitians teaching some of the LGBTQ components” (P8). Increasing the number of LGBTQ instructors within dietetics programs was seen as another way to increase diversity in the profession and to bring more lived experiences into classrooms.

Lastly, several participants who reflected on either their experiences as students or as dietetics educators recognized the challenges of curriculum and program changes. Dietetic program designers and educators must adhere to accreditation competencies within their programs and curriculum. The need to adhere to accreditation standards often makes it difficult for educators to adapt and change program outcomes, the number and breadth of courses, course learning outcomes, and course content.

Curricula matters are a big issue because whenever you talk about changing the curriculum the immediate response is what shall we take out, because the curriculum is full, dietetics students have very minimal options . . . there’s not much to take out that’s not required. . . . Now that being said, I think it could fit in a lot of places (within the curriculum).—(P6)

This participant believed that attempting to queer the curriculum or to change teaching practices to be more inclusive was often challenging because of the many topics that must be covered to meet accreditation standards and competencies within the dietetics curriculum. However, this participant did not see this constraint as insurmountable or a reason to not try to address queering the curriculum. The one thing most participants believed was that any changes to dietetics programs must be done with intentionality. “It (LGBTQ content and queer approaches) has to be in there [dietetics education programs] in an intentional way not just like ‘ah #diversity’” (P4). Intentional ways to integrate LGBTQ content and concepts more fully and deeply into dietetics programs were viewed as necessary.
RESEARCH

DISCUSSION

The themes of this research were thematically analyzed through a poststructuralist approach, in order to explore the ways that knowledge, beliefs, values, assumptions, and experiences are socially constructed and experienced. The socially constructed nature of the participants’ perspectives and experiences interconnects and overlaps with our themes. The first theme emphasizes the ethical responsibility of dietetics educators to teach students about ways gender and sexuality influence the nutritional health of people. Participants believed that a responsibility of educators is to address issues of cis- and hetero-normativity so that newly graduated dietitians can provide safe, inclusive, and affirming care across diverse gender and sexual orientation identities. As noted in Theme 1, LGBTQ lives and nutritional considerations were, for the most part, missing from the experiences of the participants, or participants had to seek out LGBTQ content on their own. The voices of LGBTQ people within dietetics educational systems were silent for many participants, and they felt that this was misaligned with the ethical and professional responsibilities of educators to prepare students for LGBTQ inclusive care on graduation.

Theme 2 focused on the cis- and hetero-normative nature of dietetics education, and how the history of the profession often (re)creates relations of power within dietetics education based on societal concepts of the nuclear family, binary gender roles, and the erasure and medical pathologization of LGBTQ lives. Such relations of power often privilege knowledge and discourses that are focused primarily for and about straight people. Again, the consequence of the predominant cis- and hetero-normative discourses in the dietetics profession perpetuates the silencing of LGBTQ people, their needs, experiences, and lives within dietetics education, and mirrors the same systemic and structural issues experienced by LGBTQ people within health care systems and policies.

Lastly, Theme 3 explored how participants believed the dietetics education system could incorporate safe, inclusive, and affirming care philosophies in order to enhance the dietetics profession. Participants viewed the lack of LGBTQ-focused content, teaching approaches, and curriculum choices within their dietetics training programs as contrary to the professional code of ethics, as mandated through dietetics competencies, which obligate dietitians to provide safe, inclusive, and affirming care to all patients and populations regardless of gender or sexual orientation.

Others within various health fields have suggested LGBTQ curriculum should include pedagogical approaches that explore the historical, social, cultural, and political contexts of the health and lives of LGBTQ people, as well as structures and relations of power naturally embedded within those fields. The use of queer pedagogical practices may help dietetics educators to fulfill their responsibilities to teach students principles of inclusive client-centered care and allow educators to critique and deconstruct the cis- and hetero-normative nature of profession within their classroom. Dietetics educators, by queering their classrooms, then uphold the caring ethos of the profession.

In health literature, many teaching approaches and activities have been recommended, including the integration of varied voices and lived experiences of equity-deserving groups through the use of case studies, images and videos featuring LGBTQ people, storytelling and personal narratives, and experiential learning methods, including the use of performative theater. Although these methods are effective, it is equally important for dietetics educators and curriculum developers to remember that “the mere inclusion of gay and lesbian subjects into the traditional “straight” curriculum simply constructs them as momentary disruptions to be tolerated, reaffirming the heteronormal as not only stable but also generous” and leads to inauthentic or tokenized learning experiences. Many of the participants noted thoughts similar to DePalma’s, and that for dietetics education to be truly political and ethical, educators must not just simply include LGBTQ people within the “straight” curriculum, but provide learning opportunities that fundamentally examine, critique, and disrupt cis- and hetero-normative social constructs that shape the health of LGBTQ people. Queer pedagogy, as Britzman described, attempts to not only move beyond binary notions of gender and sexual orientation, but also of the oppressed and the oppressor, while analyzing the social concepts that create those binary notions. Integration of LGBTQ content must be done thoughtfully and be paired with opportunities for students to critically reflect on the deeply rooted systems of oppression that their clients experience daily. Dietetics educators, by using the principles of queer pedagogy, can help students to fully understand the ways and reasons groups of people are excluded from society and the resulting impacts to their nutritional health. Such understandings can support new dietitians to approach their practice with both confidence and compassion. Practices that consider, as many participants noted, the traumas people experience from social exclusion and marginalization, both from interactions within and external to the care they receive. Queer pedagogy can offer ways to transform the dietetics profession and health care by disrupting the status quo and provide students with experiences that challenge their personal and professional ideologies of genders and sexualities that ultimately cascade into their everyday practice. However, this will require dietetics educators to integrate LGBTQ topics within their classrooms and throughout their programs, potentially requiring a restructuring of curriculum to include mandatory training on LGBTQ experiences, lives, and nutritional considerations. This queering of the curriculum may help to effectively and critically explore how the practice of dietetics unknowingly perpetuates cis-hetero-normativity and erasure of LGBTQ experiences.

The strength of this research is that the research team included a member of the LGBTQ community and all of the participants self-identified as under the LGBTQ umbrella or self-identified as an ally to these groups. Insider perspectives have been noted by other researchers as critical for community-based research. However, the sample could be viewed as potentially limiting, as dietitians with little to no connections to LGBTQ groups are not included. The sample was equally limited in terms of racial diversity, with most participants identifying as White. Although it has been reported by the Commission on Dietetic Registration that approximately 76% of dietitians in the United States are White, the sample did not capture the lived experiences of racially diverse dietetics professionals, and the potential intersectionality of race and gender. Future studies need to focus on voices largely under-represented in the dietetics field and within dietetics research. Finally, all of the participants were educated and trained through different
universities and dietetics programs across Canada at different times. However, because registration to become a dietitian in Canada requires graduation from a nationally accredited program and passing a standardized national examination, the core programming should be similar across the country, although it should be noted that national examinations and competencies have changed over the years. For example, the National Integrated Competencies for Dietetic Education and Practice were updated in 2013 and again in 2020.24,30 Some variations in nationally accredited programs, therefore, can exist. In addition, dietetics educators have freedom in how to integrate the national standards into their curriculum. Participants, therefore, may have different perspectives and experiences of LGBTQ content and pedagogy based on when and where they received their training.

CONCLUSIONS

LGBTQ individuals continue to face barriers, including erasure, discrimination, homophobia, and transphobia that can create unique nutritional concerns and prevent them from accessing adequate nutrition and dietetics health care. Many aspects of the dietetics profession are still rooted in cis- and hetero-normative ideologies and practices, including the lack of LGBTQ representatives with dietetics profession training. The researchers do not intend to draw definite generalizations from the data but to draw attention to the need for queer pedagogical principles and practices with dietetics training programs. The need for dietetics educators and curriculum developers of all genders and sexualities to embrace queer pedagogy as a means to work toward moving the profession forward in terms of diversity and inclusive was highlighted through the voices of our participants. By “queering” the dietetics curriculum and pedagogical strategies, new dietitians will be better able to provide safe, inclusive, and affirming care to all clients.

References


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**STATEMENT OF POTENTIAL CONFLICT OF INTEREST**

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**AUTHOR CONTRIBUTIONS**

P. Joy contributed to the funding, research design, data collection, data analysis, interpretation, and writing of manuscript. J. M. McSweeney-Flaherty contributed to the data analysis, interpretation, and writing of manuscript. Both authors are in agreement with the manuscript and declare that the content has not been published elsewhere.
Association of Food Insecurity and Food Addiction Symptoms: A Secondary Analysis of Two Samples of Low-Income Female Adults

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ABSTRACT

Background Household food insecurity persists in the United States and has important implications for health and well-being. Food insecurity in female-identified caregivers is particularly concerning, given its association with their mental health and adverse health outcomes for their children. Food insecurity is associated with disordered eating but, to our knowledge, no prior studies have examined an association between food insecurity and food addiction.

Objective Our aim was to examine whether food insecurity is associated with higher food addiction symptom endorsement in low-income female adults.

Design Secondary analysis of baseline data from a quasi-experimental study of a mindfulness-based intervention on gestational weight gain among low-income pregnant individuals and an observational study of low-income families.

Participants/setting Participants in study 1 (n = 208) were English-speaking, low-income pregnant individuals with overweight or obesity, recruited in California from 2011 to 2013. Participants in study 2 (n = 181) were English-speaking, low-income female caregivers for children aged 8 through 10 years, recruited in Michigan from 2018 to 2019. Both studies recruited participants from community health clinics, social service agencies, and online advertisements.

Main outcome measures The primary outcome measure was food addiction symptoms, assessed by the Yale Food Addiction Scale.

Statistical analysis Multivariate Poisson regression was used to examine the association between household food insecurity and food addiction symptoms in each sample, adjusted for sociodemographic characteristics.

Results In study 1, pregnant individuals in food-insecure households reported 21% higher food addiction symptoms than pregnant individuals in food-secure households (incidence rate ratio 1.21; 95% CI 1.00 to 1.47; P = .047). In study 2, caregivers in food-insecure households had 56% higher food addiction symptoms than caregivers in food-secure households (incidence rate ratio 1.56; 95% CI 1.01 to 2.40; P = .045).

Conclusions These findings provide preliminary support for a relationship between household food insecurity and food addiction. Future research should examine potential mechanisms and whether interventions to reduce food insecurity lower risk of food addiction.

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HOUSEHOLD FOOD INSECURITY, WHICH REFERS TO the lack of access to sufficient food to meet the nutritional needs of all household members, was estimated to affect 10.5% of US households in 2019.1 Food insecurity affects households with children and single-parent households disproportionately.2 Food insecurity is particularly concerning for low-income female-identified caregivers, who are often responsible for feeding children and other household members due to gender norms and expectations.2 Mothers who experience food insecurity report elevated levels of depression, anxiety, and other psychopathology,3,4 which may impact parenting and increase children’s risk for developmental delays and psychopathology.5,6 In high-income countries, food insecurity is associated with greater body mass index (BMI; calculated as kg/m²).7,8 Although the role of gender in the relationship between food insecurity and BMI is not fully understood, several studies suggest women in food-insecure households are at greater risk for obesity than men in food-insecure households.3 For children in food-insecure households, BMI in the
overweight and obese ranges is associated with increased health risks, some of which may track into adulthood, even after adequate access to food is restored.\(^1\) Food insecurity is associated with overall eating disorder pathology.\(^6,11\) increased incidence of diagnosable eating disorders, such as bulimia nervosa\(^12,13\) and binge eating disorder,\(^14\) as well as dysfunctional eating symptoms, including dietary restraint\(^10,13,15\) and loss-of-control eating.\(^10,15\) During pregnancy, food insecurity is associated with disordered eating and food insecurity coupled with dietary restraint is associated with greater gestational weight gain.\(^18\)

Families experiencing food insecurity often have limited access to nutrient-rich foods like fruits, vegetables, and lean proteins, and relatively greater access to less expensive, highly processed foods, which are high in refined carbohydrates (ie, white flour and sugar) and fat.\(^19\) Highly processed foods are much more effective than naturally occurring foods at activating neural reward responses\(^26\) and are associated with behavioral patterns that mirror substance use disorders.\(^21,22\) Food addiction is measured by the Yale Food Addiction Scale (YFAS), which assesses symptoms of substance use disorder (eg, compulsive use, unsuccessful attempts to cut down, tolerance, and withdrawal) in the context of highly processed foods.\(^23,24\) In parallel to the diagnosis of a substance use disorder, individuals are considered to have a food addiction “diagnosis” if they endorse at least 2 symptoms and clinically significant impairment or distress.\(^25\) Approximately 15% of adults in community samples report symptoms that meet the criteria for diagnosable food addiction.\(^26\) Meeting the diagnostic definition of food addiction is associated with adverse health outcomes, including diet-related disease (eg, hypercholesterolemia), depression, and poor quality of life.\(^25,28\) Furthermore, higher endorsement of food addiction symptoms is a strong psychosocial predictor of weight gain and attrition during weight loss treatment.\(^29\) Food insecurity is associated with outcomes that are also associated with food addiction symptoms, including increased BMI and disordered eating.\(^10,11,14\) However, no prior studies have examined whether food insecurity is associated specifically with food addiction symptoms.

Findings regarding the relationship between food addiction and measures of socioeconomic status (SES) have been mixed.\(^34,30,37\) Findings may vary because prior studies have used relatively high SES samples where relatively few participants were experiencing food insecurity. This highlights the need for research examining these relationships specifically in low-income samples that are adequately powered to detect relationships between food addiction and food insecurity, along with SES measures. In low-income samples, at equally low levels of income there is a range of levels of food insecurity. Examining food insecurity and food addiction among low-income samples is one way to test these relationships.

This secondary analysis examined the association between food insecurity and food addiction symptoms in 2 low-income vulnerable populations: pregnant individuals and female caregivers of school-aged children. The study had the following aims: to determine whether a relationship exists between food insecurity and food addiction and, if so, to determine whether the relationship can be replicated across 2 samples of low-income female adults. The study tested the hypotheses that food insecurity would be associated with greater endorsement of food addiction symptoms in both samples, and this relationship would be observed independent of other measures of SES.

### METHODS

#### Participants

This analysis included baseline data from the following cohort studies of low-income female adults: Maternal Adiposity, Metabolism, and Stress (MAMAS) study and the Family Food Study (FFS). Detailed methodology for the MAMAS study has been reported previously.\(^32\) Briefly, the MAMAS study was a quasi-experimental study of an 8-week mindfulness-based intervention on gestational weight gain in low-income pregnant individuals with overweight or obesity. MAMAS study participants were recruited from hospital-based and community-based clinics, offices for federally funded nutrition benefits, organizations providing services to pregnant individuals, and online advertisements in the San Francisco Bay area between August 2011 and June 2013. Participants (n = 208) were English-speaking pregnant individuals aged 18 through 45 years at 12 to 19 weeks of a singleton pregnancy at the time of assessment. Participants had a prepregnancy BMI of 25 to 41 and a household income <500% of the US federal poverty guidelines. Data for the present study come from the baseline survey completed before the initiation of the intervention. All study procedures were approved by the University of California San Francisco, California Pacific Medical Center, University of California Berkeley, and Contra Costa Regional Medical Center and Health Centers Institutional Review Boards. All participants provided written informed consent before enrollment.

FFS was a follow-up study of low-income families recruited from Southeast Michigan that aimed to assess associations between food insecurity, child weight gain, and maternal weight gain. Participants in the FFS (n = 181) were English-speaking adult female-identified caregivers aged 27 through 57 years, with children aged 8 through 10 years, and a household income ≤200% of the US federal poverty guidelines. Families were recruited from community health clinics, social service agencies, and UMHealthResearch.org, an online database where community members find opportunities to participate in ongoing clinical and behavioral studies. Data for the present study come from the baseline survey completed by FFS participants from September 2018 to December 2019. All study procedures were approved by the
University of Michigan Institutional Review Board Health Sciences and Behavioral Sciences. All participants provided written informed consent before enrollment.

Measures

Food Security. The US Household Food Security Module is an 18-item scale designed to examine a family's level of household food security in the last 12 months.27 The first 10 questions assess adult respondents’ experiences (US Adult Food Security Module), and the remaining 8 questions assess experiences of respondents’ children. The MAMAS study used the US Adult Food Security Module and the FFS used the full module. The first 3 questions of each module assess for frequency of food insecurity experiences (eg, worrying whether food would run out until they got money to buy more). The remaining questions assess other experiences of food insecurity (eg, cutting the size of meals or skipping meals because there was not enough money for food). Participants were categorized as “food-insecure” when they answered affirmatively to 3 or more questions (“often true,” “sometimes true,” “true,” or “yes” to questions with binary response options). All other participants were categorized as “food-secure.”

YFAS. The YFAS was developed to assess food addiction symptoms. The questions are based on the substance use disorder criteria in the Diagnostic and Statistical Manual of Mental Disorders (DSM), adapted to the context of highly processed food. Each study used a different YFAS version, based on the current version at the time of data collection. The MAMAS study used the original YFAS, which consists of 27 questions and assesses the 7 substance use disorder symptoms from DSM-IV.35 The FFS used the Modified YFAS, version 2.0 (mYFAS 2.0), which consists of 13 questions and assesses for the 11 substance use disorder symptoms from DSM-5.35 Participants reported the frequency of each symptom over the last 12 months, from “never” to “every day.” Each symptom has a different frequency threshold that must be reached to meet criteria for that symptom. For example, on the YFAS, in order to meet criteria for the symptom “substance taken in larger amount and for longer period than intended,” participants must report that they “found that when they started eating certain foods, they ended up eating much more than planned” at least 4 times per week. Participant symptom endorsement was scored as 0 or 1 for each symptom based on thresholds for each YFAS version. The number of symptoms each participant endorsed was added to create a symptom count score. A symptom count of 2 is the current estimated threshold for a clinical level of addictive eating.24 A symptom count was used rather than a dichotomous diagnostic score because continuous dimensional measures are more sensitive for detecting food addiction symptoms in community samples.34

Sociodemographic Covariates. Participants in both studies reported their age, race and ethnicity, level of educational attainment, and household income. These variables were selected as potential confounders, as they have each been associated with food insecurity and/or food addiction symptoms. Gender and sex were not included as covariates, as all participants identified their sex as female, and data on gender identity were not collected in either study. Female sex was assumed in the MAMAS study, as all participants were pregnant during participation, as an aim of the study was to evaluate the effectiveness of a mindfulness intervention during pregnancy on birth outcomes. The FFS was limited to caregivers of school-aged children who self-identified as female, as female caregivers are more likely to take responsibility for children’s nutritional needs.2

Statistical Analysis

All statistical analyses were performed using SAS software, version 9.3.36 Statistical significance was set at $P < .05$, 2-tailed. First, means and distributions in sociodemographic covariates were compared by food security status using univariate linear regression (for age) and $\chi^2$ tests (for categorical variables).

Multivariate Poisson regression was used to examine the association between food insecurity and food addiction symptom count. For each sample, the report includes an initial unadjusted model, a second model adjusted for age, and a final model adjusted for all other sociodemographic covariates (race and ethnicity, educational attainment, and household income). The incidence rate ratio (IRR) was interpreted as the difference in food addiction symptoms endorsed by food-insecure participants compared with food-secure participants. Cohen's $d$ was calculated as a measure of the standardized effect size for each multivariate model.27 Effects were considered small at $|d| > .2$, medium at $|d| > .5$, and large at $|d| > .8$.38

RESULTS

Comparisons of demographic characteristics by food security status revealed no significant differences between participants in food-secure and food-insecure households in either sample. Table 1 details the characteristics of MAMAS study participants by household food security status. In the MAMAS study sample, 41.8% of pregnant individuals were food-insecure; 20.2% of pregnant individuals had low food security and 21.6% had very low food security. On average, MAMAS study participants met criteria for 2.1 food addiction symptoms. Food-secure and food-insecure MAMAS study participants did not differ by age, race and ethnicity, educational attainment, or household income.

Table 2 details characteristics of FFS participants by household food security status. In the FFS sample, 60.1% of caregivers were food-insecure; 27.8% of caregivers had low food security and 32.4% had very low food security. On average, FFS participants met criteria for 0.6 food addiction symptoms. Similar to MAMAS, food-secure and food-insecure FFS participants did not differ by age, race and ethnicity, educational attainment, or household income.

Multivariate Poisson regression revealed that participants in food-insecure households in both samples reported significantly more food addiction symptoms compared with participants in food-secure households. Table 3 shows the multivariate-adjusted associations between food insecurity and food addiction symptoms. In MAMAS, pregnant individuals in food-insecure households had 21% more food addiction symptoms than pregnant individuals from food-secure households, after adjusting for sociodemographic variables (IRR 1.21; 95% CI 1.00 to 1.47; $P = .047$). Cohen’s
TABLE 1. Characteristics of MAMAS study participants by food security status

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total (n = 208)</th>
<th>Food secure (n = 121)</th>
<th>Food insecure (n = 87)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>27.9 ± 5.8</td>
<td>28.3 ± 6.0</td>
<td>27.3 ± 5.4</td>
<td>.22</td>
</tr>
<tr>
<td>Race and ethnicity</td>
<td></td>
<td></td>
<td></td>
<td>.44</td>
</tr>
<tr>
<td>White</td>
<td>28 (13.5)</td>
<td>16 (13.2)</td>
<td>12 (13.8)</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>81 (38.9)</td>
<td>42 (34.7)</td>
<td>39 (44.8)</td>
<td></td>
</tr>
<tr>
<td>Latino</td>
<td>63 (30.3)</td>
<td>41 (33.9)</td>
<td>22 (25.3)</td>
<td></td>
</tr>
<tr>
<td>Other race</td>
<td>36 (17.3)</td>
<td>22 (18.2)</td>
<td>14 (16.1)</td>
<td></td>
</tr>
<tr>
<td>Educational attainment</td>
<td></td>
<td></td>
<td></td>
<td>.12</td>
</tr>
<tr>
<td>Less than high school degree</td>
<td>152 (73.1)</td>
<td>85 (70.3)</td>
<td>67 (77.0)</td>
<td></td>
</tr>
<tr>
<td>High school graduate or more</td>
<td>25 (12.0)</td>
<td>13 (10.7)</td>
<td>12 (13.8)</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>31 (14.9)</td>
<td>23 (19.0)</td>
<td>8 (9.2)</td>
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</tr>
<tr>
<td>Household income</td>
<td></td>
<td></td>
<td></td>
<td>.40</td>
</tr>
<tr>
<td>At or below federal poverty guidelines</td>
<td>98 (47.1)</td>
<td>60 (49.6)</td>
<td>38 (43.7)</td>
<td></td>
</tr>
<tr>
<td>Above federal poverty guidelines</td>
<td>110 (52.9)</td>
<td>61 (50.4)</td>
<td>49 (56.3)</td>
<td></td>
</tr>
<tr>
<td>Total food addiction symptomsc</td>
<td>2.1 ± 1.6</td>
<td>1.9 ± 1.5</td>
<td>2.4 ± 1.7</td>
<td></td>
</tr>
</tbody>
</table>

Note: MAMAS = Maternal Adiposity, Metabolism, and Stress.
\(^{a}\)Food security status was determined by responses on the US Household Food Security Module. Participants were categorized as food insecure when they answered affirmatively to 3 or more questions. All other participants were categorized as food secure.
\(^{b}\)Food addiction symptoms were determined by responses to the Yale Food Addiction Scale. Participants received a score of 0 or 1 for each symptom on the basis of the frequency threshold for that symptom. The number of symptoms each participant endorsed was added to create a symptom count score. Symptom scores could range from 0 to 7.

The effect size value (d = .39) suggested a small effect. In FFS, caregivers in food-insecure households had 56% more food addiction symptoms than caregivers from food-secure households, after adjusting for sociodemographic variables (IRR 1.56; 95% CI 1.01 to 2.40; P = .045). Cohen’s effect size value (d = .29) suggested a small effect. Note that MAMAS study and FFS used different versions of the YFAS as the outcome measure. Thus, these results cannot necessarily be compared meaningfully across samples.

DISCUSSION

This study examined the association between food insecurity and food addiction symptoms in 2 samples of low-income female adults. Consistent with hypotheses, food insecurity was associated with higher food addiction symptom endorsement when controlling for sociodemographic characteristics in both samples. To our knowledge, this is the first study to identify an association between food security status and endorsement of food addiction symptoms. The magnitude of the observed associations was small, which is likely due to multiple biopsychosocial factors that contribute to food addiction.\(^{39}\) However, these findings suggest food insecurity is a relevant overlooked factor related to food addiction. Given that food addiction is associated with poorer mental and physical health,^25-27 food addiction may contribute to negative outcomes for low-income female individuals experiencing food insecurity. These findings represent an important step toward advancing scientific understanding of the detrimental health impacts of food insecurity and point to several mechanisms that may serve as intervention targets to reduce food addiction among low-income female adults.

These findings are consistent with prior studies that found that food insecurity is associated with increased binge eating disorder and loss-of-control eating.\(^{14,16,17}\) Although binge eating disorder and food addiction show some overlap in symptomatology, they are considered distinct constructs that account for unique variance in clinical impairment.\(^{30-42}\) Three interrelated key mechanisms of addiction may contribute to increased food addiction symptoms in the food-insecurity context. First, food insecurity is associated with low or poor diet quality.\(^{15}\) The current food environment is dominated by highly processed foods, which are cheaper and more convenient than minimally processed foods.\(^{44}\) Individuals experiencing food insecurity may be particularly vulnerable to the effects of the food environment due to targeted marketing and other food industry tactics (eg, manipulating shelf space in supermarkets in low-income areas).\(^{45,46}\) Given these factors, it is not surprising that people with food insecurity are more likely to consume highly processed foods, including high-fat dairy products, salty snacks, and sugar-sweetened beverages.\(^{47}\) Food addiction theory posits that the refined ingredients in these highly processed foods parallel the
process of distilling active ingredients in other addictive agents in order to make them more addictive (eg, processing the coca leaf, which has little addictive potential, into powder cocaine, which has a higher addictive potential).21 There is currently scientific controversy about whether highly processed foods are truly capable of triggering an addictive response.22 However, evidence from basic science shows diets composed of refined carbohydrates and fats can cause changes in the brain that drive forward addictive eating behavior.23,24 This is consistent with human studies, which showed that individuals almost exclusively exhibit signs of addictive intake with highly processed foods, but not with minimally processed foods.21 Thus, individuals experiencing food insecurity may be particularly vulnerable to food addiction due to the dominance of potentially addictive highly processed foods in their food environment.44,50,51

An important area of future study is to investigate how availability and access to highly processed foods shape eating behavior in food-insecure samples. It will be important to investigate whether the pattern of addictively eating highly processed foods only generalizes to food-insecure samples, or whether patterns of deprivation and availability of all food

<table>
<thead>
<tr>
<th>Variable</th>
<th>MAMAS study (n = 208)</th>
<th>FFS (n = 181)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RR 95% CI P value</td>
<td>RR 95% CI P value</td>
</tr>
<tr>
<td>Unadjusted</td>
<td>1.23 1.02 to 1.48 .03</td>
<td>1.64 1.07 to 2.50 .02</td>
</tr>
<tr>
<td>Age adjusted</td>
<td>1.22 1.01 to 1.48 .036</td>
<td>1.58 1.03 to 2.43 .04</td>
</tr>
<tr>
<td>Multivariate adjusted</td>
<td>1.21 1.00 to 1.47 .047</td>
<td>1.56 1.01 to 2.40 .045</td>
</tr>
</tbody>
</table>

aYFAS = Yale Food Addiction Scale.
bMAMAS = Maternal Adiposity, Metabolism, and Stress.
cFFS = Family Food Study.
dFood addiction symptoms were determined by responses to the original YFAS22 in the MAMAS and the modified YFAS 2.027 in the FFS. Participants received a score of 0 or 1 for each symptom on the basis of the frequency threshold for that symptom. The number of symptoms each participant endorsed was added to create a symptom count score. Symptom scores could range from 0 to 11.

## Table 2. Characteristics of Family Food Study participants by food security status

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total (n = 173)</th>
<th>Food secure (n = 69)</th>
<th>Food insecure (n = 104)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>36.6 ± 6.4</td>
<td>37.7 ± 6.4</td>
<td>35.9 ± 6.3</td>
<td>.07</td>
</tr>
<tr>
<td>Race and ethnicity, n (%)</td>
<td></td>
<td></td>
<td></td>
<td>.24</td>
</tr>
<tr>
<td>White</td>
<td>102 (59.0)</td>
<td>39 (56.5)</td>
<td>63 (60.6)</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>47 (27.2)</td>
<td>23 (33.3)</td>
<td>24 (23.1)</td>
<td></td>
</tr>
<tr>
<td>Other race</td>
<td>24 (13.9)</td>
<td>7 (10.1)</td>
<td>17 (16.4)</td>
<td></td>
</tr>
<tr>
<td>Educational attainment, n (%)</td>
<td></td>
<td></td>
<td></td>
<td>.35</td>
</tr>
<tr>
<td>Less than high school degree</td>
<td>11 (6.4)</td>
<td>6 (8.7)</td>
<td>5 (4.8)</td>
<td></td>
</tr>
<tr>
<td>High school graduate or more</td>
<td>162 (93.6)</td>
<td>63 (91.3)</td>
<td>99 (95.2)</td>
<td></td>
</tr>
<tr>
<td>Household income, n (%)</td>
<td></td>
<td></td>
<td></td>
<td>.63</td>
</tr>
<tr>
<td>At or below federal poverty guidelines</td>
<td>74 (42.8)</td>
<td>28 (40.6)</td>
<td>46 (44.2)</td>
<td></td>
</tr>
<tr>
<td>Above federal poverty guidelines</td>
<td>99 (57.2)</td>
<td>41 (59.4)</td>
<td>58 (55.8)</td>
<td></td>
</tr>
<tr>
<td>Total food addiction symptomsb</td>
<td>0.6 ± 1.3</td>
<td>0.4 ± 1.0</td>
<td>0.7 ± 1.4</td>
<td></td>
</tr>
</tbody>
</table>

aFood security status was determined by responses on the US Household Food Security Module.33 Participants were categorized as food insecure when they answered affirmatively to 3 or more questions. All other participants were categorized as food secure.

bFood addiction symptoms were determined by responses to the modified Yale Food Addiction Scale 2.0.27 Participants received a score of 0 or 1 for each symptom on the basis of the frequency threshold for that symptom. The number of symptoms each participant endorsed was added to create a symptom count score. Symptom scores could range from 0 to 11.
may lead to addictive patterns of consumption that occur regardless of food type.

Second, people experiencing food insecurity may have uncertain or intermittent patterns of food availability (e.g., food resources are abundant at the beginning of a month, but scarce at the end of the month once resources have been exhausted). Animal research shows intermittent access to addictive drugs facilitates addictive patterns of consumption, even when animals are exposed to a relatively small amount of the drug. This pattern mirrors drug use patterns that contribute to addiction in humans. Animal research has replicated this effect with food; mice subjected to intermittent periods of fasting and food availability display more binge behavior than mice that fast and eat at predictable intervals. However, this pattern only emerges in rats given intermittent access to sugar, but not intermittent access to chow, suggesting a combination of intermittency and highly processed food may be necessary to facilitate addictive eating. Food insecurity may replicate these conditions by causing individuals to access potentially addictive highly processed foods in intermittent patterns that further increase risk for addictive eating.

Third, individuals experiencing food insecurity report higher stress levels, which are associated with greater food insecurity severity. Chronic stress is an important risk factor for the development and maintenance of addiction. Chronic stress is a common mechanism between addiction and obesity, as it alters the reward system in ways that potentiate overconsumption of both addictive drugs and highly processed foods. A recent study found food insecurity was indirectly associated with higher body weight via increased distress and eating to cope. Thus, the stress associated with food insecurity may increase individuals’ risk for food addiction.

The samples were an important strength of this study, in that they comprised low-income female adults with a large proportion of participants experiencing food insecurity; the distribution increased power to detect differences by food security status. Having samples that represent distinct groups of low-income female adults from different geographic regions, with data collected from nonoverlapping time periods, and representing different stages of parenthood or caregiving point to the robustness of the findings. Although the IRRs between the 2 samples differ in magnitude, overlapping CIs indicate similar associations between food insecurity and food addiction between samples, despite differences in participant characteristics. Participants in the MAMAS study were pregnant individuals who may or may not have had other children, while participants in the FFS were caregivers for at least one 8- to 10-year-old child. The studies also differed in the required income threshold for participation. There may be aspects of pregnancy or being a female caregiver of a school-aged child that account for potential differences in food addiction symptom endorsement and the association between food insecurity and food addiction symptoms. Future research may examine whether income level, pregnancy status, age of children, or number of children in the household impact food addiction symptom endorsement or moderate the relationship between food insecurity and food addiction.

This study was subject to several limitations to consider when interpreting the findings. First, this study was cross-sectional and cannot prove causation. Longitudinal studies may illuminate temporal relationships between food insecurity and food addiction and potential explanatory mechanisms over time. Third, this study analyzed baseline data from studies with different primary aims. The MAMAS study was an intervention study that required participants to commit to attending 8 weekly mindfulness-based intervention sessions, plus 2 booster telephone sessions and 1 postpartum group session with parents and infants. Participant characteristics may have been influenced by participants’ motivation and availability to attend the intervention. For example, participants with greater eating pathology or food addiction symptomatology may have been drawn to a study that offered training in mindful eating. In contrast, the FFS was an observational study that did not offer any potential benefit regarding managing eating. The replication of the observed association between food insecurity and food addiction across samples suggests the findings were not unique to an intervention-seeking sample. Future research should investigate whether the association between food insecurity and food addiction and generalized to non-parents and children. An additional limitation of these samples is that sex and gender identity were not assessed as distinct constructs. Future studies should assess both constructs and consider the impact of biological mechanisms (e.g., reproductive hormones) and societal gender roles on the association between food addiction and food insecurity.

Measurement error may have been introduced by the scales used in this study. The Food Security Module asks participants to report whether they have experienced indicators of food insecurity within the last 12 months. Thus, participants may have experienced food insecurity up to 12 months before the study but were no longer experiencing it at the time of study participation. The YFAS also asks participants to report their food addiction symptoms in the past 12 months, which poses the same limitation. Longitudinal studies with larger sample sizes are needed to determine the temporal relationship between experiences of food insecurity and food addiction and to examine how the severity of food insecurity affects the risk of subsequent food addiction. In addition, the FFS used the mYFAS 2.0, which is an abbreviated version of the YFAS 2.0. There is evidence that the mYFAS 2.0 is less sensitive at detecting food addiction symptoms compared with the full version of the scale. Thus, this study may have underestimated food addiction symptoms in the FFS sample.

Another key limitation of this study is that the YFAS has not been psychometrically validated in samples of pregnant individuals or people experiencing food insecurity. Recent studies with related samples provide preliminary evidence of construct validity for the use of the YFAS in the current study. For example, in an urban, low-income sample, YFAS scores were associated with severity of emotional eating and higher BMI and, in a more well-resourced sample of pregnant women, YFAS scores were associated with eating in the absence of hunger. Furthermore, qualitative research with low-income women found that they identified food addiction as a valid and relevant construct. However, validation studies are needed to account for potential differences in these populations’ experiences of addictive eating. Participants in this study may have interpreted the YFAS questions in a way that reflected specific aspects of pregnancy (e.g., increased cravings...
for specific foods driven by hormonal changes) or food insecurity rather than an addictive phenotype. Although the YFAS primes participants to consider highly processed foods driven by hormonal changes, they may have eaten in addictive ways. It is possible that endorsement of food addiction symptoms in food-insecure samples reflects increased hedonic urges to eat any available foods, not just highly processed foods typically implicated in food addiction. Psychometric validation of the YFAS for pregnant individuals and people experiencing food insecurity is an important next step.

CONCLUSIONS

The current study shows preliminary evidence for an association between food insecurity and food addiction symptoms. This association was replicated in 2 samples of low-income female adults: pregnant individuals and female caregivers of school-aged children. These findings expand on prior research that found associations between food insecurity and disordered eating patterns by suggesting that food insecurity is also associated with an addictive pattern of eating that resembles substance use disorders. Addictive mechanisms may be valuable avenues for better understanding the relationship between food insecurity and overconsumption of highly processed foods.

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Food Insecurity and Less Frequent Cooking Dinner at Home Are Associated with Lower Diet Quality in a National Sample of Low-Income Adults in the United States during the Initial Months of the Coronavirus Disease 2019 Pandemic

Julia A. Wolfson, PhD, MPP; Hannah Poslusny; Selma Kronsteiner-Gicevic, ScD; Walter Willett, MD, DrPH; Cindy W. Leung, ScD, MPH

ABSTRACT

Background Food insecurity is a critical public health problem in the United States that has been associated with poor diet quality. Cooking dinner more frequently is associated with better diet quality.

Objective This study aimed to examine how food insecurity and dinner cooking frequency are associated with diet quality during the initial months of the coronavirus disease 2019 pandemic.

Design This cross-sectional study analyzed data from a national web-based survey (June 23 to July 1, 2020).

Participants/setting Participants were 1,739 low-income (<250% of the federal poverty level) adults in the United States.

Main outcome measures The outcome was diet quality, measured by the Prime Diet Quality Score (PDQS-30D). The PDQS-30D is a food frequency questionnaire-based, 22-component diet quality index.

Statistical analyses performed Food security status (high, marginal, low, or very low) and frequency of cooking dinner (7, 5 to 6, 3 to 4, or 0 to 2 times/week) were evaluated in relation to PDQS-30D scores (possible range = zero to 126) in age- and sex- and gender-, and fully adjusted linear regression models. Postestimation margins were used to predict mean PDQS-30D score by food security status and dinner cooking frequency. The interaction between food security status and frequency of cooking dinner was also tested.

Results Overall, the mean PDQS-30D score was 51.9 ± 11 points (possible range = zero to 126). The prevalence of food insecurity (low/very low) was 43%, 37% of the sample cooked 7 times/week and 15% cooked 0 to 2 times/week. Lower food security and less frequent cooking dinner were both associated with lower diet quality. Very low food security was associated with a 3.2-point lower PDQS-30D score (95% CI = -4.6 to -1.8) compared with those with high food security. Cooking dinner 0 to 2 times/week was associated with a 4.4-point lower PDQS-30D score (95% CI = -6.0 to -2.8) compared with cooking 7 times/week. The relationship between food insecurity and diet quality did not differ based on cooking dinner frequency.

Conclusions During the initial months of the coronavirus disease 2019 pandemic food insecurity and less frequently cooking dinner at home were both associated with lower diet quality among low-income Americans. More research is needed to identify and address barriers to low-income households’ ability to access, afford and prepare enough nutritious food for a healthy diet.


Food insecurity, a condition of limited or uncertain access to sufficient and nutritionally adequate food, is a critical public health problem in the United States that contributes to poor diet quality and other health disparities. In 2019, approximately 10.5% (or 13.7 million) US households experienced food insecurity; however, in the early months of the coronavirus disease 2019 (COVID-19) pandemic approximately one-quarter to
RESEARCH

one-third of all Americans, and 44% of low-income Americans, were estimated to experience food insecurity.7-9 If accompanied by reductions in diet quality, as has been previously documented,3,4 food insecurity during the pandemic, particularly among low-income Americans, may contribute to long-lasting health consequences among groups that have been historically economically and socially marginalized.5,6,10

During the initial months of the COVID-19 pandemic, early reports indicated that food insecurity rose due to economic disruptions related to the pandemic.7,10,11 However, annual estimates of food insecurity from the US Department of Agriculture using the Current Population Survey Food Security Supplement indicate that the overall level of food insecurity remained stable in 2020 compared with 2019 though disparities in food security rates did widen for some groups.12 Questions arose about whether or not more people staying home would lead to improvements in diet quality due to more frequent cooking at home and less frequent eating out.12 Prior evidence suggests that cooking at home is associated with better diet quality,13-16 but that diet quality is lower among low-income groups even when they cook frequently.16 During the pandemic, the limited emerging evidence regarding the relationship between food insecurity, cooking frequency, and diet quality has been mixed.19-24 Food insecurity has been associated with lower fruit and vegetable consumption,23 higher energy intake,22 and lower diet quality.21 In a cohort study, diet quality and food security status improved compared with prepandemic levels, and eating out frequency decreased.19 In a cross-country comparisons from June 2020, the United States had the least change in cooking frequency compared to other countries and all countries saw no significant change in fruit or vegetable consumption compared with prepandemic levels.20 No study during the COVID-19 pandemic has examined the relationships between food insecurity, cooking frequency, and diet quality, which all could have been affected by the societal, economic, and supply chain disruptions during the early months of the pandemic.20,25,26

The objective of this study was to examine how food insecurity and frequency of cooking dinner were associated with diet quality during the initial months of the COVID-19 pandemic among a large sample of low-income adults in the United States. A second objective was to examine whether or not dinner cooking frequency modified the relationship between food security status and diet quality. Food insecurity was hypothesized to be associated with lower diet quality and cooking dinner more frequently at home was hypothesized to be associated with better diet quality, particularly among food-secure adults.

METHODS

This cross-sectional study analyzed data from a web-based survey, designed using Qualtrics software,27 to assess food choices and behaviors, food security, and health during the initial months of the COVID-19 pandemic. Developed by the study investigators, the survey included previously validated measures wherever possible (eg, food security status,12 food agency,28 diet quality,28,30,31 cooking behavior,31 anxiety and depression,29,31 and diabetes distress29), and was pilot tested for clarity before rollout. The survey was fielded using CloudResearch, formerly TurkPrime, an online crowdsourcing platform designed to be used for academic research across multiple disciplines.34 The survey was fielded on Prime Panels. Prime Panels aggregates several market research panels and allows researchers to employ census matching and other targeted recruitment strategies to enable large samples that are more representative of the US population than microtask sites such as MTurk.35 This study used a census-matched panel of US adults aged 18 years or older (matched on age, sex, and race and ethnicity to the overall population) while also limiting the sample to adults with annual household income <250% of the 2020 federal poverty level (based on household size and annual household income).36

The survey was open to participants from June 23, 2020, to July 1, 2020, via an advertisement inviting eligible Prime Panel members to complete the survey. The survey opportunity was displayed to potential participants using a generic survey name (eg, “New Survey Opportunity” or “New Survey”). Data collection was ongoing until the target sample size for all demographic targets was reached. Participants provided informed consent at the start of the survey after reading a brief description of the survey. The survey was described as “a research study assessing your experience and views during a COVID-19 outbreak. The purpose of the study is to understand the effect of the outbreak on the health and well-being of adults in the United States.” Participants who completed the survey received a small monetary compensation set by the survey platform through which they were recruited. In total, 2,307 complete survey responses were received. Participants who indicated they did not live in the United States (n = 2), completed the survey unrealistically quickly (<10 minutes) (n = 240), were missing information on food security status (n = 17) or who failed to answer attention check questions correctly (n = 309) were excluded resulting in a final analytic sample of 1,739. The final sample included participants in all 50 states and the District of Columbia, and American citizenship was not a requirement to participate (citizenship was not measured). This study was determined to be exempt by the University of Michigan School of Public Health Institutional Review Board.

Measures

Diet quality, as measured by the Prime Diet Quality Score 30-day screener (PDQS-30D) was the outcome for all analyses.29 A 24-hour recall period and a 30-day recall period version of the PDQS exist; the 30-day version was used for this survey.

RESEARCH SNAPSHOT

Research Question: How were food insecurity and frequency of cooking dinner associated with diet quality during the initial months of the coronavirus disease 2019 pandemic among low-income adults in the United States?

Key Findings: In this large, national survey of low-income adults in the United States, overall diet quality was poor. Food insecurity and frequency of cooking dinner were independently associated with lower diet quality. The relationship between food insecurity and diet quality did not differ based on frequency of cooking dinner.
The PDQS-30D is a food-based diet quality index that includes 22 components (14 healthy, seven unhealthy, and one neutral in a high-income country setting). The PDQS-30D measures frequency of intake of the 22 component foods/food groups over the past 30 days via a food frequency questionnaire with seven possible responses for each component: less than once/month, 2 to 3 times/month, 1 to 2 times/week, 3 to 4 times/week, 5 to 6 times/week, once a day, or 2 or more times/day. Responses are coded from zero to six with unhealthy components scored in reverse and the neutral component not scored. Scores are then summed to create a PDQS-30D total diet quality score (possible score zero to 126) with higher scores indicating a healthier diet. More information about the development and validation of the PDQS diet quality index and its associated data collection tool (PDQS-30D) is available elsewhere. Briefly, the PDQS-30D was developed to be used as a short-form screener and global diet quality assessment tool and has been shown to be strongly correlated with usual nutrient intakes as measured by the Automated Self-Administered 24-hour (ASA24) Dietary Assessment Tool, and compared favorably with the Healthy Eating Index-2015. In the PDQS-30D validation study there was a statistically significant association between total Healthy Eating Index-2015 score and PDQS-30D score ($r = 0.60$) as well as generally consistent results comparing PDQS-30D results with usual nutrient intakes as measured by the ASA24.

Household food security during the past 30 days was measured using the 18-item US Household Food Security Survey Module. Questions were ordered by severity and included three levels of screening for adults and one additional level of questions for households with children. Affirmative responses were summed to create a total food security score (out of 10 for household with only adults and out of 18 for households with children). Food security categories (high, marginal, low, and very low) were assigned according to the US Department of Agriculture scoring guidelines. Food insecurity refers to both categories of low and very low food security.

Household frequency of cooking dinner was based on the question “In the past 7 days, how many days did you or someone else cook food for dinner or supper at home?” This question was based on the cooking frequency measure included in the 2007-2010 National Health and Nutrition Examination Survey and was asked of all survey respondents. Following prior literature, a four category measure of dinner cooking frequency was created: 7 days/week, 5 to 6 days/week, 3 to 4 days/week, and 0 to 2 days/week.

Covariates were measured using multiple choice questions and included age (18 to 39 years, 40 to 59 years, and $\geq 60$ years), sex and gender (male, female, or transgender/nonbinary/other), race and ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, Asian, or other), education (high school degree/GED or less, some college, or college degree or higher), student status (yes or no), marital status (single, married, divorced/separated/widowed, or living with a partner), annual household income ($< $35,000 or $\geq $35,000), Supplemental Nutrition Assistance Program (SNAP) participation (yes/no), household size (1 to 3 people or $\geq 4$ people), presence of children younger than age 18 years old in the household (yes/no), and employment status (full time, part time, unemployed/looking for work, or out of the labor force).

Analysis

First, descriptive statistics were used to examine mean PDQS-30D scores by each study covariate. Simple linear regressions were used to evaluate unadjusted differences in PDQS-30D scores across sample characteristics. Then, associations of food security status and dinner cooking frequency with PDQS-30D scores were examined in age- and sex and gender-adjusted linear regression models. Next, separate linear regression models for food security and dinner cooking frequency adjusted for the full set of covariates described above were used to calculate predicted PDQS-30D scores while holding all other covariates at their means. Trend tests across categories of food security status and dinner cooking frequency were calculated using Stata’s contrast command. Finally, differences in the association of food security with diet quality by frequency of cooking dinner was investigated by including an interaction term (the product of categorical variables for food security and cooking dinner frequency) in the fully adjusted model. The significance of the interaction was tested using a likelihood ratio test. In addition, to account for the ordinal nature of the food security and cooking frequency variables, a likelihood ratio test with one degree of freedom using the ‘c’ prefix in Stata for both measures was also estimated. All analyses were conducted in Stata version 15.0. All tests were two-sided and significance was considered at $P < 0.05$.

RESULTS

Characteristics of the study sample and unadjusted mean PDQS-30D scores across socio-demographic characteristics are presented in Table 1. The mean PDQS-30D score was 51.9 $\pm$ 11.4 points (of possible 0 to 126 points). Compared with non-Hispanic White participants, Hispanic participants (53.2 $\pm$ 11.3 vs 50.8 $\pm$ 11.1; $P =$ 0.002) and Asian participants (58.2 $\pm$ 12.0 vs 50.8 $\pm$ 11.1; $P <$ 0.0001) had higher PDQS-30D scores. Higher educational attainment (some college $[P = 0.001]$ and college degree or higher $[P <$ 0.0001]) and higher income was also associated with higher PDQS-30D scores ($P <$ 0.0001).

Overall, 41.5% of the sample experienced high food security (Table 1). In bivariate associations, those with high food security had the highest PDQS-30D score (53.4 $\pm$ 12.2) across all food security levels. Individuals experiencing food insecurity comprised 43.2% of the sample (17.4% low food security and 25.8% very low food security) and had lower PDQS-30D scores compared with those with high food security (low vs high: 51.7 $\pm$ 10.5 vs 53.4 $\pm$ 12.2; $P =$ 0.028; very low vs high: 49.6 $\pm$ 10.1 vs 53.4 $\pm$ 12.2; $P <$ 0.0001). More than one-third (36.6%) of low-income Americans cooked dinner 7 times/week and had the highest PDQS-30D scores (53.9 $\pm$ 12.2) compared with less frequent cooks. The least frequent cooks (0 to 2 times/week) had the lowest mean PDQS-30D score (49.2 $\pm$ 11.5; $P <$ 0.0001 [difference from cooking dinner 7 times/week]).

Age- and sex and gender-adjusted associations between food security status and diet quality (PDQS-30D score) are presented in Table 2. Greater food insecurity was associated with worse PDQS-30D score ($P$ for trend $< 0.0001). Compared with individuals with high food security, low food security ($\beta =$ −1.7, 95% CI −3.2 to −0.1) and very low food security ($\beta =$ −3.9, 95% CI −5.3 to −2.5) were both significantly associated with lower diet quality. These associations...
Table 1. Characteristics and unadjusted diet quality score (Prime Diet Quality Screener [PDQS-30D]) of the sample of low-income adults in the United States between June 23 and July 1, 2020 (N = 1,739)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>%</th>
<th>Mean</th>
<th>SD</th>
<th>Min²</th>
<th>Max²</th>
<th>P valueᵇ</th>
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<td>21</td>
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<td>52.2</td>
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<td>24</td>
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<td>51.6</td>
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<td>30</td>
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<td>0.002</td>
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<td>11.4</td>
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<td>11.1</td>
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<td>11.4</td>
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<td>≥$35,000</td>
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<td>54.1</td>
<td>10.9</td>
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<td>97</td>
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<td>10.4</td>
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<td>51.3</td>
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<td>50.0</td>
<td>10.0</td>
<td>27</td>
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</table>

(continued on next page)
remained but were slightly attenuated (see Table 3, available at www.jandonline.org). However, there was no evidence that the association between food insecurity and PDQS-30D scores persisted in the fully adjusted models: low food security was associated with a 3.2-point lower PDQS-30D score (95% CI 0.2 to 6.5) compared with high food security.

In age- and sex and gender-adjusted models cooking dinner less frequently was also associated with lower PDQS-30D scores (P for trend < 0.0001) (Table 2). Compared with individuals who cooked dinner at home 7 times/week, cooking dinner 5 to 6 times/week (β = −1.5, 95% CI −3.4 to −0.6), 3 to 4 times/week (β = −4.8, 95% CI −6.3 to −3.3), and 0 to 2 times/week (β = −4.8, 95% CI −6.5 to −3.2) were all significantly associated with lower diet quality. These associations persisted in the fully adjusted models: cooking 0 to 2 times/week was associated with a 4.4-point lower PDQS-30D score (95% CI −6.0 to −2.8) compared with cooking 7 times/week.

In fully adjusted models that mutually adjusted for food security status and cooking dinner frequency, the significant inverse associations with diet quality for both exposures persisted in the fully adjusted models: cooking dinner less frequently was associated with a 4.4-point lower PDQS-30D score (95% CI 6.0 to 2.8) compared with cooking dinner 7 times/week.

In fully adjusted models the association between food insecurity and PDQS-30D scores differed based on frequency of cooking dinner (effect modification) based on likelihood ratio tests with multiple degrees of freedom or one degree of freedom (P values < 0.05) (data not shown).

Differences in the frequency of consumption of PDQS-30D components by food security status are available in Table 4 (available at www.jandonline.org). Lower PDQS-30D scores related to more severe food insecurity were largely accounted for by lower frequency of consumption of several healthy PDQS-30D components (ie, dark green leafy vegetables, cruciferous vegetables, other vegetables, other fruits, nuts and seeds, fish, whole grains, low-fat dairy, and liquid vegetable oils) and higher frequency of consumption of unhealthy PDQS-30D components (ie, processed meats, sugar-sweetened beverages, and fried foods away from home) (all P values < 0.05). Similarly, lower diet quality among those who cooked dinner less frequently (see Table 5, available at www.jandonline.org) was accounted for by lower frequency of consumption of all healthy PDQS-30D components (with the exception of fish) and higher frequency of consumption of some unhealthy components (ie, sugar-sweetened beverages and fried foods away from home) (all P values < 0.05).

The Figure displays the predicted mean PDQS-30D scores by food security status (Panel A) and frequency of cooking dinner at home (Panel B) based on separate fully adjusted models. Individuals with high food security were expected to have PDQS-30D scores of 53.2 points, which were...
that adverse diet-related health outcomes may follow. Department of Agriculture annual food security estimates,12 dinner 5 to 6 times/week (52.4 points), 3 to 4 times/week which were signi-

had the highest expected PDQS-30D scores (54.0 points),

Individuals who cooked dinner 7 times/week individuals with low (51.3 points) and very low (50.0 points)

was poor (mean scores less than half of the possible PDQS-

was significant, which contrasts with prior evidence. 18 The fact that the

demonic mean frequency of cooking dinner as measured in

months of the pandemic, on average, frequently in the early months of the pandemic,7 although some people may have been cooking more

US women (mean score = 56 points).45 Also consistent with prior research,4,23,31,52 lower diet quality among those experiencing food insecurity was due to lower consumption of some fruits and vege-

tables, whole grains, and healthy fats; and higher consumption of highly palatable and highly processed foods such as processed meat, fried foods, and sweetened bever-

ages. These known associations between food insecurity and diet quality not only persisted for low-income Americans during the COVID-19 pandemic, but may have also been exacerbated because food-insecure households faced unique challenges in acquiring necessary food items during the early months of the pandemic.7

Notably, the mean frequency of cooking dinner (5.0 times/ week) in the current study is consistent with the prepan-
demic mean frequency of cooking dinner as measured in multiple US national samples.31,33,36 This suggests that although some people may have been cooking more frequently in the early months of the pandemic, on average, overall cooking dinner frequency did not increase. It is also notable that even within a low-income sample, higher cooking dinner frequency was still associated with better diet quality, even after adjusting for sociodemographic measures that contrasts with prior evidence.18 The fact that the

significantly higher than expected PDQS-30D scores of individuals with low (51.3 points) and very low (50.0 points) food security. Individuals who cooked dinner 7 times/week had the highest expected PDQS-30D scores (54.0 points), which were significantly higher than those individuals cooking dinner 5 to 6 times/week (52.4 points), 3 to 4 times/week (49.3 points), and 0 to 2 times/week (49.5 points).

DISCUSSION

In this national survey of low-income Americans during the COVID-19 pandemic results show that overall diet quality was poor (mean scores less than half of the possible PDQS-

30D score), and that after adjusting for sociodemographic characteristics, both greater food insecurity and less frequent cooking dinner at home were associated with lower diet quality as measured by the PDQS-30D. Contrary to our hypothesis, the relationship between food insecurity and diet quality did not differ by frequency of cooking dinner; in this sample, food insecurity was associated with lower diet quality regardless of how frequently people cooked dinner. Given the high levels of food insecurity observed during the early months of the pandemic from this study and others,7-9,42 and the widening disparities documented in US Department of Agriculture annual food security estimates,12 and prior evidence regarding associations between food insecurity and health,8-48 findings from this study suggest that adverse diet-related health outcomes may follow. These findings are consistent with prior evidence showing that food insecurity is associated with poor diet quality, and that these findings are robust across dietary assessment methods and diet quality indexes.1-4,49-52 PDQS-30D scores were also low for all demographic groups (mean scores were all below 50% of possible scores), which is consistent with prior evidence of poor diet quality among Americans with low income.53,54 PDQS-30D scores in this sample were also lower than prior estimates among US women (mean score = 56 points).45 Also consistent with prior research,4,23,31,52 lower diet quality among those experiencing food insecurity was due to lower consumption of some fruits and vege-
tables, whole grains, and healthy fats; and higher consumption of highly palatable and highly processed foods such as processed meat, fried foods, and sweetened bever-

ages. These known associations between food insecurity and diet quality not only persisted for low-income Americans during the COVID-19 pandemic, but may have also been exacerbated because food-insecure households faced unique challenges in acquiring necessary food items during the early months of the pandemic.7

Table 2. Food insecurity and cooking dinner frequency associations with diet quality among low-income adults in the United States between June 23 and July 1, 2020 (N = 1,739)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Model 2&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>95% CI</td>
</tr>
<tr>
<td><strong>Panel A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food security status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Ref&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Marginal</td>
<td>-1.1</td>
<td>-2.7 to 0.5</td>
</tr>
<tr>
<td>Low</td>
<td>-1.7</td>
<td>-3.2 to -0.1</td>
</tr>
<tr>
<td>Very low</td>
<td>-3.9</td>
<td>-5.3 to -2.5</td>
</tr>
<tr>
<td>P for trend&lt;sup&gt;d&lt;/sup&gt;</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
<tr>
<td><strong>Panel B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooking dinner frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 times/week</td>
<td>Ref</td>
<td></td>
</tr>
<tr>
<td>5-6 times/week</td>
<td>-1.5</td>
<td>-2.8 to -0.2</td>
</tr>
<tr>
<td>3-4 times/week</td>
<td>-4.8</td>
<td>-6.3 to -3.3</td>
</tr>
<tr>
<td>0-2 times/week</td>
<td>-4.8</td>
<td>-6.5 to -3.2</td>
</tr>
<tr>
<td>P for trend&lt;sup&gt;d&lt;/sup&gt;</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Model 1 is an age- and gender-adjusted ordinary least squares regression model (separate models for food security and cooking frequency).

<sup>b</sup>Model 2 is an ordinary least squares model (separate models for food security and cooking frequency) adjusted for age, sex and gender, race and ethnicity, education, income, marital status, household size, presence of children aged younger than 18 years in the household, employment, Supplemental Nutrition Assistance Program participation, and student status.

<sup>c</sup>Ref = reference category.

<sup>d</sup>P for trend obtained using the postestimation contrast command in Stata41 to test whether or not the linear trend across categories is significant.
relationship between food insecurity and diet quality did not differ by cooking dinner frequency is also striking. Although cooking is a modifiable behavior that can improve diet quality, our findings suggest that other policy interventions are needed to improve food access and availability, both key dimensions of food insecurity,⁵⁷,⁵⁸ to influence diet quality in food-insecure populations.

During the COVID-19 pandemic numerous policy interventions, including stimulus payments and unemployment insurance program expansions, aimed to blunt the economic influence of the pandemic for US households, particularly those at risk for food insecurity.⁵⁹-⁶¹ SNAP, the largest federal nutrition assistance program, expanded rapidly growing by 17% in the early months of the pandemic.⁶² Later Congressional relief bills further modified the program to, among other things, ease enrollment and recertification requirements and increase benefits by 15%.⁵⁹-⁶¹ The present findings underscore that though those efforts likely contributed to overall estimates of food insecurity remaining stable from 2019 to 2020,¹² many households still experienced food insecurity, which was associated with poor diet quality even when people cooked at home frequently. Due to the positive association between cooking frequency and diet quality, more efforts and continued support is needed to help households at risk for food insecurity both procure and prepare enough nutritious food to support a healthy diet.⁶³-⁶⁸ The recent changes to the Thrifty Food Plan, which SNAP benefits are based on, will increase SNAP benefits by 21% and are an important step that may help food insecure households afford the true cost of a healthy diet.⁶⁹ It will be important for future research to investigate whether or not/how these benefit increases influence cooking behaviors and diet quality.

Limitations
This study should be considered in light of several limitations. Primarily, the cross-sectional nature of the data precludes making any causal inferences about food insecurity, cooking and diet quality. Measures of prepandemic food security status or cooking frequency were also not included, which precludes examination of pandemic related changes in food security or cooking. Second, all data are self-reported which can lead to social desirability and recall bias.⁷⁰ This may be particularly relevant when it comes to the PDQS-30D data. The PDQS-30D requires participants to recall and estimate usual frequency of consumption over the past 30 days, which could be more vulnerable to recall bias than a shorter timeframe or 24-hour recall. Relatedly, selection bias could also be present if Prime Panel members who participated in the survey systematically differed from those who did not participate or from the general population. The use of quotas to match the sample with US Census demographic characteristics mitigates some of this concern (see Table 6, available at www.jand.online), but unmeasured differences could still be present, which could limit generalizability. Another potential limitation related to the survey platform used is...
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satisficing, in which respondents rush through a survey and do not provide thoughtful or true answers. To address this possibility participants who completed the survey unreasonably quickly or who failed attention checks embedded in the survey were excluded. Furthermore, the survey was fielded with PrimePanels, which employs their own quality checks for participants who are part of the panel. Third, the survey was fielded in English only, and its web-based nature required participants to have Internet access. This could limit the representativeness of the data to some subpopulations that are particularly vulnerable to food insecurity (i.e., those with very low incomes, without high school degrees, or without Internet access) and could limit the generalizability of the results to non-English-speaking populations. Fourth, the PDQS-30D is a short form dietary screener that does not fully capture every food or beverage a person could consume, but rather focuses on a limited number of food and beverage groups. However, the PDQS-30D has compared well against an open-ended dietary assessment method, specifically the ASA24. Fifth, the observed differences in dietary quality measured in this study were relatively small and how sustained such differences would be over time or how likely they are to contribute to differences in health outcomes over the long term is unknown. In addition, the way sex was measured in the survey included both biological sex and gender identity response options within the same question, which could have caused confusion among some participants about how to respond. Finally, the cooking frequency measure used in this study focused on only frequency of cooking dinner, rather than other meals, and did not further define what types of food preparation should be included in the definition of cooking, which prior research shows varies considerably and can influence how individuals report how frequently they cook at home. Although frequency of cooking dinner was chosen because it is a widely used measure of cooking frequency, and because in the United States, dinner is the most frequently cooked meal, it is possible that, particularly during the COVID-19 pandemic, other meals were cooked at home more frequently, which could also influence diet quality. Relatedly, cooking skill levels, motivation for cooking, or other factors that could influence the relationship between cooking frequency and diet quality were not investigated in this study.

CONCLUSIONS

During the COVID-19 pandemic, overall diet quality in this sample of low-income Americans was poor and low food security and less frequent cooking dinner at home were both associated with lower diet quality. However, the relationship between food security and diet quality did not differ based on frequency of cooking dinner, indicating that food insecurity in the present sample was associated with lower diet quality regardless of how frequently people cooked dinner at home. More research is needed to identify and address barriers to low-income households’ ability to access, afford, and prepare enough nutritious food for a healthy diet.

References


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STATEMENT OF POTENTIAL CONFLICT OF INTEREST
No potential conflict of interest was reported by the authors.

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AUTHOR CONTRIBUTIONS
J. Wolfson and C. Leung designed the study and developed and fielded the survey. J. Wolfson and C. Leung developed the study hypotheses. J. Wolfson conducted the analyses and wrote the first draft of the manuscript. All authors critically reviewed and approved the manuscript as submitted.
### Table 3. Food security and cooking dinner frequency associations with diet quality among low-income adults in the United States between June 23 and July 1, 2020 (N = 1,739)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 3&lt;sup&gt;a&lt;/sup&gt;</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food security status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Ref&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Marginal</td>
<td>−0.8</td>
<td>−2.3 to 0.7</td>
</tr>
<tr>
<td>Low</td>
<td>−1.6</td>
<td>−3.1 to −0.2</td>
</tr>
<tr>
<td>Very low</td>
<td>−2.8</td>
<td>−4.1 to −1.4</td>
</tr>
<tr>
<td><em>P</em> for trend&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td>0.0001</td>
</tr>
<tr>
<td><strong>Cooking dinner frequency</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(times/wk)</td>
<td>Ref</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>−1.7</td>
<td>−2.9 to −0.3</td>
</tr>
<tr>
<td>5-6</td>
<td>−4.5</td>
<td>−5.9 to −3.0</td>
</tr>
<tr>
<td>3-4</td>
<td>−4.2</td>
<td>−5.8 to −2.6</td>
</tr>
<tr>
<td><em>P</em> for trend&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>

<sup>a</sup>Model 3 is an ordinary least squares model that included food insecurity, cooking frequency (both exposures simultaneously in the model), age, sex and gender, race and ethnicity, education, income, marital status, household size, presence of children younger than age 18 years in the household, employment, Supplemental Nutrition Assistance Program participation, and student status.

<sup>b</sup>Ref = reference category.

<sup>c</sup>*P* value for trend obtained by using the postestimation contrast command in Stata<sup>11</sup> to test whether or not the linear trend across categories is significant.
Table 4. Differences in Prime Diet Quality Screener (PDQS-30D) component consumption frequency (%) by food security status among low-income adults in the United States between June 23 and July 1, 2020 (N = 1,739)

<table>
<thead>
<tr>
<th>Component</th>
<th>Food Security Status</th>
<th>P value&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High (n = 722)</td>
<td>Marginal (n = 266)</td>
</tr>
<tr>
<td>Healthy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dark green leafy vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ once/mo</td>
<td>26.9</td>
<td>27.8</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td>18.1</td>
<td>18.4</td>
</tr>
<tr>
<td>1-2 times/wk</td>
<td>24.9</td>
<td>25.9</td>
</tr>
<tr>
<td>3-4 times/wk</td>
<td>16.5</td>
<td>15.8</td>
</tr>
<tr>
<td>5-6 times/wk</td>
<td>5.8</td>
<td>6.0</td>
</tr>
<tr>
<td>Once a day</td>
<td>5.3</td>
<td>4.9</td>
</tr>
<tr>
<td>≥2 times/d</td>
<td>2.5</td>
<td>1.1</td>
</tr>
<tr>
<td>Cruciferous vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ once/mo</td>
<td>26</td>
<td>29.7</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td>21.3</td>
<td>19.9</td>
</tr>
<tr>
<td>1-2 times/wk</td>
<td>26.3</td>
<td>24.4</td>
</tr>
<tr>
<td>3-4 times/wk</td>
<td>14.8</td>
<td>18.1</td>
</tr>
<tr>
<td>5-6 times/wk</td>
<td>5.7</td>
<td>4.1</td>
</tr>
<tr>
<td>Once a day</td>
<td>4.7</td>
<td>3.0</td>
</tr>
<tr>
<td>≥2 times/d</td>
<td>1.1</td>
<td>0.8</td>
</tr>
<tr>
<td>Deep orange vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ once/mo</td>
<td>35</td>
<td>35.3</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td>24.5</td>
<td>25.9</td>
</tr>
<tr>
<td>1-2 times/wk</td>
<td>25.1</td>
<td>25.6</td>
</tr>
<tr>
<td>3-4 times/wk</td>
<td>8.3</td>
<td>7.5</td>
</tr>
<tr>
<td>5-6 times/wk</td>
<td>4.4</td>
<td>2.6</td>
</tr>
<tr>
<td>Once a day</td>
<td>1.8</td>
<td>2.3</td>
</tr>
<tr>
<td>≥2 times/d</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Other vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ once/mo</td>
<td>16.9</td>
<td>19.9</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td>17.0</td>
<td>22.2</td>
</tr>
<tr>
<td>1-2 times/wk</td>
<td>28.0</td>
<td>29.7</td>
</tr>
<tr>
<td>3-4 times/wk</td>
<td>21.9</td>
<td>18.8</td>
</tr>
<tr>
<td>5-6 times/wk</td>
<td>10.7</td>
<td>4.4</td>
</tr>
<tr>
<td>Once a day</td>
<td>4.3</td>
<td>3.4</td>
</tr>
<tr>
<td>≥2 times/d</td>
<td>1.3</td>
<td>1.9</td>
</tr>
<tr>
<td>Citrus fruits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ once/mo</td>
<td>32.7</td>
<td>36.1</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td>22.0</td>
<td>19.6</td>
</tr>
<tr>
<td>1-2 times/wk</td>
<td>20.2</td>
<td>21.1</td>
</tr>
<tr>
<td>3-4 times/wk</td>
<td>12.5</td>
<td>10.9</td>
</tr>
</tbody>
</table>

(continued on next page)
Table 4. Differences in Prime Diet Quality Screener (PDQS-30D) component consumption frequency (%) by food security status among low-income adults in the United States between June 23 and July 1, 2020 (N = 1,739) (continued)

<table>
<thead>
<tr>
<th>Component</th>
<th>Food Security Status</th>
<th>High (n = 722)</th>
<th>Marginal (n = 266)</th>
<th>Low (n = 302)</th>
<th>Very Low (n = 449)</th>
<th>P value&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-6 times/wk</td>
<td></td>
<td>4.9</td>
<td>4.9</td>
<td>6.6</td>
<td>4.9</td>
<td></td>
</tr>
<tr>
<td>Once a day</td>
<td></td>
<td>6.0</td>
<td>5.3</td>
<td>4.6</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>≥2 times/d</td>
<td></td>
<td>1.8</td>
<td>2.3</td>
<td>1.3</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Deep orange fruits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.472</td>
</tr>
<tr>
<td>≤ once/mo</td>
<td></td>
<td>58.3</td>
<td>54.5</td>
<td>49.7</td>
<td>56.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td></td>
<td>18.0</td>
<td>22.2</td>
<td>21.5</td>
<td>19.8</td>
<td></td>
</tr>
<tr>
<td>1-2 times/wk</td>
<td></td>
<td>13.6</td>
<td>13.9</td>
<td>15.9</td>
<td>13.1</td>
<td></td>
</tr>
<tr>
<td>3-4 times/wk</td>
<td></td>
<td>6.2</td>
<td>4.9</td>
<td>8.3</td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td>5-6 times/wk</td>
<td></td>
<td>1.5</td>
<td>1.5</td>
<td>3.0</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>Once a day</td>
<td></td>
<td>1.9</td>
<td>2.3</td>
<td>1.3</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>≥2 times/d</td>
<td></td>
<td>0.4</td>
<td>0.8</td>
<td>0.3</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Other fruits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>≤ once/mo</td>
<td></td>
<td>16.2</td>
<td>16.9</td>
<td>18.2</td>
<td>24.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td></td>
<td>23.3</td>
<td>25.2</td>
<td>27.5</td>
<td>28.1</td>
<td></td>
</tr>
<tr>
<td>1-2 times/wk</td>
<td></td>
<td>22.0</td>
<td>25.2</td>
<td>23.2</td>
<td>26.7</td>
<td></td>
</tr>
<tr>
<td>3-4 times/wk</td>
<td></td>
<td>18.8</td>
<td>15.8</td>
<td>18.5</td>
<td>13.1</td>
<td></td>
</tr>
<tr>
<td>5-6 times/wk</td>
<td></td>
<td>10.0</td>
<td>7.1</td>
<td>7.6</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>Once a day</td>
<td></td>
<td>7.3</td>
<td>7.9</td>
<td>4.3</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>≥2 times/d</td>
<td></td>
<td>2.4</td>
<td>1.9</td>
<td>0.7</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Legumes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.119</td>
</tr>
<tr>
<td>≤ once/mo</td>
<td></td>
<td>27.8</td>
<td>22.9</td>
<td>23.5</td>
<td>25.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td></td>
<td>24.8</td>
<td>30.1</td>
<td>27.5</td>
<td>26.7</td>
<td></td>
</tr>
<tr>
<td>1-2 times/wk</td>
<td></td>
<td>26.5</td>
<td>29.7</td>
<td>32.5</td>
<td>22.3</td>
<td></td>
</tr>
<tr>
<td>3-4 times/wk</td>
<td></td>
<td>13.3</td>
<td>10.9</td>
<td>11.6</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td>5-6 times/wk</td>
<td></td>
<td>4.7</td>
<td>3.8</td>
<td>3.6</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>Once a day</td>
<td></td>
<td>1.9</td>
<td>1.9</td>
<td>1.3</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>≥2 times/d</td>
<td></td>
<td>1.0</td>
<td>0.8</td>
<td>0</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Nuts and seeds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>≤ once/mo</td>
<td></td>
<td>30.3</td>
<td>28.2</td>
<td>32.8</td>
<td>42.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2-3 times/mo</td>
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(continued on next page)
Table 4. Differences in Prime Diet Quality Screener (PDQS-30D) component consumption frequency (%) by food security status among low-income adults in the United States between June 23 and July 1, 2020 (N = 1,739) (continued)

<table>
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<th>Low (n = 302)</th>
<th>Very Low (n = 449)</th>
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(continued on next page)
Table 4. Differences in Prime Diet Quality Screener (PDQS-30D) component consumption frequency (%) by food security status among low-income adults in the United States between June 23 and July 1, 2020 (N = 1,739) (continued)

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<td>0.7</td>
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<tr>
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<td>27.1</td>
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Table 4. Differences in Prime Diet Quality Screener (PDQS-30D) component consumption frequency (%) by food security status among low-income adults in the United States between June 23 and July 1, 2020 (N = 1,739) (continued)

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<tr>
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Bold values are statistically significant (P < .05).
Pvalues from Pearson’s χ² test.
Table 5. Differences in Prime Diet Quality Screener (PDQS-30D) component consumption frequency by frequency of cooking dinner among low-income adults in the United States between June 23 and July 1, 2020 (N = 1,739)

| Component                        | Dinner cooking frequency (times/wk) | 7 (n = 637) | 5-6 (n = 510) | 3-4 (n = 340) | 0-2 (n = 252) | P value
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Table 5. Differences in Prime Diet Quality Screener (PDQS-30D) component consumption frequency by frequency of cooking dinner among low-income adults in the United States between June 23 and July 1, 2020 (N = 1,739) (continued)

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<td>3.8</td>
<td>1.0</td>
<td>1.5</td>
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<tr>
<td>Low-fat dairy</td>
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</tr>
<tr>
<td>≤ once/mo</td>
<td>32.8</td>
<td>27.1</td>
<td>29.7</td>
<td>36.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td>11.99</td>
<td>13.1</td>
<td>19.4</td>
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<td>1-2 times/wk</td>
<td>16.5</td>
<td>21.6</td>
<td>22.4</td>
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<td></td>
</tr>
<tr>
<td>3-4 times/wk</td>
<td>13.8</td>
<td>17.7</td>
<td>14.1</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td>5-6 times/wk</td>
<td>7.9</td>
<td>7.8</td>
<td>6.5</td>
<td>10.7</td>
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<tr>
<td>Once a day</td>
<td>12.1</td>
<td>11.4</td>
<td>4.4</td>
<td>6.4</td>
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</tr>
<tr>
<td>≥2 times/d</td>
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<td>Liquid vegetable oils</td>
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<td>14.7</td>
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<td>13.5</td>
<td>18.0</td>
<td>15.3</td>
<td>9.5</td>
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<tr>
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<tr>
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<td>13.3</td>
<td>17.7</td>
<td>26.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td>19.5</td>
<td>18.6</td>
<td>24.4</td>
<td>31.0</td>
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(continued on next page)
Table 5. Differences in Prime Diet Quality Screener (PDQS-30D) component consumption frequency by frequency of cooking dinner among low-income adults in the United States between June 23 and July 1, 2020 (N = 1,739) (continued)

<table>
<thead>
<tr>
<th>Component</th>
<th>Dinner cooking frequency (times/wk)</th>
<th>7 (n = 637)</th>
<th>5-6 (n = 510)</th>
<th>3-4 (n = 340)</th>
<th>0-2 (n = 252)</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 times/wk</td>
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<td>32.5</td>
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<td>35.9</td>
<td>25.8</td>
<td></td>
</tr>
<tr>
<td>3-4 times/wk</td>
<td></td>
<td>18.8</td>
<td>25.3</td>
<td>15.6</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td>5-6 times/wk</td>
<td></td>
<td>6.1</td>
<td>5.3</td>
<td>4.7</td>
<td>2.0</td>
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</tr>
<tr>
<td>Once a day</td>
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<td>1.1</td>
<td>2.0</td>
<td>0.9</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>≥2 times/d</td>
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<td>0.5</td>
<td>0.4</td>
<td>0.9</td>
<td>0.4</td>
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<td>Processed meat</td>
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<tr>
<td>≤ once/mo</td>
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<td>17.8</td>
<td>18.8</td>
<td>25.8</td>
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<td>22.9</td>
<td>22.4</td>
<td>29.4</td>
<td>25.8</td>
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</tr>
<tr>
<td>1-2 times/wk</td>
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<td>27.0</td>
<td>32.9</td>
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<td>30.2</td>
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</tr>
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<td>3-4 times/wk</td>
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<td>14.8</td>
<td>18.8</td>
<td>18.8</td>
<td>12.3</td>
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<tr>
<td>5-6 times/wk</td>
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<td>5.3</td>
<td>5.3</td>
<td>5.0</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Once a day</td>
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<td>3.0</td>
<td>2.2</td>
<td>1.8</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>≥2 times/d</td>
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<td>0.8</td>
<td>0.6</td>
<td>0.0</td>
<td>0.8</td>
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</tr>
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<td>Potatoes</td>
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<td></td>
</tr>
<tr>
<td>≤ once/mo</td>
<td></td>
<td>22.9</td>
<td>16.1</td>
<td>24.1</td>
<td>33.7</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td></td>
<td>18.2</td>
<td>15.7</td>
<td>14.4</td>
<td>21.4</td>
<td></td>
</tr>
<tr>
<td>1-2 times/wk</td>
<td></td>
<td>25.0</td>
<td>30.4</td>
<td>30.3</td>
<td>18.3</td>
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</tr>
<tr>
<td>3-4 times/wk</td>
<td></td>
<td>21.7</td>
<td>26.5</td>
<td>22.7</td>
<td>15.5</td>
<td></td>
</tr>
<tr>
<td>5-6 times/wk</td>
<td></td>
<td>7.4</td>
<td>8.0</td>
<td>6.5</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td>Once a day</td>
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<td>3.1</td>
<td>2.9</td>
<td>1.2</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>≥2 times/d</td>
<td></td>
<td>1.7</td>
<td>0.4</td>
<td>0.9</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>Refined grains and baked goods</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ once/mo</td>
<td></td>
<td>14.3</td>
<td>7.8</td>
<td>12.7</td>
<td>18.7</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td></td>
<td>16.2</td>
<td>16.7</td>
<td>20.3</td>
<td>23.4</td>
<td></td>
</tr>
<tr>
<td>1-2 times/wk</td>
<td></td>
<td>27.9</td>
<td>29.4</td>
<td>28.8</td>
<td>22.6</td>
<td></td>
</tr>
<tr>
<td>3-4 times/wk</td>
<td></td>
<td>18.4</td>
<td>28.8</td>
<td>21.7</td>
<td>19.1</td>
<td></td>
</tr>
<tr>
<td>5-6 times/wk</td>
<td></td>
<td>11.0</td>
<td>9.8</td>
<td>9.1</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>Once a day</td>
<td></td>
<td>9.6</td>
<td>5.7</td>
<td>5.6</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>≥2 times/d</td>
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<td>2.7</td>
<td>1.8</td>
<td>1.8</td>
<td>1.6</td>
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<td>Sugar-sweetened beverages</td>
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</tr>
<tr>
<td>≤ once/mo</td>
<td></td>
<td>42.2</td>
<td>27.3</td>
<td>26.2</td>
<td>31.4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td></td>
<td>12.1</td>
<td>13.7</td>
<td>15.6</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>1-2 times/wk</td>
<td></td>
<td>14.0</td>
<td>18.2</td>
<td>20.3</td>
<td>15.5</td>
<td></td>
</tr>
<tr>
<td>3-4 times/wk</td>
<td></td>
<td>8.2</td>
<td>15.1</td>
<td>15.0</td>
<td>9.9</td>
<td></td>
</tr>
<tr>
<td>5-6 times/wk</td>
<td></td>
<td>6.8</td>
<td>8.4</td>
<td>7.7</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>Once a day</td>
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<td>7.8</td>
<td>9.2</td>
<td>7.9</td>
<td>9.5</td>
<td></td>
</tr>
<tr>
<td>≥2 times/d</td>
<td></td>
<td>9.1</td>
<td>8.0</td>
<td>7.1</td>
<td>10.3</td>
<td></td>
</tr>
<tr>
<td>Fried foods away from home</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ once/mo</td>
<td></td>
<td>52.6</td>
<td>27.1</td>
<td>22.1</td>
<td>35.3</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td></td>
<td>22.5</td>
<td>29.4</td>
<td>24.7</td>
<td>25.8</td>
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</tbody>
</table>
Table 5. Differences in Prime Diet Quality Screener (PDQS-30D) component consumption frequency by frequency of cooking dinner among low-income adults in the United States between June 23 and July 1, 2020 (N = 1,739) (continued)

<table>
<thead>
<tr>
<th>Component</th>
<th>Dinner cooking frequency (times/wk)</th>
<th>( P ) value(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7 (n = 637)</td>
<td>5-6 (n = 510)</td>
</tr>
<tr>
<td>1-2 times/wk</td>
<td>15.9</td>
<td>30.2</td>
</tr>
<tr>
<td>3-4 times/wk</td>
<td>5.2</td>
<td>9.8</td>
</tr>
<tr>
<td>5-6 times/wk</td>
<td>2.2</td>
<td>1.8</td>
</tr>
<tr>
<td>Once a day</td>
<td>1.1</td>
<td>0.8</td>
</tr>
<tr>
<td>≥2 times/d</td>
<td>0.6</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Sweets and ice cream**

<table>
<thead>
<tr>
<th>Component</th>
<th>Dinner cooking frequency (times/wk)</th>
<th>( P ) value(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ once/mo</td>
<td>25.6</td>
<td>12.0</td>
</tr>
<tr>
<td>2-3 times/mo</td>
<td>22.9</td>
<td>19.6</td>
</tr>
<tr>
<td>1-2 times/wk</td>
<td>21.0</td>
<td>28.6</td>
</tr>
<tr>
<td>3-4 times/wk</td>
<td>13.8</td>
<td>22.9</td>
</tr>
<tr>
<td>5-6 times/wk</td>
<td>7.9</td>
<td>7.1</td>
</tr>
<tr>
<td>Once a day</td>
<td>5.6</td>
<td>7.5</td>
</tr>
<tr>
<td>≥2 times/d</td>
<td>3.3</td>
<td>2.4</td>
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</tbody>
</table>

**Neutral**

**Eggs**

<table>
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<th>Dinner cooking frequency (times/wk)</th>
<th>( P ) value(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ once/month</td>
<td>17.0</td>
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<td>17.7</td>
</tr>
<tr>
<td>1-2 times/week</td>
<td>25.1</td>
<td>28.4</td>
</tr>
<tr>
<td>3-4 times/week</td>
<td>19.6</td>
<td>25.1</td>
</tr>
<tr>
<td>5-6 times/week</td>
<td>10.8</td>
<td>9.4</td>
</tr>
<tr>
<td>Once a day</td>
<td>11.5</td>
<td>8.4</td>
</tr>
<tr>
<td>≥2 times/d</td>
<td>1.6</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Bold values are statistically significant \( P < 0.05 \).

\(^a\)\( P \) values from Pearson \( \chi^2 \) tests.
Table 6. Sampling quotas, distribution of the final sample, and census demographic estimates

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Quota name</th>
<th>Field Target</th>
<th>Final Sample</th>
<th>2019 ACSb (%)</th>
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<td>Age</td>
<td>18 to 24 years old</td>
<td>13</td>
<td>–</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>25 to 44 years old</td>
<td>41</td>
<td>–</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>45 to 64 years old</td>
<td>30</td>
<td>–</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Over 65 years old</td>
<td>16</td>
<td>–</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>18-29 years old</td>
<td>–</td>
<td>25</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>30-39 years old</td>
<td>–</td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>40-49 years old</td>
<td>–</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>50-59 years old</td>
<td>–</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>60-69 years old</td>
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<td>18</td>
<td>15</td>
</tr>
<tr>
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<td>70-79 years old</td>
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<td>7</td>
<td>9</td>
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<tr>
<td></td>
<td>80+ years old</td>
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<td>49</td>
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<td>Black</td>
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<td>13</td>
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<td>72</td>
<td>72</td>
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<tr>
<td></td>
<td>Other race</td>
<td>18</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Region</td>
<td>Midwest</td>
<td>22</td>
<td>22</td>
<td>21</td>
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<tr>
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<td>Northeast</td>
<td>18</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>South</td>
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<td>37</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>West</td>
<td>23</td>
<td>22</td>
<td>23</td>
</tr>
<tr>
<td>Household size</td>
<td>Household Size 1 and maximum annual household income $31,900</td>
<td>25</td>
<td>23</td>
<td>26</td>
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<tr>
<td></td>
<td>Household Size 2 and maximum annual household income $43,100</td>
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<td>30</td>
<td>33</td>
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<td></td>
<td>Household Size 3 and maximum annual household income $54,300</td>
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<td>20</td>
<td>17</td>
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<tr>
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<td>Household Size 4 and maximum annual household income $65,500</td>
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<td>Household Size 5 and maximum annual household income $76,700</td>
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<td>Household Size 6 and maximum annual household income $87,900</td>
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<td></td>
<td>Household Size 7 and maximum annual household income $110,000</td>
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<td>2</td>
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</tr>
</tbody>
</table>

*aThis study used a census-matched panel of US adults aged 18 years or older (matched on age, sex, and race and ethnicity to the overall US population. The sample was limited to adults with annual household income <250% of the 2020 federal poverty level. This table shows the quotas used to recruit participants with CloudResearch (Quota), the actual sample recruited (Field Sample), in comparison to demographics of the US population based on the American Community Survey.

*bACS = American Community Survey 2019 1-year estimates.

*cAge categories the study collected did not align completely with the target sampling age categories.

*dGender identity was not included as a criteria for sampling (the census-matched panel was based on sex not gender) and is therefore not included as a point of comparison here.
FOOD INSECURITY, THE LIMITED AVAILABILITY OF OR access to nutritionally adequate and safe foods, is a persistent health concern in the United States.1,2 Food insecurity disproportionately affects households with children, households headed by a single parent, and Black and Hispanic households.3 As a result of the ongoing coronavirus disease 2019 pandemic, a recent report showed that food insecurity among households with children increased from 13.6% in 2019 to 14.8% in 2020.3

A robust body of research has linked the experience of food insecurity with indicators of mental health,4-5 including elevated perceived stress,6-8 depressive symptoms,7-10 and serious psychological distress.11-14 These associations are particularly salient among parents or caregivers of children.15,16 In a recent analysis of the California Health Interview Survey, very low food security was associated with an almost nine-fold higher odds of serious psychological distress in adults with children.12 Because prior studies used global/ nonspecific measures of mental health status, the extent to which these associations are attributed directly to the experience of food insecurity or other correlated socio-economic stressors is unknown.

Whereas quantitative studies can help to establish the scope of the influence of food insecurity on physical and mental health outcomes, qualitative studies can provide context on individuals' lived experiences of food insecurity to understand the complex pathways by which food insecurity influences health behaviors and outcomes. Qualitative studies are also important for identifying additional indicators for monitoring and surveillance and improving
implementation and planning of programs. For example, a qualitative study of low-income individuals in Québec, Canada, found that adults with food insecurity described elements of “psychological suffering” due to food insecurity, including feeling constrained and a loss of dignity when asking for help. A qualitative study of parents of young children revealed a variety of mental health concerns, which included depression, frustration, fear, and anxiety related to food insecurity as well as to other stressors such as unsafe living conditions, homelessness, and exposure to violence. These findings suggest the need for mental health and social support referrals, in parallel with providing food assistance. In addition, there has been little focus on exploring the behavioral or psychological coping strategies used by parents and caregivers of children to manage food insecurity, which may lead to positive or negative influences on subsequent food insecurity and health outcomes. Understanding how individuals are psychologically influenced by food insecurity and how they cope is critical to gaining contextual knowledge of the subjective stress behind these health disparities.

Using in-depth interviews, the objective of this study was to understand parental experiences of psychological distress specific to food insecurity, with a specific focus on identifying types of psychological distress, experiential descriptions, and the array of emotional responses and coping strategies specific to food insecurity.

METHODS
Overview and Study Participants
The phenomenological qualitative research project recruited families in the San Francisco Bay Area through Internet postings, fliers at food pantries, social service agencies, and snowball sampling. The study was described as “a research study that examines how families meet their food needs during difficult economic times.” Interested participants were screened over the telephone or by e-mail to confirm eligibility. Parents (and children) were eligible in the case that they met three criteria. First, the parent and child were both fluent in English. Second, the child was aged 7 to 14 years. The age range for children was established to capture children in the transition to adolescence because separate interviews were conducted with children to explore their experiences of psychological distress associated with food insecurity. Data from children are reported elsewhere.

Third, the parent reported at least some level of food insecurity based on the 18-item US Department of Agriculture (USDA) Household Food Security Survey Module. The USDA Household Food Security Survey Module is the widely used gold standard for national food security measurement, assessing experiences or behaviors related to inadequate resources to acquire food over the past 12 months. Affirmative responses are summed to create a score ranging from zero to 18, and food security categories were assigned according to USDA guidelines: 0 = high food security, 1 to 2 = marginal food security, 3 to 7 = low food security, and 8 to 18 = very low food security. This study included parents in households with marginal, low, or very low food security. Participants from households with marginal food security were included because of prior research supporting adverse associations between marginal food security and health outcomes in children and adults.

RESEARCH SNAPSHOT
Research Question: What are the psychological implications and subsequent coping strategies of food insecurity as reported by parents?

Key Findings: Multiple themes of psychological distress of food insecurity were discussed, including stress from the logistical and financial balancing act of feeding one’s family, frustration and lack of choice associated with the high costs of healthy foods, stigma of using community resources, and shame of not being able to provide for one’s family. Sadness about their cyclical and chronic food situation, and guilt over their inability to provide for their children. Parents discussed positive and negative strategies to cope with food insecurity.

In total, 48 parents from distinct families agreed to participate in the present study; 33 additional parents expressed interest but either did not meet the eligibility criteria (n = 11) or did not respond to further study communication after initial contact (n = 22). Participants were recruited until data saturation was reached. All participants received information about the objective of the study and occupation of the researcher; they then provided written informed consent for their participation. Before their interview, participants completed a brief online survey assessing their demographic characteristics, household food security status, and participation in federal food programs over the past year. Demographic characteristics included the participant’s sex (male or female), race/ethnicity (White, Black, Asian, Hispanic, other), educational attainment, marital status, and employment status. All household and individual characteristics were reported by the primary participant (i.e., parent). Here forward, parents who reported their sex as female are referred to as mothers and parents who reported their sex as male are referred to as fathers per convention in previous research. Participants received $40 for their participation in the study. All interviews were conducted between June 2016 and January 2017 by the principal investigator, who has formal training in qualitative research. The study protocol was approved by the University of Michigan Institutional Review Board.

Procedures
One-on-one, in-depth interviews were conducted with study participants by the principal investigator. The interviews were conducted in their home or at the [blinded for review] campus. One-on-one interviews were chosen specifically for privacy that would allow participants to reveal personal experiences and struggles that may be difficult to discuss in a larger group setting. All participants provided verbal consent for audiotaping their interview.

A semistructured interview guide was developed by the project team, with expertise in food insecurity, health psychology, health disparities, and qualitative research methods. Additional questions were taken from prior qualitative studies of food insecurity among adults, with a focus on studies of parents or caregivers of children. The interview began with general conversation about the participant’s day and family to help establish rapport. Then, the interviewer...
asked questions about their family’s overall food situation during the past year, their family’s food preferences, and resources they used to procure food. The next stage of questions delved into their experience of psychological distress specific to food insecurity, with additional questions probing emotions such as embarrassment, loneliness, lack of control, and depression. If the parent attributed a specific emotion to the experience of food insecurity, they were then asked to elaborate on their experience and the coping strategies they employed. The interviews were, on average, 30 minutes in length. The interview guide is provided in the Figure (available at www.jandonline.org). A flexible conversation format allowed the interviewer to explore more deeply into topics discussed, or respond to new issues raised by the parents.

Data Analysis
Audiotaped interviews were transcribed, and checked for accuracy by the study team. Data were analyzed using the constant comparative method, an inductive and iterative process to reveal emergent themes across multiple interviews.27,28 The principal investigator initially developed the draft codebook after reviewing the content from all transcripts, which was then revised by two members of the project team until a final codebook was reached. Three members of the project team independently reviewed and coded all transcripts. Discrepancies were discussed and resolved by the principal investigator and two project team members until consensus was achieved. The final transcripts were entered into NVivo version 11.420 to organize and manage the themes that emerged. The principal investigator identified the final themes; direct quotations were then chosen to exemplify those themes.

RESULTS
In total, 48 parents (from distinct families) participated in this study (see the Table, available at www.jandonline.org). In-depth interviews were conducted with 43 mothers and five fathers (mean age = 36.4 years). The racial/ethnic distribution of the parents was as follows: 29% White, 29% Black, 2% Asian, 25% Hispanic/Latino, and 15% as another racial/ethnic category or multiracial. This last race/ethnicity category included participants who identified as Native American, Pacific Islander, and of two or more races/ethnicities. Approximately 44% of parents were single or never married, 40% were married or living with a partner, and 17% were divorced. The majority of parents (63%) were currently working for pay. With respect to food security status (assessed during the screening interview), 8% of families had marginal food security, 42% had low food security, and 50% had very low food security.

Parents’ Psychological Distress of Food Insecurity
Parents discussed six themes around the psychological distress of food insecurity. These included the stress from the logistical and financial balancing act of feeding their family, the frustration and lack of choice associated with the high costs of healthy foods, the stigma of using community resources, the shame of not being able to provide for one’s family, the sadness about their cyclical and chronic food situation, and the guilt over their inability to adequately provide for their children.

Stress from the Logistical and Financial Balancing Act of Feeding Their Family. Although the experience of food insecurity was unique to each family, every participant characterized food insecurity as stressful, particularly due to its chronic and persistent nature. One participant (ID #104) said, “It’s like spinning 10 plates, and you can’t drop one.” Another participant (ID #145) equated her ability to provide food for her children with survival. She said,

*It can get difficult and sometimes, even scary. You’ve got to have dinner, and what do you do if you don’t have dinner?...I empathize for people who have gone into the store and stolen a steak. You want to survive. What do you do when you have no food?*

For some participants, the stress of food insecurity was heightened by unexpected expenses that further strained their food budget. For example, one participant (ID #114) explained that her car was stolen and she had to pay $600 to retrieve her car from the tow yard. A second parent (ID #109) shared how her son had recently learned how to drive. Purchasing car insurance for him led to an increase of $400 per month, which came out of her food budget. She said, “We’ve had to somehow find money to cover these basic needs, so something gets cut out. There’s not much else besides food.”

The stress of food insecurity was also compounded by the need to manage food preferences of their family members and the role of the mother in making it all work. Some parents discussed the stress of feeding children who were picky eaters, leading them to only buy familiar items so they would not risk wasting food. Mothers in particular described the heavy pressure they felt to feed their families and balance their expenses. Some mothers described the stress they felt when their spouses spent more than their allocated food budget when grocery shopping. One mother (ID #137) described her husband as being oblivious to their budget because she handled all of their bills. She said,

*I feel like I am the spoke that holds everything together, in terms of working and doing all the food shopping and doing all the budgeting, paying all the bills. It’s up to me…It’s really stressful because nobody can share the burden.*

Frustration and Lack of Choice associated with the High Costs of Healthy Foods. Many parents wanted to feed their children organic and other high-quality foods, but often resorted to highly processed foods (eg, instant noodles, frozen lasagna, or hot dogs) that were cheaper and readily available in their neighborhoods. Compromising the nutritional quality of their foods to accommodate their budget left parents feeling frustrated, angry, and helpless. One participant (ID #125) expressed her frustration over how $2 could buy her a McDonald’s meal but not ingredients for a salad. Another participant (ID #127) commented on how a healthier cereal was four times the price of a sugary cereal. She said,

*I was pulling my hair out to grocery shop today. I go in there, and I’m like, ‘Okay, I can get Fruity Pebbles [Post Consumer Products] for $0.99 a box or I can get Frosted Mini Wheats [Kellogg’s] for $3.99 a box.’ Well, do you buy four boxes of this one, with crap? Or do I buy one box of this? Ultimately, I bought four boxes of crap.*
When asked how this made her feel, she responded, “There were a lot of nights I cried myself to sleep, because how do you stretch it?”

Another parent (ID #144) characterized the struggle of feeding her family healthy food as “unfair,” “frustrating,” and “a joke.” She said,

I’m stuck buying things that’s not great for us to eat. I buy Cup Noodles—that’s filled with sodium. I can’t buy fresh vegetables; it’s expensive... We want to eat healthy, but it’s hard. I don’t want my kids having diabetes or eating all these processed foods, but what can we do? They got to eat somehow. So, I buy what I can afford and the things that we can afford are the things that’s not good for you. And that sucks. It’s ridiculous, and that’s not fair to everyone. That’s so not fair. It’s very, very frustrating.

Stigma of Using Community Resources. In addition to the stress from the experience of food insecurity itself, several participants described the stigma they felt using food assistance, such as food stamps or local food pantries. One Latina mother (ID #141) described feeling very self-conscious about using her food stamps to pay for food at the grocery store. During the interview, she demonstrated how she hid her food stamp card in her sleeve so other shoppers wouldn’t see that she was receiving public assistance. She said,

I know a lot of people have that in their head—all Latinos are all on food stamps. It was embarrassing because I fit that profile of the typical Latina with kids that has food stamps... It made me feel like, ‘Oh my God, I am just like them.’ I fit that stereotype. I was ashamed of it.

Other participants described the stigma they felt when using local food pantries. The previous participant (ID #141) shared how she went to the food pantry at the local church in “total disguise” because she didn’t want anyone to recognize her. She cried afterward and said, “You feel alone. You feel like nobody cares.” Another participant (ID #113) shared her experience of using food pantries. While she felt it was already embarrassing enough to be in the line, her experience was exacerbated by how she was treated by the pantry workers:

Some of the volunteers treat you in a humiliating way. Sometimes they’re just very nasty. They may say, “Here’s two little pieces of cheese.” I say, “I have four kids, may I have another one?” [They’ll say,] “well, you know, there has to be enough for everybody.” They call you greedy. Just the way they say it and how they put you on the spot. They embarrass you as if you already don’t feel bad being in the line.”

Shame of Not Being Able to Provide for One’s Family. Several participants discussed the shame they felt about their inability to provide food for their children, as well as how others may perceive them. One parent (ID #130) described feeling ashamed when her children offered to use their savings to pay for food, saying,

[My children] have savings accounts and we pay [into them] every week when we have money. They actually offer to pay for things, which makes me super embarrassed. I shouldn’t be taking money out of my kids’ savings accounts to pay for groceries.

One mother (ID #147) recounted being recently laid off from her position as an executive and found herself experiencing food insecurity for the first time. She hid her food-related struggles from her social circle, calling it “a grand falling from grace.” Another father (ID #115) said his son was acutely aware that he was struggling to make ends meet. He said, “I think the shame is that he asks me, ‘Dad, can we afford it? That makes me cry because I don’t want to be a loser. I don’t want to say, ‘No we can’t.’

Sadness about Their Cyclical and Chronic Food Situation. Feeling sad and depressed was common across parents’ experiences of food insecurity. Similar to the first theme of stress, the chronic and persistent nature of food insecurity, compounded by the strenuous cycle of paychecks and food stamp benefits, was internalized strongly by some parents. One parent (ID #109) described the feeling of realizing the amount of money she had didn’t cover what she needed as “upsetting” and that this cycle had been going on for months. Another parent (ID #106) said,

I’m just waiting around for the next month to come around where I can get that extra boost again. It’s every month that you have to go through that, so you kind of feel kinda down and depressed... it’s like, why do I gotta keep waiting around for this? When payday comes, you have so many bills that take up your whole check. So am I gonna pay bills or food?

Parents also expressed feelings of sadness in not being able to provide “fancy” meals for their family and working long hours instead of spending time with their children. When asked if their children were aware of their feelings, some parents described not wanting to wallow in their emotions. One parent (ID #114) said, “I don’t want kids to see me down. I don’t want that to brush off on them, so I try to stay strong so they don’t see me like that.”

Guilt over Their Inability to Adequately Provide for Their Children. Guilt was experienced in different situations related to food insecurity and the need to give their children a “normal life.” One parent (ID #144) described feeling guilty because she wasn’t able to provide opportunities for her children to develop healthy behaviors. She said,

I’m supposed to teach them healthy lifestyles, healthy habits. I know what they’re supposed to have, but can I give it to them? No... To not be able to provide how I want to, how I need to, it’s hard...

Two participants shared their thoughts around having another family member raise their children, who might be able to give them a better life. One of these parents (ID #145) said, “I felt like such a bad mother. That I couldn’t provide for my kids. That somebody else could do better.” Another participant (ID #130) shared how she signed her children up for extra-curricular activities through scholarships as a trade-off for not being able to provide the food she wanted them to eat. She said,

It’s just hard to feel that you can’t give your kids everything they need. I give them all these activities and we live off of donations for food... it’s a lousy feeling not being able to give your kids the life that you think they deserve.
Parents’ Coping Responses for Food Insecurity

Parents expressed negative and positive coping responses for the distress they felt related to food insecurity. Negative responses included avoiding interaction with others, sleeping, and drinking. One parent (ID #137) described,

“When it gets to a point where it’s unbearable and I just feel overwhelmed, that’s when I go to sleep. After a day or two, I have to get out of it because it’s just trying to sleep my problems away. The problems are still there. It’s a catch-22. I can’t just ignore them because it’s not going to be solved. I try to get to a point where I’m not so irritable.”

One parent (ID #104) mentioned using alcohol to cope. They said, “It’s not a good solution. I’m not proud of it. But, I have to stop thinking so much. So, drinking and thinking don’t go together, right?”

Positive coping responses included relying on friends and family for support, seeing a mental health professional, praying, and staying optimistic. One parent (ID #144) stated, “God makes no mistakes. We’re going to get through this. We have a roof over our head. Everything happens for a reason.” Several parents also expressed spending more time with their children, which either indirectly or directly provided them with comfort. One parent (ID #114) said,

“When I get sad and depressed, I just come out and play with the kids. I feel like your kids feel your pain. They feel it. I love [my son] so much. And no matter how mad I am or how angry, stressed out, he will still come over and hug me and tells me he loves me.”

Discussion

Results of the present phenomenological study demonstrate that the psychological influence of food insecurity extends far beyond a sense of anxiety over the food supply.17 Parents discussed themes of stress attributed to the chronic balancing act needed to feed their family; the frustration and helplessness associated with the high costs of healthy foods; the stigma of using food stamp benefits or community food pantries; the shame of not being able to provide for one’s family; sadness about their cyclical and chronic food situation; and the guilt over their inability to provide healthy, adequate food for their children. Although recent qualitative research has been used to study the context of food insecurity10-32 and some of the themes from the present study were raised in previous studies,18,19 this study focused specifically on the breadth of psychological distress experienced by parents of older children and early adolescents. Parents often discussed multiple themes in the same conversation, suggesting that food insecurity is a chronic, multifaceted, and inherently distressing experience. Furthermore, these types of psychological distress may be categorized as toxic due to their unrelenting nature and self-focused negative emotions, which together create high risk for chronic stress arousal, allostatic load, and clinical anxiety and depression, all of which have been linked with food insecurity in epidemiologic research.33-36

Several of the themes that were raised by parents in the present study were also echoed by their children in Leung and colleagues.20 In separate interviews, children of study participants revealed themes of worrying over not having enough food, worrying about their parents’ health, anger and frustration, embarrassment, and sadness attributed specifically to food insecurity. Some parents in the present study acknowledged the influence that food insecurity had on their children, despite their best attempts to protect them from the experience. The similarity of themes raised by parents and children suggest that parents may not be able to effectively shield their children from the distressing experience of food insecurity,37 and that the psychological distress of food insecurity may be transmitted from parents to children. Thus, the collective experience of psychological distress in food-insecure households can be particularly problematic if it impairs cognitive function and dietary regulation, which could also increase the risk of mental illness and cardiometabolic disease.38-40

Parents also discussed a variety of strategies they employed to cope with the distress of food insecurity. In particular, negative strategies included sleeping, drinking alcohol, and avoidance of others. These strategies align with disengagement coping, suggesting that food insecurity presents as a threatening stressor beyond one’s control.41 Parents in the study were unable to find coping strategies to address the issue of food insecurity itself (ie, problem-focused coping) and resorted to coping strategies to mitigate their own emotional burden (ie, emotion-focused coping), which could further lead to clinical anxiety.42 Furthermore, these coping mechanisms shed light on the known associations between food insecurity and negative health outcomes. For example, prior studies have shown that food insecurity is associated with poorer sleep outcomes in adults,43-46 and one study further identified psychological distress as mediating the food insecurity–sleep association.47 Other studies have demonstrated the association between food insecurity and increased alcohol use48 as well as other illicit substances.49,50 If individuals experiencing food insecurity consistently turn to disengagement-oriented strategies to ameliorate the distress response, these behaviors could further exacerbate food-related hardship and increase the risk of long-term physical and mental health effects.

The theme of stigma attributed to community food acquisition was particularly noteworthy. Federal food programs and the charitable food system both comprise our nation’s safety net against food insecurity and hunger. However, a national study found that only 20% of food-insecure households received food stamps and <10% of food-insecure households used food banks.51 The current study showed that utilization of these resources was a direct source of stigma for many parents with food insecurity. Specifically, this stigma was internalized by some parents, whereas for others, it was perpetrated by pantry workers. The stigma shared by parents corroborated previous studies examining why individuals with food insecurity choose not to receive food assistance.52-55 Addressing this stigma is critical to encourage individuals with food insecurity to seek assistance, preserve the dignity and mental health of those utilizing these resources, and improve the delivery of these services to reach more individuals at risk of food insecurity and poor health.

Understanding the psychological distress of food insecurity has become even more critical during the ongoing coronavirus disease 2019 pandemic, which has widened the burden of food insecurity in households with children. During the
first year of the pandemic, school closures influenced children’s ability to participate in federally funded breakfast and lunch programs, heightening the vulnerability to food insecurity that low-income families with children faced. A study conducted in the initial months of the pandemic found a dose–response relationship with greater food insecurity and perceived stress, anxiety, and depression among low-income adults. Whereas multiple food and economic relief policies have been enacted to mitigate the effects of the pandemic, a comprehensive evaluation is needed to understand whether or not and how these policies influence food insecurity and its negative mental and physical health consequences.

One limitation of this study is that the eligibility criteria included English-speaking participants, which may have excluded non-English-speaking parents and families who may have different experiences of food insecurity than English-speaking parents. Second, the participants in the present study were heavily skewed toward mothers. Mothers were more likely to express interest in the study, manage their family’s food budget, and were more knowledgeable about their family’s food preferences. Future studies should make efforts to recruit non-English-speaking families and fathers/other caregivers to better understand their experiences of psychological distress specific to food insecurity. Parents were categorized as mothers or fathers based on their reported sex, which may have resulted in misclassification. Future studies should ask parents whether they identify as mothers, fathers, or other parents. Finally, although participants were specifically asked how they coped with the manifestations of psychological distress, the in-depth discussions of the coping strategies were somewhat limited. Future studies may want to focus on exploring coping strategies further and the extent to which they can mitigate the psychological distress of food insecurity.

CONCLUSIONS

Food insecurity is a source of psychological distress among parents that presents as a complex constellation of the stress from balancing logistical and financial restrictions to feed their family, frustration and stigma due to unequal access to normal food procurement channels, and the internalization of negative emotions. Recognizing the breadth of psychological distress in the experience of food-insecure populations can help to inform the development of interventions that better preserve the dignity and mental health of individuals experiencing food-related hardship.

References

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

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AUTHOR CONTRIBUTIONS

C. Leung, B. Laraia, A. Steward, N. Adler, and E. Epel designed the research study. C. Leung collected the data. C. Leung, C. Feiner, and K. Solis analyzed the data. C. Leung prepared first draft of the manuscript and critically revised the manuscript and had primary responsibility for the final content. All authors read and approved the final manuscript.
<table>
<thead>
<tr>
<th>Question</th>
<th>Follow-up questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tell me about your family’s food situation in the past 12 mo</td>
<td>How do/did you feel about this? How do you think [your child] feels about this? How do you know?</td>
</tr>
<tr>
<td>What do you do to help your family stretch your food budget to last throughout the month?</td>
<td>How do you feel about this? How do you think [your child] feels about this? How do you know?</td>
</tr>
<tr>
<td>What other resources does your family use to get food for your family?</td>
<td>How do you feel about this? How do you think [your child] feels about this? How do you know?</td>
</tr>
<tr>
<td>When your family didn’t have enough money for food, how did you feel?</td>
<td>What did you do in that situation? How did this experience change your food shopping habits? How did this experience change your eating behaviors?</td>
</tr>
<tr>
<td>When your family didn’t have enough money for food, how do you think [your child] felt?</td>
<td>Do you think he/she was aware of the situation? What makes you say that? When this occurred, did you notice any differences in his/her behavior? How did [your child’s] eating habits change?</td>
</tr>
<tr>
<td>People in families who have gone through similar situations have reported feeling like they have no control or choice over the situation when there wasn’t enough money for food. Did you ever feel this way?</td>
<td>How did you deal with the situation when you felt you had no control or choice over the situation?</td>
</tr>
<tr>
<td>Other people in similar situations have reported feeling embarrassment or stigmatized when there wasn’t enough money for food. Did you ever feel this way?</td>
<td>How did you deal with feeling embarrassed?</td>
</tr>
<tr>
<td>Another common experience for people in similar situations is isolation or loneliness when there isn’t enough money for food. Did you ever feel this way?</td>
<td>How did you deal with feeling lonely or isolated?</td>
</tr>
<tr>
<td>Sometimes, people report feeling sad or depressed when there isn’t enough money for food. Did you ever feel this way?</td>
<td>How did you deal with feeling sad or depressed?</td>
</tr>
<tr>
<td>Are there any other emotions that you would like to share with me about your food situation?</td>
<td>How did you deal with this when you felt this way?</td>
</tr>
</tbody>
</table>

**Figure.** Interview guide for a study of the psychological distress of food insecurity from 48 parents of children aged 7 to 14 years recruited from the San Francisco Bay Area.
Table. Characteristics of 48 parents in food-insecure households recruited from the San Francisco Bay Area in a qualitative study of the psychological distress of food insecurity

<table>
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<th>Characteristic</th>
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<tr>
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<td>Range</td>
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<tr>
<td><strong>n (%)</strong></td>
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<td>Black</td>
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</tr>
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<td>Married or living with partner</td>
<td>19 (39.6)</td>
</tr>
<tr>
<td>Divorced</td>
<td>8 (16.7)</td>
</tr>
</tbody>
</table>

\(^a\)Includes individuals who identified as Native American, Pacific Islander, and two or more racial or ethnic groups.

**Household food security status\(^b\)**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Marginal food security</td>
<td>4 (8.3)</td>
</tr>
<tr>
<td>Low food security</td>
<td>20 (41.7)</td>
</tr>
<tr>
<td>Very low food security</td>
<td>24 (50.0)</td>
</tr>
</tbody>
</table>

**CalFresh\(^c\) participation over the past 12 mo**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>17 (36.2)</td>
</tr>
<tr>
<td>Yes</td>
<td>30 (63.8)</td>
</tr>
</tbody>
</table>

**WIC\(^d\) participation over the past 12 mo**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>No</td>
<td>38 (80.9)</td>
</tr>
<tr>
<td>Yes</td>
<td>9 (19.2)</td>
</tr>
</tbody>
</table>

**Food pantry use over the past 12 mo**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>20 (42.6)</td>
</tr>
<tr>
<td>Yes</td>
<td>27 (57.5)</td>
</tr>
</tbody>
</table>

\(^b\)Household food security was assessed using the US Department of Agriculture Household Food Security Survey Module.\(^21\)

\(^c\)CalFresh is California’s name for the federal Supplemental Nutrition Assistance Program.

\(^d\)WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.
Health-Related Preconception Factors: Adherence to Guidelines and Associations with Weight Status

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ABSTRACT
Background Knowing the percentage of women planning a pregnancy who meet preconception dietary and physical activity (PA) guidelines and which health-related preconception factors are associated with body mass index (BMI) could help improve preconception care.

Objectives In a study conducted in women who were planning to conceive, the aims were to describe and compare eating and PA habits to current guidelines, as well as to identify the factors associated with BMI.

Design This was a cross-sectional study.

Participants/setting From 2017 to 2020, women planning to conceive within the next year (n = 217) were recruited in the province of Québec (Canada) to participate in the Apports Nutritionnels durant la Grossesse Cohorte Contrôle study. Among them, 184 (84.8%) were included in the analyses.

Main outcome measures Women completed three (90.2%) or two (9.8%) Web-based 24-hour dietary recalls and the International Physical Activity Questionnaire. Weight and height as well as the presence/absence of weight/body image concerns were self-reported. Eating and PA habits were compared with dietary reference intakes and Canadian guidelines, respectively.

Statistical analyses Descriptive statistics were used to describe the sample, eating and PA habits, as well as adherence to guidelines. A multivariable regression analysis was performed to identify the factors associated with BMI.

Results On average, women were aged 30.8 ± 4.1 years and identified as White (94.0%). Most of them had weight/body image concerns (58.7%), 54.6% of whom had a normal body weight. Overall, 42.3% engaged in 150 minutes/week or more of moderate-to-vigorous intensity PA and 84.8% consumed <135 g alcoholic beverages per week. Mean dietary intake was below Dietary Reference Intakes for carbohydrates, vitamins D and E, and above Dietary Reference Intakes for total fat and folic acid. Factors associated with a higher BMI were weight/body image concerns (β = 1.83; R² = 13.0%), higher dietary protein intake (β = .05; R² = 4.0%), lower income (β = .85; R² = 2.9%), no folic acid supplementation (β = .83; R² = 2.5%), spending less time in moderate-to-vigorous intensity PA (β = −.006; R² = 2.4%), eating <2 snacks (β = .75; R² = 2.2%), and <3 meals (β = 1.38; R² = 1.5%) daily.

Conclusion Women planning to conceive do not have optimal eating and PA behaviors. Modifiable factors associated with BMI in preconception were identified.

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RECONCEPTION IS A CRITICAL PERIOD FOR THE health of the mother and child.1,13 During this period, it is important to adopt and maintain healthy lifestyle behaviors that meet the established national guidelines for dietary intakes and physical activity (PA). Similar to American guidelines,4-6 Canadian guidelines on preconception care recommend that women planning to conceive adopt healthy eating habits that meet Canada’s Food Guide (CFG) guidelines and Dietary Reference Intakes.7-12 A daily supplement of folic acid or a prenatal multivitamin containing at least 400 µg folic acid to prevent neural tube defects and other folic acid-sensitive congenital anomalies is also recommended.9,10 Moreover, at least 150 minutes of moderate-to-vigorous intensity PA (MVPA) per week is advised.13,14 To quit smoking, consume no more than 300 mg/day caffeine, and avoid alcohol consumption are also suggested.9,15,16 Finally, women should have optimal psychological well-being, low stress, and minimal concerns.17,18

An increasing number of research studies and national surveys conducted in North America have reported data on

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adherence to recommendations in the preconception period. However, these studies and surveys appear to focus primarily on PA data. Only one prospective pilot study focusing on dietary data was conducted in Canada during the early 2000s with a small sample of 49 women.22

Besides the adoption of a healthy lifestyle before conceiving, women should also attain or maintain a normal body mass index (BMI), which spans between 18.5 and 24.9, before pregnancy.25 During 2015, the prevalence of preconception overweight or obesity (ie, BMI ≥25) was considerably high in Canada, with approximately 45% of women entering their pregnancy with overweight or obesity.26 This proportion is of importance because a BMI ≥25 is associated with numerous maternal, neonatal, and even early childhood deleterious health outcomes.27 Indeed, presence of obesity in women of childbearing age can lead to difficulty to conceive, pregnancy and delivery complications, as well as large-for-gestational-age infants and childhood obesity.27

Despite the importance of lifestyle habits, BMI, and psychological well-being for health, few studies have examined the association between these factors in women planning to conceive, and most are retrospective, with a high risk of recall bias.28,29 Thus, additional studies with a stronger design (eg, cross-sectional and prospective cohorts) using validated tools are needed to more accurately describe weight-related lifestyle behaviors and psychological well-being in women who are planning to conceive. These types of studies may also contribute to a better understanding of the modifiable behaviors and factors that are closely associated with BMI in women planning to conceive.7 The current study has the potential to contribute to this important knowledge acquisition.

In women planning to conceive, the objectives of this study are to describe and compare eating and PA habits with current guidelines as well as to identify factors associated with BMI. The first hypothesis is that most women have suboptimal diet and PA levels. The second hypothesis is that modifiable health-related factors, such as diet, PA, and weight concerns are significantly associated with BMI during the preconception period.

**MATERIALS AND METHODS**

**Study Population**

From June 2017 to July 2020, women planning to conceive during the next year were recruited in the Apports Nutritionnels durant la GrossessE — Cohorte Contrôle (ANGE-Ctrl) through social media and e-mail sent to members of Laval University and the Québec City University Hospital Center) in the province of Québec, Canada. The ANGE-Ctrl study is part of an ongoing study (ANGE-Ctrl-Enceinte) whose main purpose is to examine the changes in women’s nutritional status and PA levels from preconception to the third trimester of pregnancy. Exclusion criteria included being younger than age 18 years and having a previous diagnosis of a severe medical condition such as type 1 or type 2 diabetes or renal, inflammatory, and autoimmune diseases. Women expressed interest in the study through e-mail or telephone calls. Next, a research assistant made a telephone appointment with the potential participants to explain the study. If the women were still interested in participating, the consent form was sent to them by e-mail. A total of 304 women expressed interest, among which 217 gave their informed written consent and 184 were included in the study analyses (Figure 1). The ANGE-Ctrl project was approved by the CHU de Québec — Université Laval Research Center’s Ethics Committee (reference no.: 2016–2866).

Within a 2- to 3-week period, participants completed a variety of Web-based self-administered questionnaires at home, hosted by a Laval University web-based platform named Application fonctionnelle de nutrition sur Internet.

**General Health Questionnaire**

The General Health Questionnaire includes questions on sociodemographic and anthropometric characteristics as well as one question on weight/body image concerns: “Are you concerned about your weight and/or body image?” The response choices were: “Yes, No, or I don’t know.” The questions about smoking were optional. However, when smoking data was missing, the participant was contacted afterward to collect the information. Nevertheless, some participants still preferred not to answer (n = 29; 15.8%). All questions from the General Health Questionnaire were standardized and self-reported.

![Figure 1. Flow diagram for the Apports Nutritionnels Durant la GrossessE — Cohorte Contrôle study, Québec, Canada, 2017-2020.](image-url)
PA Questionnaire
Women’s PA habits during the last 7 days were evaluated using the International Physical Activity Questionnaire (IPAQ) from which weekly minutes of MVPA were calculated. Women were classified as meeting or not meeting the national PA recommendations of 150 minutes or more of MVPA per week.3

Web-Based 24-Hour Dietary Recalls
Dietary intakes were evaluated using a Web-based 24-h dietary recall tool from the Rappel de 24h Web (R24W) platform. The R24W was previously validated in the general adult population. Briefly, this tool includes a database of 2,865 food items that are linked to the 2015 Canadian Nutrient File to enable automatic extraction of nutritional values. Respondents are asked to report all food and beverages consumed during the past 24 hours and to select the portion size and added condiments, if applicable. Macro- and micronutrients intakes as well as percentage of energy from macronutrients were obtained through the R24W application. During the 2-week evaluation period, the R24W platform randomly sent three recalls to the participants via e-mail (on 2 weekdays and 1 weekend day). If there was an incomplete recall after the first three were sent, the platform randomly generated another one until three recalls were completed or until the end of the 2-week period. If more than one recall was still missing at the end of the evaluation period, women were offered additional opportunities to complete the R24W over an extended 1-week period. To be considered as representative nutrition data, women were required to complete at least two recalls.

Healthy Eating Index
Diet quality was derived from the dietary recalls and was assessed using the 2007 version of the Canadian Healthy Eating Index (C-HEI). The C-HEI is adapted from the Healthy Eating Index developed by Kennedy and colleagues and its assessment relies on the number of servings of certain foods reported by the participant, according to age and sex. Briefly, the C-HEI includes eight adequacy components (total fruits and vegetables, whole fruit, dark green and orange vegetables, milk and alternatives, meat and alternatives, total grain products, whole-grain products, and unsaturated fats) and three moderation components (sodium, saturated fats, and other foods; that is, foods that are not included in any of the categories of the 2007 CFG). Diet quality was classified into three categories: poor quality (<50 points), required improvements (50 to 80 points) and good quality (>80 points). The C-HEI measures the adherence to the 2007 CFG, which may not adequately reflect the new Canadian recommendations recently published in the 2019 CFG.

Supplement Use Questionnaire
Information on the use of dietary supplements was collected using a web questionnaire in which participants were required to identify the supplement’s name, its drug identification number, measurement unit, dose, and frequency of use per day. Participants could enter up to 10 dietary supplements. If needed, information regarding supplement use was added by a research assistant using The Health Canada Licensed Natural Health Product Database as well as company product labels and websites. If information was still missing or incomplete for any of the characteristics of the supplements, the research assistant contacted the participant to obtain the missing information. Finally, types of dietary supplements used (multivitamins or single-nutrient supplements) and the number of users for each type of supplement were compiled.

Statistical Analyses
Data are presented in mean ± standard deviation or n (%). Distribution normality was determined by testing the residuals of the models. Normality was confirmed if the goodness of fit was ≥0.03 and if the curve visually respected the normal curve. Wilcoxon Mann-Whitney tests for non-normally distributed continuous variables, Student t test for normally distributed continuous variables, and χ² tests or Fisher exact tests for dichotomous variables were performed to compare the characteristics of women included (n = 184) and excluded (n = 33). Descriptive analyses were used to describe the study population as well as eating and PA habits, and whether or not the women met the lifestyle behavior recommendations. Mean daily energy intake for each woman was compared with her own estimated energy requirement. The latter was calculated using the following formula: 354 – (age [in years] × 6.91) + PA coefficient × ((9.36 × weight [in kilograms]) + (726 × height [in meters])). PA coefficient was derived from the IPAQ and the adjusted weight was calculated for women with a BMI > 25 using the following formula: ideal weight [in kilograms] + 0.25 (actual weight [in kilograms] – ideal weight [in kilograms]), where ideal weight refers to the estimated weight at a BMI of 25. Protein, carbohydrate, and total fat intakes as percentages of energy were compared with the acceptable macronutrient distribution ranges (AMDR). Proportions of women with nutritional intake below the estimated average intakes (EAI), as well as above the adequate intakes (AI) or the tolerable upper limit (UL) were calculated, when applicable. The cut-point method was used to compare participants’ data with AMDR, EAR, AI, or UL values. Total dietary intakes reflect mean supplement intake that was added to the mean of food intake’s values for each participant. Multivariable linear regression analyses were conducted to identify factors associated with the women’s BMI during the preconception period. Overall, 12 variables were entered into the multivariable linear regression model using the stepwise
procedure (mixed approach) at a probability to enter of $P < 0.25$. The 12 variables are the following: concerns about weight/body image (yes), dietary protein intake, annual household income <$100,000 CAN, folic acid supplement (no), MVPA, number of snacks eaten per day (<2 vs ≥2), number of meals eaten per day (<3 vs ≥3), total fat intake, dietary fiber, restaurant occasions (<1 meal/week), C-HEI total score, and marital status (living with a partner). From them, seven variables were retained in the final linear regression model at a probability to leave $P > 0.10$. G^2 Power software (version 3.1.9.7) was used to perform a posteriori power analysis on the multiple linear regression, which revealed that a sample size of 63 women was required to give an effect size of 0.40, an $\alpha = 0.05,$ and a 95% power. Therefore, the ANGE-Ctrl study was adequately powered. Finally, to better understand results about folic acid intakes, additional analyses (ie, Fisher exact test or Student t test) were performed to compare diet quality and PA levels between women who took a folic acid supplement, and those who did not. All statistical analyses were performed in JMP Pro version 14. The statistical significance level was set at $P < 0.05$.

RESULTS
Among the 217 women planning to conceive during the next year, 184 (84.8%) fully completed the evaluation and were included in the analyses. Reasons for incomplete evaluation are detailed in Figure 1. Excluded participants were similar in terms of sociodemographic characteristics, except for parity. Indeed, compared with the excluded participants, those included were more likely to be nulliparous (64.1% vs 37.0%; $P = 0.018$). Table 1 presents the women’s age, first language, ethnicity, number of children, BMI, education levels, household income, marital status, and place of residence. Participants’ BMI was classified as underweight (n = 4; 2.2%), normal weight (n = 122; 66.3%), overweight (n = 36; 19.5%), or obese (n = 22; 12.0%).

Regarding eating habits, women consumed on average 153.6 ± 134 mg/day caffeine, and most of them did not smoke during the study period (95.4%). Almost all women ate three meals per day (94.0%), whereas 52.1% ate more than one snack per day. Results on dietary supplements revealed that 34.2% of women did not take any, 64.2% took either folic acid supplements or multivitamins, and 1.6% took both (data not shown).

Overall, three dietary recalls were completed; only 18 women (9.8%) missed one recall. Average C-HEI score was 56.1 ± 12.9 out of 100, a diet adequacy component score of 44.6 ± 7.9 out of 60 and a diet moderation component score of 17.0 ± 8.10 out of 40 (Figure 2). Based on the classification proposed for C-HEI score, 17.9% of women had a poor diet quality (C-HEI score <50), 75% had a diet that required improvements (C-HEI score = 50 to 80) and only 7.1% had a good diet quality (C-HEI score >80).

Women’s energy and macronutrient intakes are presented in Table 2. When comparing the mean daily energy intake for each woman with their own estimated energy requirement, 54.9% of women were above their energy needs on average by 415 kcal/day. When looking at the percentage of daily energy intake from macronutrients, mean average was above the AMDR for total fat (+2.2%) and below the AMDR for carbohydrate intake (−1.7%) and n-6 linoleic acid (−0.6%). Moreover, only 11.4% and 33.6% of women were above the AI for fiber and n-6 linoleic acid, respectively. Nevertheless, most women, if not all, had protein (100%) and n-3 linoleic acid (86.4%) intakes above the AI. Finally, women consumed on average 64.9 ± 107.6 g alcohol every week corresponding to almost five drinks per week and 15.2% were above the recommendation for low-risk drinking; that is <135 g/week alcohol.

Micronutrient intakes (food alone and with supplements) are presented in Table 3. Among women who did not take a supplement (63 out of 184; 34.2%), 61 women (96.8%) had an adequate folate intake (between 320 μg and 1,000 μg) whereas 2 women (3.2%) had intakes below the EAR of 320 μg/day. When combining food or fortified food and supplement intakes, 47.8% women (88 out of 184) had folic acid intakes above the UL (1,000 μg/day). Data not shown revealed that in comparison to women who did not take a folic acid supplement, women who did take one were as active (P > 0.05, for all PA data), but had a better diet quality (P < 0.001). Finally, women consumed on average 3,177.8 ± 869.7 mg/day sodium.

Results on PA levels revealed that although women accumulated an average of 142 ± 137 minutes of MVPA per week, more than half (57.7%) did not meet the PA recommendation of ≥150 minutes of MVPA per week.

Regarding data on psychological well-being, 58.7% (108 out of 184) of women reported having concerns about their weight or body image, although 54.6% of them (59 out of 108) had a normal body weight (data not shown).

Lastly, among the 12 women’s health-related characteristics included in the stepwise procedure, 7 of them formed the best linear regression model of women’s BMI during the preconception period (Table 4). This final model revealed that a higher BMI during the preconception period was associated with a woman’s concerns about her weight or body image, higher dietary protein intake, lower annual household income, no folic acid supplementation, spending less time in MVPA, eating <2 snacks, and eating <3 meals per day. Altogether, those variables explained 28.5% of total BMI variability in women planning to conceive, with women’s weight or body image concerns contributing to almost half of the total percentage (13%).

Discussion
The study findings suggest that most women had a diet quality that required improvements according to the CFG 2007 and had suboptimal total intakes of several micro- and macronutrients, including vitamins D and E, sodium, folic acid, carbohydrates, and total fat. Moreover, more than half of the women reported weight or body image concerns and did not meet national recommendations for PA. Finally, seven important modifiable factors were identified as significantly associated with women’s preconception BMI, with the strongest factor being the presence of concerns about weight or body image.

Diet Quality
Three out of four women had a diet quality that required improvement, according to CFG 2007. This is similar to the proportion obtained retrospectively by Carmichael and
Indeed, among women who did not intend to become pregnant, the authors found that 14.2% (188 out of 1,073) had a low diet quality score and 8.2% (57 out of 1,073) had a high diet quality score, respectively. Women’s diet was evaluated during the year before pregnancy using a food frequency questionnaire from which a diet quality index was adapted and a diet quality score was calculated. Other studies in which women’s diet quality in preconception was assessed found a considerable prevalence of low scores, independent from the women’s pregnancy intention. Overall, data suggest that women’s diet quality before pregnancy is suboptimal and needs improvement.

**Micronutrient Intakes**

Vitamin D and E intakes from food alone were below the EAR for most women. When combining food sources and supplements, most women still had vitamin D and E intakes that were below the EARs. It is noteworthy that inadequate vitamin D and E intakes, with or without the use of prenatal supplements, have been observed in other Canadian or American studies conducted among women of childbearing age or among pregnant women in whom dietary intakes were estimated during the year preceding pregnancy. Although vitamin D intakes were low for most women, no firm conclusion can be drawn about vitamin D status. Indeed, serum 25(OH)D concentrations, which could have been

**Table 1. Sociodemographic and anthropometric characteristics of women planning to conceive from the Apports Nutritionnels durant la Grossesse—Cohorte Contrôle study (ANGE-Ctrl), Québec, Canada, 2017-2020 (N = 184) (continued)**

<table>
<thead>
<tr>
<th>Marital status</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Divorced</td>
<td>2 (1.1)</td>
</tr>
<tr>
<td>Single</td>
<td>10 (5.5)</td>
</tr>
<tr>
<td>Prefer not to answer</td>
<td>1 (0.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Place of residence</th>
<th>18 (9.8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural or countryside</td>
<td>18 (9.8)</td>
</tr>
<tr>
<td>Urban or city</td>
<td>89 (48.4)</td>
</tr>
<tr>
<td>Suburban</td>
<td>77 (41.8)</td>
</tr>
</tbody>
</table>

| Others include Arab, Creole, Hungarian, Polish, Portuguese, and Spanish. |
| Ethnicty categories as defined in the ANGE-Ctrl General Health Questionnaire. |
| Caucasian/White refers to ethnic origins from Canada, United States, Europe, Middle East, North Africa, and so on. |
| Hispanic refers to ethnic origins from Mexico, Puerto Rico, Cuba, Dominican Republic, and so on. |
| Asian refers to ethnic origins from Far East, Southeast Asia, Cambodia, China, and so on. |
| Black refers to ethnic origins from Jamaica, Caribbean, Niger, Haiti, and so on. |
| Inuit refers to ethnic origins from Eskimo. |
| Body mass index categories were underweight <18.5, normal weight 18.5 to 24.9, overweight 25 to 29.9, and obese ≥30. |
| CEGEP = Collège d’enseignement général et professionnel, a preuniversity and technical college institution specific to the Québec educational system. |
| Incomes are reported in Canadian dollars (CAN). $1.00 CAN corresponds to $0.81 US. |

Overall, data suggest that women’s diet quality before pregnancy is suboptimal and needs improvement.

**Micronutrient Intakes**

Vitamin D and E intakes from food alone were below the EAR for most women. When combining food sources and supplements, most women still had vitamin D and E intakes that were below the EARs. It is noteworthy that inadequate vitamin D and E intakes, with or without the use of prenatal supplements, have been observed in other Canadian or American studies conducted among women of childbearing age or among pregnant women in whom dietary intakes were estimated during the year preceding pregnancy. Although vitamin D intakes were low for most women, no firm conclusion can be drawn about vitamin D status. Indeed, serum 25(OH)D concentrations, which could have been
influenced by other factors such as sun exposure, were not measured.46

Regarding folic acid, results showed that 34.2% (63 out of 184) of women did not take a daily folic acid supplement or a prenatal multivitamin containing folic acid. Similarly, Carmichael and colleagues40 retrospectively found that only 35.8% of their participants (n = 3,934 out of 10,976) took a folic acid supplement or a multivitamin containing at least 400 μg folic acid during the 3 months before their pregnancy. However, the authors did not specify the percentage of women who met the EAR for folate.47 Most participants in the ANGE-Ctrl study met the EAR for folic acid even among those who did not take supplements. Consuming sufficient folate during the preconception period is of particular importance because its deficiency during pregnancy can lead to neural tube defects as well as other folic acid-sensitive congenital anomalies.10 When combining food or fortified food and supplement intakes, only 1.1% of women (2 out of 184) were still not consuming enough folate (<320 μg/day), whereas 47.8% of women (88 out of 184) had folic acid intakes above the UL (1,000 μg/day). Similarly, other studies conducted among pregnant Canadian women found excessive intakes of folic acid due to a single supplementation of folic acid.44,47,48 It seems that until now, only one Canadian study has examined folate intakes during the preconception period, but from food only.42

Sodium intakes were above the UL for most women. Indeed, 85% (156 out of 184) of the women participating in the ANGE-Ctrl study had dietary intakes above 2,300 mg/day. This high prevalence is relatively common and consistent with the results from other studies conducted in Canadian women of reproductive ages.49-51

In summary, when combining food and supplements, micronutrient intakes were optimal except for folic acid, sodium, and vitamins D and E. Consequently, results indicate that a lot of women might benefit from education about the importance of an optimal diet and/or supplement use. More importantly, women planning a pregnancy might benefit from nutritional support provided by health professionals such as registered dietitian nutritionists as early as preconception. The support may include problem-solving barriers and collaborating on ways to meet the national recommendations considering their considerable influence on reproductive function and periconception health.

PA Levels
Regarding preconception PA levels, 57.7% of women were below the recommendations of ≥150 minutes per week of MVPA.13 Although this proportion is high, Canadian and American surveys showed similar results. Indeed, 43.5% of Canadian women (n = 4,299,500) aged 18 to 49 years during 2018 and 75.5% of American women (n = 100,297) aged 18 to 44 years during 2019 reported PA levels <150 minutes of MVPA.20,21 During 2014-2015, a Canadian study conducted by Clarke and colleagues21 evaluated women’s PA levels using an accelerometer worn over the right hip for 7 consecutive days.21 The accelerometry results revealed that 78.4% of women aged 18 to 39 years engaged in MVPA <150 minutes per week.21 In short, whether or not the PA levels are measured objectively or subjectively, too many women of childbearing age are not sufficiently active to meet PA guidelines. This is problematic considering that PA in preconception is a key predictor of PA levels during pregnancy,3,52,53 which in turn is a key contributor to maternal and neonatal health.3,52,53

Concerns About Weight and/or Body Image
Although there was a higher proportion of participants presenting normal weight (n = 122; 66.3%) rather than underweight (n = 4; 2.2%), overweight (n = 36; 19.5%), or obesity (n=22; 12.0%), a total of 58.7% of women (108 out of 184) had concerns about their weight or body image. This result is of particular importance since prepregnancy body dissatisfaction can negatively influence body satisfaction during pregnancy and lead to adverse psychological consequences such as symptoms of depression, eating disorders, impaired self-
esteem, and obesity. Of note, the way body satisfaction was assessed in the current study (ie, a closed question), was not specific to body parts and concerns that may be truly salient during the preconception period. Moreover, the question used to assess women’s concerns about their weight or body image was standardized but has not been validated. The authors’ comprehension of this psychological factor is therefore limited.

Factors Associated with BMI
Using multivariable linear regression analysis, the authors identified seven factors associated with women’s BMI during the preconception period. Having concerns about weight and body image was the variable that contributed the most to explaining BMI variability with a contribution up to 13%. In fact, the presence of weight or body image concerns were associated with a higher BMI during the preconception period. These two latter results underline the importance of a better understanding of women’s attitudes, perceptions, and concerns about their weight and body satisfaction.

According to the linear regression model, dietary protein intakes contributed to a modest 4.0% of BMI’s variability. In addition, higher dietary protein intake was significantly associated with higher BMI. This result is in line with past

Table 2. Energy and macronutrient intakes in women planning to conceive in comparison with dietary reference intakes from the Apports Nutritionnels durant la Grossesse—Cohorte Contrôle study, Québec, Canada, 2017-2020 (N = 184)

<table>
<thead>
<tr>
<th>Intake</th>
<th>Mean ± SD</th>
<th>EARa</th>
<th>% below EARa</th>
<th>AIb</th>
<th>% above AIb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy and macronutrients</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean daily energy intake (kcal/d)</td>
<td>2168 ± 466</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Carbohydrate (g/d)</td>
<td>242.8 ± 59.3</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Total fat (g/d)</td>
<td>89.9 ± 25.4</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Protein (g/d)</td>
<td>89.7 ± 21.9</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Protein, g/kg/day</td>
<td>1.4 ± 0.4 0.66c</td>
<td>—</td>
<td>0.0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Alcohol (g/wk)</td>
<td>64.9 ± 107.6</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Alcohol intake &gt;0d</td>
<td>110 (59.8)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Dietary fiber (g/1,000 kcal)d</td>
<td>10.3 ± 2.9</td>
<td>—</td>
<td>—</td>
<td>14</td>
<td>11.4</td>
</tr>
<tr>
<td>n-6 linoleic acid (g/d)</td>
<td>10.6 ± 4.59</td>
<td>—</td>
<td>—</td>
<td>12</td>
<td>33.6</td>
</tr>
<tr>
<td>n-3 linolenic acid (g/d)</td>
<td>1.9 ± 0.8</td>
<td>—</td>
<td>—</td>
<td>1.1</td>
<td>86.4</td>
</tr>
<tr>
<td>Cholesterol (mg/d)</td>
<td>287.0 ± 132.9</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Macronutrients as %EIf</th>
<th>AMDRg</th>
<th>% below AMDRg</th>
<th>% above AMDRg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>16.7 ± 3.0</td>
<td>10-35</td>
<td>0.0</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>43.3 ± 6.3</td>
<td>45-65</td>
<td>61.4</td>
</tr>
<tr>
<td>Total fat</td>
<td>37.2 ± 5.5</td>
<td>20-35</td>
<td>—</td>
</tr>
<tr>
<td>n-6 linoleic acid</td>
<td>4.4 ± 1.6</td>
<td>5-10</td>
<td>67.9</td>
</tr>
<tr>
<td>n-3 linolenic acid</td>
<td>0.8 ± 0.3</td>
<td>0.6-1.2</td>
<td>22.3</td>
</tr>
<tr>
<td>Saturated fatty acid</td>
<td>13.1 ± 3.3</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Trans fatty acid</td>
<td>0.6 ± 0.3</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Monounsaturated fatty acids</td>
<td>13.5 ± 2.6</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Polyunsaturated fatty acid</td>
<td>7.5 ± 1.9</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Notes:

1. EAR = estimated average requirement, which corresponds to the median daily intake value that is estimated to meet the requirement of half the healthy individuals in a life stage and gender group. Mean intake below the EAR very likely need to be improved because the probability of adequacy is 50% or less.
2. Al = adequate intake, which corresponds to the recommended average daily nutrient intake level based on observed or experimentally determined approximations or estimates of nutrient intake by a group (or groups) of apparently healthy people who are assumed to be maintaining an adequate nutritional state. When the mean usual intake is at or above this threshold, it implies a low prevalence of inadequate intakes.
3. When looking at protein intakes in grams per kilogram per day, the values of 0.66 was considered as an estimated average requirement.
4. Values are presented as n (%).
5. This variable is presented as the number in grams of fiber consumed per 1,000 kcal energy intake.
6. %EI = percentage of total energy intake per day.
7. AMDR = acceptable macronutrient distribution ranges as a percentage of total energy intake. A mean intake between the lower and upper bound of the AMDR is within the acceptable range, whereas a mean intake below the lower bound or above the upper bound of the AMDR may heighten concern for possible adverse consequences.
Obesity may increase the risk of neural tube defects.58,59

In preconception, women with obesity may contributed to 2.5% of BMI

A previous study reporting a higher risk of maternal obesity BMI

Higher preconception BMI and contributed to 2.9% of BMI

0.05).27

Thus, women planning a pregnancy and experiencing

Regarding socioeconomic characteristics, annual household income <$100,000 CAN was associated with a higher preconception BMI and contributed to 2.9% of BMI's variability. This association is consistent with a previous study reporting a higher risk of maternal obesity in women with a household income lower than $22,200 per month, which corresponds to approximately $60,000 CAN per year (odds ratio 1.36, 95% CI 1.03 to 1.79; P < 0.05).27

Data from the ANGE-Ctrl linear regression model revealed that not taking a supplement of folic acid during conception was associated with a higher BMI and contributed to 2.2% and 1.5% of BMI's variability. Although Canadian recommendations for folic acid intake are similar for all prepregnancy BMI categories, women with obesity may benefit more from taking a folic acid supplement because obesity increase the risk of neural tube defects.54,57

Thus, women planning a pregnancy and experiencing overweight or obesity may benefit from counseling regarding the importance of taking a folic acid supplement during conception. Also, compared with women who did not take a folic acid supplement, women who did take one were as active (P > 0.05 for all PA data), but had better diet quality (P < 0.001) (data not shown). Therefore, folic acid supplementation may be a marker of diet quality that contributes to BMI variations.

Unsurprisingly, the final linear model also showed an inverse association between BMI and MVPA in women planning to conceive. Indeed, PA is a well-known factor that has an important role in weight regulation, especially long term.60

MVPA contribution to BMI's variability was similar to folic acid contribution (2.4% vs 2.5%).

Finally, women eating <2 snacks and <3 meals per day had a higher BMI and contributed to 2.2% and 1.5% of BMI's variability, respectively. To date, this result cannot be compared with results obtained by other studies. Indeed, a review of the literature revealed that no study has investigated the link between meal and snack consumption and BMI in preconception. However, a meta-analysis of 15 randomized controlled trials conducted in the general adult population supports that more frequent meals per day (3 to 5 vs <3) may lead to weight loss and may provide beneficial effects on body composition.61 It is noteworthy that this meta-analysis has several important limitations. Thus, its results should be interpreted carefully.

Table 3. Micronutrient intakes from food alone and with supplements in women planning to conceive in comparison with dietary reference intakes from the Apports Nutritionnels durant la Grossesse—Cohorte Contrôlée study, Québec, Canada, 2017–2020 (n = 184)

<table>
<thead>
<tr>
<th>Micronutrient</th>
<th>EARa</th>
<th>ULb</th>
<th>Mean ± SD</th>
<th>% below</th>
<th>% above</th>
<th>Mean ± SD</th>
<th>% below</th>
<th>% above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin D (IU/d)</td>
<td>400</td>
<td>4,000</td>
<td>222.7 ± 133.2</td>
<td>88.6</td>
<td>0.0</td>
<td>456.5 ± 374.1</td>
<td>56.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Vitamin E (mg/d)</td>
<td>12</td>
<td>1,000</td>
<td>9.6 ± 3.2</td>
<td>79.3</td>
<td>0.0</td>
<td>18.4 ± 13.8</td>
<td>54.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Vitamin B-6 (mg/d)</td>
<td>1.1</td>
<td>100</td>
<td>1.7 ± 0.4</td>
<td>3.8</td>
<td>0.0</td>
<td>4.0 ± 10.6</td>
<td>2.7</td>
<td>1.1</td>
</tr>
<tr>
<td>Folate (μg DFE/d)</td>
<td>320</td>
<td>—</td>
<td>452.6 ± 124.5</td>
<td>12.0</td>
<td>—</td>
<td>1458.4 ± 1236.6</td>
<td>1.1</td>
<td>—</td>
</tr>
<tr>
<td>Folic acid (μg/d)</td>
<td>—</td>
<td>1,000</td>
<td>11.0 ± 57.1</td>
<td>—</td>
<td>0.0</td>
<td>714.6 ± 743.2</td>
<td>—</td>
<td>47.8</td>
</tr>
<tr>
<td>Vitamin B-12 (μg/d)</td>
<td>2.0</td>
<td>—</td>
<td>4.8 ± 2.5</td>
<td>4.9</td>
<td>—</td>
<td>13.2 ± 52.7</td>
<td>2.7</td>
<td>—</td>
</tr>
<tr>
<td>Vitamin C (mg/d)</td>
<td>60</td>
<td>2,000c</td>
<td>111.2 ± 52.5</td>
<td>21.1</td>
<td>0.0</td>
<td>1583 ± 135.2</td>
<td>14.7</td>
<td>0.0</td>
</tr>
<tr>
<td>Minerals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium (mg/d)</td>
<td>800</td>
<td>2,500</td>
<td>1,172.5 ± 399.3</td>
<td>15.2</td>
<td>0.5</td>
<td>1,253.3 ± 410.0</td>
<td>11.4</td>
<td>0.5</td>
</tr>
<tr>
<td>Iron (mg/d)</td>
<td>8.1</td>
<td>45</td>
<td>13.7 ± 3.7</td>
<td>2.7</td>
<td>0.0</td>
<td>21.4 ± 12.6</td>
<td>1.6</td>
<td>4.3</td>
</tr>
<tr>
<td>Magnesium (mg/d)</td>
<td>255d or 265d</td>
<td>350</td>
<td>382.5 ± 107.5</td>
<td>18.2</td>
<td>—</td>
<td>398.7 ± 108.8</td>
<td>5.4</td>
<td>0.0</td>
</tr>
<tr>
<td>Sodium (mg/d)</td>
<td>—</td>
<td>2,300</td>
<td>3,177.8 ± 869.7</td>
<td>—</td>
<td>84.7</td>
<td>3,177.8 ± 869.7</td>
<td>—</td>
<td>84.7</td>
</tr>
</tbody>
</table>

aEAR = estimated average requirement, which corresponds to the median daily intake value that is estimated to meet the requirement of half the healthy individuals in a life-stage and gender group.27

bUL = upper limit, which corresponds to the highest average daily nutrient intake level likely to pose no risk of adverse health effects to almost all individuals in a given life-stage and gender group.7,12 Moreover, as intake increases above the UL, the potential risk of adverse effects increases.12

cThe same EAR and UL for vitamin C were used in smokers and nonsmokers.

dAn EAR of 255 for women aged 19 to 30 years and an EAR of 265 for women aged 31 to 50 years was considered.7

and current evidence showing a significant positive association with women's BMI and intake of total dietary protein50–57.

Comparison of household income <$100,000 CAN with a higher preconception BMI and contributed to 2.9% of BMI's variability.
misclassified muscle and body fat weight, and can lead to
use of BMI has its own limitations because it does not

Table 4. Factors associated with body mass index in women planning to conceive from the Apports Nutritionnels durant la
Grossesse – Cohorte Contrôle study, Québec, Canada, 2017-2020 (n = 172)22

<table>
<thead>
<tr>
<th>Variables included in the stepwise procedure (n = 12)</th>
<th>Parameter estimate β (95%CI)b</th>
<th>Standardized estimateb</th>
<th>Partial R² b</th>
<th>P valueb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concerns about weight/body image, yes</td>
<td>1.83 (1.15 to 2.50)</td>
<td>0.37</td>
<td>13.0</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Dietary protein intake (g/d)</td>
<td>0.05 (0.02 to 0.08)</td>
<td>0.21</td>
<td>4.0</td>
<td>0.004</td>
</tr>
<tr>
<td>Annual household income &lt;100,000c</td>
<td>.85 (.18 to 1.52)</td>
<td>0.17</td>
<td>2.9</td>
<td>0.013</td>
</tr>
<tr>
<td>Folic acid supplement, no</td>
<td>.83 (.12 to 1.53)</td>
<td>0.16</td>
<td>2.5</td>
<td>0.021</td>
</tr>
<tr>
<td>Moderate-to-vigorous intensity physical activity (min/wk)</td>
<td>-0.06 (-.01 to .01)</td>
<td>-0.16</td>
<td>2.4</td>
<td>0.023</td>
</tr>
<tr>
<td>No. of snacks eaten per day, &lt;2 vs ≥2</td>
<td>.75 (.08 to 1.43)</td>
<td>0.15</td>
<td>2.2</td>
<td>0.030</td>
</tr>
<tr>
<td>No. of meals eaten per day, &lt;3 vs ≥3</td>
<td>1.38 (-.13 to 2.88)</td>
<td>0.13</td>
<td>1.5</td>
<td>0.073</td>
</tr>
<tr>
<td>Total fat intake (g/d)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Dietary fiber (g/d)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Restaurant, ≤1 meal/wk</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>C-HeIa total score</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Marital status, living with a partner</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>28.5</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Strengths and Limitations
This study has several strengths to be acknowledged. First, all
women completed two (9.8%) or three (90.2%) R24W recalls,
which enhances the precision and representativeness of di-
etary data. Women also completed a questionnaire about
dietary supplement use, adding detailed information to the
R24W recalls. In a previous similar study, such precise in-
formation had not been collected.22 Although it is a sub-
jective tool, the IPAQ used to evaluate PA data has been validated
for adults aged 18 to 65 years living in Canada.30 Finally, the
overall cross-sectional findings of the current study make an
important and informative contribution to the advancement
of knowledge in Canada about maternal lifestyle behaviors
during the critical preconception period that could stimulate
further research in a field that yet includes mostly retro-
spective data.

Nevertheless, some limitations must be acknowledged. First, the results may not be widely generalizable, considering
that most participants were Caucasian (White), well
educated, and had a relatively high household income. In
addition, no question about gender identity was asked and
the literature review as well as the interpretation of the
ANGE-Ctrl results composed of studies that exclusively
included women. Another limitation is that self-reported
weight, diet, and AP can lead to systematic or social desir-
ability bias that may result in more favorable participant
data.62 For example, the participant’s self-reported weight
and height may have underestimated BMI.62 In addition, the
use of BMI has its own limitations because it does not
distinguish muscle and body fat weight, and can lead to
misclassification of body adiposity and health-related risks.63

To date, many clinicians still base their counseling on
BMI.64,65 Finally, the ANGE-Ctrl cross-sectional design does
not allow for a longitudinal examination of women’s lifestyle
behaviors, thus limiting result interpretation.

CONCLUSIONS
Overall, this study indicates that most women planning to
conceive, short- or medium-term, had suboptimal lifestyle
behaviors and showed concerns about their weight/body
image. In fact, most women did not achieve national PA
recommendations, and the quality of their diet needs to be
improved. Moreover, many women did not take folic acid
supplements as recommended. Nevertheless, folic acid in-
takes of most women were within the recommended
threshold or above the UL. Finally, nearly 60% of women had
weight concerns, although most had a BMI within normal
ranges. A more in-depth evaluation of women’s weight concerns
may be important, considering its close association
with BMI in preconception. In the context of preconception
care and providing support for a healthy body weight, efforts
should be oriented toward the improvement of women’s
positive body image, PA levels, and dietary intake, in align-
ment with current preconception care guidelines.

References
to improve nutrition and health behaviours before conception.
health around the time of conception: causes and consequences.


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STATEMENT OF POTENTIAL CONFLICT OF INTEREST
No potential conflict of interest was reported by the authors.

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AUTHOR CONTRIBUTIONS
A.-S. Morisset, J. Robitaille, and S. Lemieux conceptualized and designed the study; A.-S. Laurent, C. Savard, A.-S. Plante, and M. Gagnon collected the data; A.-S. Laurent carried out the statistical analyses and drafted the initial manuscript with major contributions from all other authors; A.-S. Morisset coordinated and supervised data collection. All authors reviewed and commented on subsequent drafts of the manuscript.
Changes in Food and Nutrient Intake and Diet Quality on a Low-Fat Vegan Diet Are Associated with Changes in Body Weight, Body Composition, and Insulin Sensitivity in Overweight Adults: A Randomized Clinical Trial

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ABSTRACT

Background Consuming different food groups and nutrients can have differential effects on body weight, body composition, and insulin sensitivity.

Objective The aim was to identify how food group, nutrient intake, and diet quality change relative to usual-diet controls after 16 weeks on a low-fat vegan diet and what associations those changes have with changes in body weight, body composition, and measures of metabolic health.

Design Secondary analysis of a randomized clinical trial conducted between October 2016 and December 2018 in four replications.

Participants/setting Participants included in this analysis were 219 healthy, community-based adults in the Washington, DC, area, with a body mass index (BMI) between 28 and 40, who were randomly assigned to either follow a low-fat vegan diet or make no diet changes.

Intervention A low-fat, vegan diet deriving approximately 10% of energy from fat, with weekly classes including dietary instruction, group discussion, and education on the health effects of plant-based nutrition. Control group participants continued their usual diets.

Main outcome measures Changes in food group intake, macronutrient and micronutrient intake, and dietary quality as measured by Alternate Healthy Eating Index-2010 (AHEI-2010), analyzed from 3-day diet records, and associations with changes in body weight, body composition, and insulin sensitivity were assessed.

Statistical analyses performed A repeated-measure analysis of variance model that included the factors group, subject, and time was used to test the between-group differences throughout the 16-week study. Interaction between group and time was calculated for each variable. Within each diet group, paired comparison t tests were calculated to identify significant changes from baseline to 16 weeks. Spearman correlations were calculated for the relationship between changes in food group intake, nutrient intake, AHEI-2010 score, and changes in body weight, body composition, and insulin sensitivity. The relative contribution of food groups and nutrients to weight loss was evaluated using linear regression.

Results Fruit, vegetable, legume, meat alternative, and whole grain intake significantly increased in the vegan group. Intake of meat, fish, and poultry; dairy products; eggs; nuts and seeds; and added fats decreased. Decreased weight was most associated with increased intake of legumes ($r = -0.38; P < 0.0001$) and decreased intake of total meat, fish, and poultry ($r = +0.43; P < 0.0001$). Those consuming a low-fat vegan diet also increased their intake of carbohydrates, fiber, and several micronutrients and decreased fat intake. Reduced fat intake was associated with reduced body weight ($r = +0.15; P = 0.02$) and, after adjustment for changes in BMI and energy intake, with reduced fat mass ($r = +0.14; P = 0.04$). The intervention group’s AHEI-2010 increased by 6.0 points on average, in contrast to no significant change in the control group (treatment effect, +7.2
LOW-FAT VEGAN AND VEGETARIAN DIETS HAVE BEEN consistently shown to reduce body weight and increase insulin sensitivity in randomized trials up to 74 weeks long. Such diets necessarily change the types and amounts of food groups consumed; reduce intakes of energy, fat, and protein; increase intakes of carbohydrate and fiber; and modify the intake of many micronutrients, raising the question as to which of these changes is responsible for the observed metabolic effects.

Meta-analyses of prospective studies analyzing food group intakes have found a lower risk of chronic disease and improved intermediate disease markers with decreased consumption of food groups such as red and processed meat and eggs, and increased intakes of fruits, vegetables, legumes, whole grains, and nuts. A low-fat vegan diet is characterized by the elimination of animal products and minimization of oil, nuts, and seeds; thus, the diet is predominantly made up of fruits, vegetables, whole grains, and legumes. A low-fat vegan diet would thus likely change food group intake in ways that may be protective.

Diet quality, estimated by the Alternative Healthy Eating Index (AHEI), has been shown to significantly improve on a low-fat vegan diet. Higher AHEI scores have been associated with lower risk of chronic disease, including cardiovascular disease, diabetes, and total and cardiovascular mortality.

The aim of this secondary analysis of data from a 16-week randomized clinical trial in overweight adults was to determine the effects of a low-fat vegan diet on food group intake, nutrient intake, and diet quality, and to identify potential associations with changes in body weight, body composition, and insulin sensitivity. It was hypothesized that consuming a low-fat vegan diet would increase food groups representing fiber-rich plant foods, decrease food groups representing animal products and refined foods, change nutrient intake, and improve diet quality as measured by AHEI-2010. It was also hypothesized that these changes would be associated with improvements in body weight, body composition, and insulin sensitivity.

METHODS
Study Design and Eligibility
Methods and the primary outcomes (body weight, insulin sensitivity, postprandial metabolism, and intramyocellular and hepatocellular lipid levels) have been described in detail previously. The study was conducted between October 2016 and December 2018 in Washington, DC, in four replications.

Randomization and Study Groups
The participants were randomly assigned in a 1:1 ratio to an intervention group (n = 122) or a control group (n = 122). The intervention group was asked to follow a low-fat vegan diet, without energy restriction, consisting of vegetables, grains, legumes, and fruits and to avoid animal products and

RESEARCH SNAPSHOT
Research Question: How do food group intake, nutrient intake, and diet quality change relative to usual-diet controls after 16 weeks on a low-fat vegan diet, and what associations do these changes have with body weight, body composition, and measures of metabolic health?

Key Findings: Intake of fruits, vegetables, legumes, meat alternatives, and whole grains increased, while consumption of animal foods, nuts and seeds, and added fats decreased on a low-fat vegan diet. Intake of carbohydrates, fiber, and several micronutrients also increased, and diet quality improved, as measured by the Alternative Healthy Eating Index 2010 (AHEI-2010). Increases in fruit, legume, meat alternative, and whole grain intake and decreases in animal products, added oils, and animal fats were associated with weight loss. Increases in AHEI-2010 scores were associated with decreases in body weight, fat mass, and insulin resistance after adjustment for changes in energy intake.

using a single-center, randomized, open parallel design. Otherwise healthy individuals with a body mass index (BMI) between 28 and 40 were enrolled. Exclusion criteria were history of diabetes, smoking, or alcohol or drug abuse; expected pregnancy or lactation; and current use of a vegan diet. From 3,115 people screened over the phone, 244 completed the baseline assessment and were randomized. Of 244 participants who were randomized, 91% (n = 222) completed the entire study, and food record data were available at both baseline and 16 weeks for 90% (n = 219). Only those with food records available were included in this analysis (n = 219; 117 in the vegan group and 102 in the control group). Enrollment and study completion are shown in Figure 1. The study protocol was approved by the Chesapeake Institutional Review Board. All participants gave written informed consent. Trial Registration was ClinicalTrials.gov number NCT02939638.

added fats. They received weekly 1-hour classes in the research center in Washington, DC, where the research staff (physicians, registered dietitians, and study coordinators) provided diet instruction, recipes, and group discussion. Attendance in the classes was recorded, and weekly weights were monitored but not considered in the data analysis. Daily fat intake was limited to 20 to 30 g. No meals were provided. Vitamin B₁₂ was supplemented.

Control group participants were asked to maintain their current diets, which typically included animal products, and they received no classes. In both groups, alcoholic beverages were limited to one per day for women and two per day for men. Participants were examined at baseline and 16 weeks.

Dietary Intake, Physical Activity, and Anthropometrics

A 3-day dietary record (2 weekdays and 1 weekend day) was completed at baseline and at 16 weeks. The participants were asked to list all the foods and beverages consumed within the 3 days and estimate the amounts consumed. The diet records were reviewed by registered dietitians and research staff trained in Nutrition Data System for Research (NDSR) software. To reflect the marketplace throughout the study, dietary intake data were collected using NDSR software versions 2016, 2017, and 2018, developed by the Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN. Final calculations were completed at the end of each
<table>
<thead>
<tr>
<th>Reported food group</th>
<th>Subgroups included&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit juice</td>
<td>FRU0100: Citrus juice</td>
</tr>
<tr>
<td></td>
<td>FRU0200: Fruit juice excluding citrus juice</td>
</tr>
<tr>
<td>Whole fruit</td>
<td>FRU0300: Citrus fruit</td>
</tr>
<tr>
<td></td>
<td>FRU0400: Fruit excluding citrus fruit</td>
</tr>
<tr>
<td>Avocado</td>
<td>FRU0500: Avocado and similar</td>
</tr>
<tr>
<td>Dark green vegetables</td>
<td>VEG0100: Dark green vegetables</td>
</tr>
<tr>
<td>Total nonstarchy vegetables (nonfried)</td>
<td>VEG0100: Dark green vegetables</td>
</tr>
<tr>
<td></td>
<td>VEG0200: Deep yellow vegetables</td>
</tr>
<tr>
<td></td>
<td>VEG0300: Tomato</td>
</tr>
<tr>
<td></td>
<td>VEG0600: Other vegetables</td>
</tr>
<tr>
<td>Total starchy vegetables (nonfried)</td>
<td>VEG0400: White potatoes</td>
</tr>
<tr>
<td></td>
<td>VEG0450: Other starchy vegetables (eg, cassava, corn, green peas, jicama)</td>
</tr>
<tr>
<td>Total fried vegetables</td>
<td>VEG0900: Fried vegetables</td>
</tr>
<tr>
<td></td>
<td>VEG0800: Fried potatoes</td>
</tr>
<tr>
<td>Legumes</td>
<td>VEG0700: Legumes (cooked dried beans; excludes soy products)</td>
</tr>
<tr>
<td>Meat alternatives</td>
<td>MOF0700: Meat alternatives (includes veggie burgers, tofu, tempeh, TVP, soynuts)</td>
</tr>
<tr>
<td>Total legumes and meat alternatives</td>
<td>VEG0700: Legumes</td>
</tr>
<tr>
<td></td>
<td>MOF0700: Meat alternatives</td>
</tr>
<tr>
<td>Whole grains&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Whole grains (ounce equivalents)</td>
</tr>
<tr>
<td>Refined grains&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Refined grains (ounce equivalents)</td>
</tr>
<tr>
<td>Nuts and seeds</td>
<td>MOF0500: Nuts and seeds</td>
</tr>
<tr>
<td></td>
<td>MOF0600: Nut and seed butters</td>
</tr>
<tr>
<td>Eggs</td>
<td>MOF0300: Eggs</td>
</tr>
<tr>
<td>Total high-fat dairy (&lt;2% fat by weight)</td>
<td>DMF0100: Milk—whole (3.5%)</td>
</tr>
<tr>
<td></td>
<td>DMR0100: Milk—reduced fat (2%)</td>
</tr>
<tr>
<td></td>
<td>DCF0100: Cheese—full fat</td>
</tr>
<tr>
<td></td>
<td>DCR0100: Cheese—reduced fat (natural and processed (8%–16%), part skim mozzarella, 2% cottage)</td>
</tr>
<tr>
<td></td>
<td>FCF0100: Cream (light [20%], regular whipping [31%], heavy whipping [37%], regular sour cream)</td>
</tr>
<tr>
<td></td>
<td>FCR0100: Cream—reduced fat (half and half [10%–12%], sour half and half, reduced fat sour cream)</td>
</tr>
<tr>
<td></td>
<td>DYF0100: Yogurt—sweetened whole milk (3%–4% fat)</td>
</tr>
<tr>
<td>Total low-fat dairy (&lt;2% fat by weight)</td>
<td>DYF0200: Yogurt—artificially sweetened whole milk</td>
</tr>
<tr>
<td>Total meat</td>
<td></td>
</tr>
</tbody>
</table>

<sup>b</sup> Subgroups contained within food groups reported in a 16-week clinical trial of 219 overweight adults comparing a low-fat vegan diet with usual diet.

Figure 2. Subgroups contained within food groups reported in a 16-week clinical trial of 219 overweight adults comparing a low-fat vegan diet with usual diet.
replication with the same NDSR version used for collection. For food items missing from the program, a data entry was created to match the macronutrient content and the source of the macronutrients in the given food. Selected individual food subgroups output by NDSR were combined for analysis, as described in Figure 2. Included were food groups linked to health outcomes, for example, as described in the 2015-2020 Dietary Guidelines for Americans (eg, vegetables, fruits, whole and refined grains, dairy, protein foods, and oils) or subgroups within these groups (eg, dark green vegetables, legumes, high-fat dairy, low-fat dairy), as well as other food subgroups likely to change when consuming a low-fat vegan diet (eg, meat, fish, poultry, soy-based meat alternatives, starchy vegetables, fried vegetables). In NDSR, serving sizes are based on the 2000 Dietary Guidelines for Americans, except for those foods not included in the recommendations, for which Food and Drug Administration serving sizes have been used. Whole and refined grain ounce-equivalents are defined per the USDA Food Patterns Equivalents Database.

AHEI-2010, the most recent update of the AHEI, was used to evaluate diet quality in this vegan diet intervention, because, unlike the Healthy Eating Index, AHEI separately

<table>
<thead>
<tr>
<th>Reported food group</th>
<th>Subgroups included.b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total fish and shellfish</td>
<td>MFF0100: Fish—fresh and smoked</td>
</tr>
<tr>
<td></td>
<td>MFL0100: Lean fish—fresh and smoked (&lt;10% fat)</td>
</tr>
<tr>
<td></td>
<td>MSL0100: Shellfish</td>
</tr>
<tr>
<td></td>
<td>MFF0200: Fried fish—commercial entrée and fast food</td>
</tr>
<tr>
<td></td>
<td>MSF0100: Fried shellfish—commercial entrée and fast food</td>
</tr>
<tr>
<td>Total poultry</td>
<td>MPF0100: Poultry</td>
</tr>
<tr>
<td></td>
<td>MPL0100: Lean poultry (≤10% fat)</td>
</tr>
<tr>
<td></td>
<td>MPF0200: Fried poultry</td>
</tr>
<tr>
<td>Total meat, fish, and poultry</td>
<td>Total meat</td>
</tr>
<tr>
<td></td>
<td>Total fish</td>
</tr>
<tr>
<td></td>
<td>Total poultry</td>
</tr>
<tr>
<td>Added sugars</td>
<td>Added sugars (grams, by total sugars)</td>
</tr>
<tr>
<td>Added oils</td>
<td>FOF0100: Oil (including sprays)</td>
</tr>
<tr>
<td></td>
<td>FDF0100: Salad dressing—regular</td>
</tr>
<tr>
<td>Added animal fats</td>
<td>FAF0100: Butter and other animal fats—regular</td>
</tr>
<tr>
<td></td>
<td>FAR0100: Butter and other animal fats—reduced fat</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reported food group</th>
<th>Subgroups included.b</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOFO0100: Organ meats</td>
<td></td>
</tr>
<tr>
<td>MCF0100: Cold cuts and sausage (fresh and cured)</td>
<td></td>
</tr>
<tr>
<td>MRFO0100: Beef</td>
<td></td>
</tr>
<tr>
<td>MRFO200: Veal</td>
<td></td>
</tr>
<tr>
<td>MRFO300: Lamb</td>
<td></td>
</tr>
<tr>
<td>MRFO400: Fresh pork</td>
<td></td>
</tr>
<tr>
<td>MCF0200: Cured pork</td>
<td></td>
</tr>
<tr>
<td>MCL0100: Lean cold cuts and sausage (fresh and cured, ≤10% fat)</td>
<td></td>
</tr>
<tr>
<td>MRL0100: Lean beef (≤10% fat)</td>
<td></td>
</tr>
<tr>
<td>MRL0200: Lean veal (≤10% fat)</td>
<td></td>
</tr>
<tr>
<td>MRL0400: Lean fresh pork (≤10% fat)</td>
<td></td>
</tr>
<tr>
<td>MCL0200: Lean cured pork (≤10% fat)</td>
<td></td>
</tr>
<tr>
<td>MRL0300: Lean lamb (≤10% fat)</td>
<td></td>
</tr>
<tr>
<td>MRFO500: Game</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2. (continued) Subgroups contained within food groups reported in a 16-week clinical trial of 219 overweight adults comparing a low-fat vegan diet with usual diet.

Note: Unless otherwise noted, food subgroups listed are defined by the Nutrition Coordinating Center (NCC) Food Group Serving Count System within the Nutrition Data System for Research (NDSR), version 2017, with serving sizes based on the 2000 Dietary Guidelines for Americans or Food and Drug Administration (FDA) Guidelines.16

bUnited States Department of Agriculture (USDA) Food Pattern equivalents, as described in (NCC) Food Group Serving Count System within the Nutrition Data System for Research (NDSR), version 2017.
Physical activity was assessed by the International Physical Activity Questionnaire and a periodically calibrated scale accurate to 0.1 kg in light clothing without shoes. Body composition was assessed using a dual-energy X-ray absorptiometry scan (GE Healthcare, Chicago, IL).

Plasma concentrations of glucose, immunoreactive insulin, and C-peptide were assessed at 0, 30, 60, 120, and 180 minutes after stimulation with a liquid breakfast (Boost Plus, Nestle, Vevey, Switzerland; 720 kcal, 34% of energy from fat, 16% protein, 50% carbohydrate). Serum glucose was analyzed using the Hexokinase UV endpoint method (Roche, Basel, Switzerland). Plasma immunoreactive insulin and C-peptide concentrations were determined using insulin and C-peptide electro-chemiluminescence immunoassay kits (Roche, Basel, Switzerland). PREDicted M (PREDIM) index was calculated as a measure of dynamic postprandial insulin sensitivity and has been previously validated against clamp-derived measures of insulin sensitivity. The Homeostasis Model Assessment (HOMA-IR) index was used to assess insulin resistance while fasting.

### Statistical Analysis

The analysis included all participants with available data for both baseline and 16 weeks for each outcome analyzed ($n = 219$). Data were assessed for approximate normality. A repeated-measure analysis of variance model that included the factors group, subject, and time was used to test the between-group differences throughout the 16-week study. Interaction between group and time was calculated for each variable. The treatment effect size is the difference in outcomes, from baseline to week 16, between the vegan and control groups. Within each diet group, paired comparison $t$ tests were calculated to test whether the change from baseline to 16 weeks was significantly different from 0. Spearman correlations were calculated for the relationship between changes in food group intake, nutrient intake, AHEI-2010 score, and changes in body weight, body composition, and insulin sensitivity. For the food group analysis, Bonferroni correction for multiple comparisons was used for four outcomes in 24 food groups, first unadjusted, then adjusted for changes in BMI and energy intake, at $P = 0.05/(4 \times 24 \times 2) = 0.0003$. The relative contribution of food groups and macronutrients to weight loss was evaluated

### Outcomes

All measurements were performed at baseline and 16 weeks on an outpatient basis after a 10- to 12-hour overnight water-only fast. Height and weight were measured using a stadiometer and a periodically calibrated scale accurate to 0.1 kg in light clothing without shoes. Body composition was assessed using a dual-energy X-ray absorptiometry scan (GE Healthcare, Chicago, IL).

### Table 1. Relative contribution of food groups to weight loss for food groups with significant correlations with changes in body weight in 219 overweight adults in a 16-week clinical trial comparing a low-fat vegan diet with usual diet$^a$

<table>
<thead>
<tr>
<th>Food group</th>
<th>Parameter estimate for a 1-kg weight loss</th>
<th>Parameter estimate for a 1-kg weight loss, adjusted for energy intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole fruit</td>
<td>$+3.3; P = 0.02$</td>
<td>$+3.3; P = 0.02$</td>
</tr>
<tr>
<td>Legumes</td>
<td>$+1.5; P = 0.01$</td>
<td>$+1.4; P = 0.02$</td>
</tr>
<tr>
<td>Total meat, fish, and poultry</td>
<td>$-2.6; P &lt; 0.001$</td>
<td>$-2.7; P &lt; 0.001$</td>
</tr>
<tr>
<td>High-fat dairy</td>
<td>$-2.2; P = 0.02$</td>
<td>$-2.4; P = 0.04$</td>
</tr>
<tr>
<td>Added oils</td>
<td>$-2.4; P = 0.002$</td>
<td>$-2.6; P = 0.006$</td>
</tr>
</tbody>
</table>

$^a$A multivariable model was used to determine the relative contribution of food groups to weight loss. Results are presented as a change in daily serving intake associated with a 1-kg decrease in body weight, for each food group included in the final multivariable regression model. Results are presented first unadjusted, and then adjusted for energy intake.

AHEI may also predict type 2 diabetes as well as or better than the Healthy Eating Index, suggesting AHEI may be more relevant to insulin resistance, one of the outcomes of interest.

AHEI-2010 scores were calculated for each participant in the following categories: vegetables (servings/day), fruit (servings/day), whole grains (servings/day), sugar-sweetened beverages and fruit juice (servings/day), nuts and legumes (servings/day), red or processed meat (servings/day), trans fat (percentage of energy), and sodium (mg/day). Each of these categories received a score ranging from 0 to 10.

Alcohol use was not included in the analysis, because both groups were instructed to limit alcohol intake.

All study participants were asked not to alter their exercise habits and to continue their preexisting medication regimens for the duration of the study, except as modified by their personal physicians. Medication and supplement use was evaluated at baseline and week 16, and the participants were asked to report any changes that occurred during the study.

Physical activity was assessed by the International Physical Activity Questionnaire.

### Table 2. Relative contribution of food groups and macronutrients to weight loss for food groups and macronutrients with significant correlations with changes in body weight in 219 overweight adults in a 16-week clinical trial comparing a low-fat vegan diet with usual diet$^a$

<table>
<thead>
<tr>
<th>Food group</th>
<th>Parameter estimate for a 1-kg weight loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total meat, fish, and poultry</td>
<td>$-3.0; P = 0.005$</td>
</tr>
<tr>
<td>High-fat dairy</td>
<td>$-2.8; P = 0.09$</td>
</tr>
<tr>
<td>Added oils</td>
<td>$-3.9; P = 0.08$</td>
</tr>
<tr>
<td>Total fat (g/day)</td>
<td>$-30.8; P = 0.006$</td>
</tr>
<tr>
<td>Total fiber (g/day)</td>
<td>$+13.9; P &lt; 0.001$</td>
</tr>
<tr>
<td>Total cholesterol (mg/day)</td>
<td>$+290.7; P = 0.12$</td>
</tr>
</tbody>
</table>

$^a$A multivariable model was used to determine the relative contribution of food groups and macronutrients to weight loss. The results are presented as a change in daily serving intake (or in otherwise specified units) associated with a 1-kg decrease in body weight, for each variable included in the final multivariable regression model.
using linear regression. Stepwise model selection, entering the most strongly predictive candidate factor with a P-value < 0.15 for entry into the current model, was used to construct multivariable models shown in Tables 1 and 2. Change in energy intake was forced into models denoted as energy-intake adjusted.

**RESULTS**

**Participant Characteristics**

Baseline characteristics of participants who completed the study and provided both baseline and 16-week food records (n = 219) are shown in Table 3. Most participants were...
Table 4. Changes in food group intake, nutrient intake, and AHEI-2010 with body weight and composition, and metabolic outcomes in 219 overweight adults in a 16-week clinical trial comparing a low-fat vegan diet to usual diet<sup>a</sup>

<table>
<thead>
<tr>
<th>Anthropometrics</th>
<th>Control Group</th>
<th>Vegan Group</th>
<th>Treatment Effect&lt;sup&gt;b&lt;/sup&gt;</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Week 16</td>
<td>Baseline</td>
<td>Week 16</td>
</tr>
<tr>
<td>Body weight (kg)</td>
<td>92.7 (90.0-95.4)</td>
<td>92.2 (89.5-95.0)</td>
<td>93.6 (91.1-96.1)</td>
<td>87.2 (84.9-89.6)***</td>
</tr>
<tr>
<td>BMI&lt;sup&gt;e&lt;/sup&gt;</td>
<td>33.7 (32.9-34.4)</td>
<td>33.5 (32.7-34.2)</td>
<td>33.3 (32.6-34.0)</td>
<td>31.1 (30.4-31.8)***</td>
</tr>
<tr>
<td>Fat mass (kg)</td>
<td>41.1 (39.2-43.0)</td>
<td>41.1 (39.2-43.1)</td>
<td>40.5 (38.8-42.2)</td>
<td>36.5 (34.8-38.2)***</td>
</tr>
<tr>
<td>VAT&lt;sup&gt;d&lt;/sup&gt; volume (cm&lt;sup&gt;3&lt;/sup&gt;)</td>
<td>1,538.9 (1,360.5-1,717.4)</td>
<td>1,549.8 (1,367.8-1,731.8)</td>
<td>1,439.8 (1,271.1-1,608.6)</td>
<td>1,212.4 (1,067.8-1,356.9)***</td>
</tr>
</tbody>
</table>

Insulin Resistance

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>Vegan Group</th>
<th>Treatment Effect&lt;sup&gt;b&lt;/sup&gt;</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOMA&lt;sup&gt;c&lt;/sup&gt; (dimensionless)</td>
<td>2.7 (2.3-3.1)</td>
<td>3.2 (2.4-4.0)</td>
<td>3.2 (2.7-3.6)</td>
<td>2.4 (1.9-2.8)**</td>
</tr>
<tr>
<td>PREDIM&lt;sup&gt;f&lt;/sup&gt;</td>
<td>4.39 (4.07-4.71)</td>
<td>4.20 (3.86-4.53)</td>
<td>4.05 (3.79-4.31)</td>
<td>4.74 (4.43-5.04)**</td>
</tr>
</tbody>
</table>

Physical Activity

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>Vegan Group</th>
<th>Treatment Effect&lt;sup&gt;b&lt;/sup&gt;</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical activity (MET min/week&lt;sup&gt;i&lt;/sup&gt;)</td>
<td>2,851.0 (2,213.1-3,488.9)</td>
<td>2,218.9 (1,651.3-2,786.5)</td>
<td>2,915.6 (1,916.2-3,914.9)</td>
<td>2,271.6 (1,738.9-2,804.3)</td>
</tr>
</tbody>
</table>

Food Group Intake<sup>h,i</sup>

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Week 16</th>
<th>Baseline</th>
<th>Week 16</th>
<th>Treatment Effect&lt;sup&gt;b&lt;/sup&gt;</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit juice</td>
<td>0.3 (0.2-0.4)</td>
<td>0.2 (0.1-0.3)</td>
<td>0.2 (0.1-0.3)</td>
<td>0.3 (0.2-0.4)</td>
<td>+0.1 (−0.1 to +0.3)</td>
<td>0.265</td>
</tr>
<tr>
<td>Whole fruit</td>
<td>1.4 (1.2-1.6)</td>
<td>1.6 (1.2-2.0)</td>
<td>1.5 (1.2-1.8)</td>
<td>2.5 (2.2-2.8)**</td>
<td>+0.7 (+0.2 to +1.3)</td>
<td>0.008</td>
</tr>
<tr>
<td>Avocado</td>
<td>0.1 (0.1-0.2)</td>
<td>0.1 (0.1-0.1)</td>
<td>0.1 (0.1-0.1)</td>
<td>0.0 (0.0-0.0)***</td>
<td>−0.1 (−0.1 to 0.0)</td>
<td>0.049</td>
</tr>
<tr>
<td>Dark green vegetables</td>
<td>1.1 (0.8-1.4)</td>
<td>1.1 (0.9-1.3)</td>
<td>1.0 (0.8-1.2)</td>
<td>1.2 (1.0-1.4)</td>
<td>+0.1 (−0.3 to +0.5)</td>
<td>0.530</td>
</tr>
<tr>
<td>Total nonstarchy vegetables—nonfried</td>
<td>3.4 (2.9-3.8)</td>
<td>3.5 (3.1-3.8)</td>
<td>3.3 (2.9-3.6)</td>
<td>4.4 (4.0-4.9)**</td>
<td>+1.1 (+0.4 to +1.8)</td>
<td>0.003</td>
</tr>
<tr>
<td>Total starchy vegetables—nonfried</td>
<td>0.3 (0.2-0.4)</td>
<td>0.3 (0.2-0.4)</td>
<td>0.3 (0.2-0.4)</td>
<td>0.6 (0.4-0.7)**</td>
<td>+0.3 (+0.1 to +0.5)</td>
<td>0.005</td>
</tr>
<tr>
<td>Total fried vegetables</td>
<td>0.1 (0.1-0.2)</td>
<td>0.1 (0.1-0.2)</td>
<td>0.2 (0.1-0.3)</td>
<td>0.1 (0.0-0.1)*</td>
<td>−0.1 (−0.3 to 0.0)</td>
<td>0.017</td>
</tr>
<tr>
<td>Legumes</td>
<td>0.4 (0.3-0.5)</td>
<td>0.4 (0.3-0.5)</td>
<td>0.4 (0.3-0.5)</td>
<td>1.1 (0.9-1.3)**</td>
<td>+0.8 (+0.5 to +1.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Meat alternatives</td>
<td>0.4 (0.2-0.6)</td>
<td>0.4 (0.2-0.6)</td>
<td>0.4 (0.2-0.5)</td>
<td>1.3 (1.0-1.6)**</td>
<td>+1.0 (+0.6 to +1.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total legumes and meat alternatives</td>
<td>0.8 (0.6-1.1)</td>
<td>0.7 (0.5-1.0)</td>
<td>0.7 (0.5-1.0)</td>
<td>2.4 (2.0-2.7)</td>
<td>+1.7 (+1.3 to +2.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Whole grains (oz eq)</td>
<td>2.0 (1.7-2.3)</td>
<td>1.6 (1.3-1.9)*</td>
<td>1.8 (1.6-2.1)</td>
<td>2.9 (2.6-3.3)**</td>
<td>+1.5 (+1.0 to +2.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Refined grains (oz eq)</td>
<td>3.8 (3.3-4.2)</td>
<td>3.5 (3.1-4.0)</td>
<td>4.4 (3.9-4.9)</td>
<td>3.6 (3.1-4.0)**</td>
<td>−0.6 (−1.4 to +0.2)</td>
<td>0.160</td>
</tr>
<tr>
<td>Nuts and seeds</td>
<td>1.0 (0.7-1.3)</td>
<td>0.9 (0.6-1.1)</td>
<td>0.9 (0.6-1.2)</td>
<td>0.2 (0.1-0.3)**</td>
<td>−0.6 (−1.1 to −0.2)</td>
<td>0.006</td>
</tr>
</tbody>
</table>

(continued on next page)
Table 4. Changes in food group intake, nutrient intake, and AHEI-2010 with body weight and composition, and metabolic outcomes in 219 overweight adults in a 16-week clinical trial comparing a low-fat vegan diet to usual diet (continued)

<table>
<thead>
<tr>
<th>Nut and seed butters</th>
<th>Control Group</th>
<th>Week 16</th>
<th>Vegan Group</th>
<th>Week 16</th>
<th>Treatment Effect</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nut and seed butters</td>
<td>0.3 (0.2-0.5)</td>
<td>0.2 (0.2-0.3)</td>
<td>0.2 (0.1-0.2)</td>
<td>0.1 (0.1-0.2)</td>
<td>+0.1 (-0.1 to +0.2)</td>
<td>0.608</td>
</tr>
<tr>
<td>Eggs</td>
<td>0.6 (0.4-0.7)</td>
<td>0.5 (0.4-0.7)</td>
<td>0.6 (0.4-0.7)</td>
<td>0.0 (0.0-0.0)**</td>
<td>-0.5 (-0.7 to -0.3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total high-fat dairy</td>
<td>1.0 (0.8-1.2)</td>
<td>0.8 (0.6-1.0)</td>
<td>1.2 (0.9-1.4)</td>
<td>0.0 (0.0-0.0)**</td>
<td>-0.9 (-1.3 to -0.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total low-fat dairy</td>
<td>0.2 (0.1-0.2)</td>
<td>0.2 (0.1-0.3)*</td>
<td>0.2 (0.1-0.4)</td>
<td>0.0 (0.0-0.0)**</td>
<td>-0.3 (-0.4 to -0.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total meat (oz)</td>
<td>1.2 (0.9-1.5)</td>
<td>1.3 (1.0-1.6)</td>
<td>1.0 (0.8-1.2)</td>
<td>0.0 (0.0-0.0)**</td>
<td>-1.1 (-1.5 to -0.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total fish and shellfish (oz)</td>
<td>0.8 (0.6-1.0)</td>
<td>0.9 (0.6-1.2)</td>
<td>0.9 (0.6-1.1)</td>
<td>0.0 (0.0-0.1)**</td>
<td>-1.0 (-1.4 to -0.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total poultry (oz)</td>
<td>1.4 (1.1-1.7)</td>
<td>1.3 (1.0-1.6)</td>
<td>1.6 (1.3-1.9)</td>
<td>0.0 (0.0-0.0)**</td>
<td>-1.5 (-2.0 to -1.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total meat, fish, and poultry (oz)</td>
<td>3.4 (3.0-3.8)</td>
<td>3.5 (3.0-4.0)</td>
<td>3.5 (3.0-3.9)</td>
<td>0.1 (0.0-0.1)**</td>
<td>-3.5 (-4.2 to -2.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Added sugars (g)</td>
<td>40.9 (34.2-47.6)</td>
<td>38.0 (31.5-44.4)</td>
<td>42.9 (36.3-49.5)</td>
<td>29.4 (25.3-33.4)**</td>
<td>-10.6 (-19.5 to -1.6)</td>
<td>0.021</td>
</tr>
<tr>
<td>Added oils</td>
<td>1.9 (1.6-2.2)</td>
<td>2.1 (1.8-2.4)</td>
<td>2.1 (1.8-2.4)</td>
<td>1.0 (0.8-1.2)**</td>
<td>-1.4 (-1.9 to -0.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Added animal fats</td>
<td>0.7 (0.4-1.0)</td>
<td>0.8 (0.4-1.2)</td>
<td>0.7 (0.4-0.9)</td>
<td>0.0 (0.0-0.1)**</td>
<td>-0.7 (-1.1 to -0.3)</td>
<td>0.002</td>
</tr>
</tbody>
</table>

**Macronutrient Intake**

| Energy (kcal)         | 1,790 (1,666-1,914) | 1,656 (1,546-1,766)* | 1,834 (1,729-1,940) | 1,343 (1,259-1,427)** | -357 (-522 to -192) | P < 0.001 |
| Total fat (g)         | 76 (69-83) | 70 (63-76) | 75 (70-80) | 26 (24-28)** | -43 (-51 to -35) | P < 0.001 |
| Total carbohydrate (g) | 208 (193-222) | 193 (179-207)* | 220 (206-235) | 244 (227-260)** | +38 (+14 to +62) | P = 0.002 |
| Total protein (g)     | 70 (65-75) | 68 (63-73) | 71 (67-76) | 45 (42-49)** | -24 (-31 to -17) | P < 0.001 |
| Animal protein (g)    | 40 (36-44) | 39 (35-44) | 41 (37-44) | 2 (1-3)** | -38 (-45 to -32) | P < 0.001 |
| Vegetable protein (g) | 30 (28-32) | 29 (26-31) | 31 (28-33) | 44 (40-47)** | +14 (+10 to +18) | P < 0.001 |
| Alcohol (g)           | 6 (4-9) | 4 (3-6)* | 5 (3-7) | 3 (2-4)** | -1 (-3 to +2) | P = 0.64 |
| Cholesterol (mg)      | 247 (214-280) | 233 (198-267) | 239 (212-265) | 6 (4-7)** | -219 (-265 to -173) | P < 0.001 |
| Total SFA1 (g)        | 23 (20-25) | 21 (18-23) | 24 (21-26) | 5 (5-6)** | -16 (-20 to -13) | P < 0.001 |
| Total MUFA2 (g)       | 28 (25-31) | 25 (23-28)* | 27 (25-29) | 8 (8-9)** | -16 (-19 to -13) | P < 0.001 |
| Total PUFA (g)        | 19 (17-21) | 18 (16-20) | 18 (17-20) | 10 (9-10)** | -8 (-10 to -5) | P < 0.001 |
| Total fiber (g)       | 24 (22-26) | 23 (21-25) | 24 (22-26) | 35 (32-37)** | +11 (+8 to +15) | P < 0.001 |
| Soluble fiber (g)     | 6 (6-7) | 7 (6-7)* | 7 (6-7) | 9 (8-10)** | +2 (0 to +3) | P = 0.004 |
| Insoluble fiber (g)   | 18 (16-19) | 16 (15-18) | 17 (16-19) | 26 (24-27)** | +10 (+7 to +12) | P < 0.001 |

(continued on next page)
Table 4. Changes in food group intake, nutrient intake, and AHEI-2010 with body weight and composition, and metabolic outcomes in 219 overweight adults in a 16-week clinical trial comparing a low-fat vegan diet to usual diet* (continued)

<table>
<thead>
<tr>
<th>Micronutrient Intake</th>
<th>Control Group</th>
<th>Vegan Group</th>
<th>Treatment Effect</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antioxidant vitamins</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total vitamin A activity (µg)</td>
<td>825 (711-939)</td>
<td>834 (748-921)</td>
<td>853 (766-939)</td>
<td>866 (756-977)</td>
</tr>
<tr>
<td>Beta-carotene equiv. (µg)</td>
<td>6,165 (4,857-7,473)</td>
<td>6,570 (5,569-7,571)</td>
<td>6,102 (5,106-7,098)</td>
<td>8,748 (7,435-10,061)***</td>
</tr>
<tr>
<td>Beta-carotene (µg)</td>
<td>5,703 (4,504-6,901)</td>
<td>6,021 (5,119-6,923)</td>
<td>5,639 (4,696-6,582)</td>
<td>8,026 (6,818-9,235)***</td>
</tr>
<tr>
<td>Retinol (µg)</td>
<td>311 (274-349)</td>
<td>287 (252-322)</td>
<td>344 (301-388)</td>
<td>137 (107-167)***</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>90 (79-102)</td>
<td>99 (81-117)</td>
<td>92 (82-103)</td>
<td>133 (117-150)***</td>
</tr>
<tr>
<td>Vitamin E (IU)</td>
<td>16 (14-18)</td>
<td>16 (14-18)</td>
<td>17 (15-18)</td>
<td>14 (13-16)*</td>
</tr>
<tr>
<td>Vitamin K (µg)</td>
<td>217 (180-254)</td>
<td>222 (197-247)</td>
<td>252 (207-296)</td>
<td>276 (226-327)</td>
</tr>
<tr>
<td><strong>B vitamins</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin B6 (mg)</td>
<td>1.7 (1.5-1.8)</td>
<td>1.7 (1.5-1.8)</td>
<td>1.8 (1.7-1.9)</td>
<td>1.9 (1.6-2.3)</td>
</tr>
<tr>
<td>Vitamin B12 (µg)</td>
<td>3.1 (2.6-3.6)</td>
<td>3.1 (2.8-3.5)</td>
<td>3.3 (3.0-3.7)</td>
<td>1.2 (0.9-1.6)***</td>
</tr>
<tr>
<td>Total folate (µg)</td>
<td>390 (356-424)</td>
<td>377 (351-403)</td>
<td>402 (369-435)</td>
<td>484 (444-523)***</td>
</tr>
<tr>
<td>Natural folate (µg)</td>
<td>295 (264-326)</td>
<td>282 (259-305)</td>
<td>281 (255-308)</td>
<td>375 (340-410)***</td>
</tr>
<tr>
<td>Synthetic folate (µg)</td>
<td>95 (80-111)</td>
<td>95 (79-111)</td>
<td>121 (101-141)</td>
<td>109 (90-127)</td>
</tr>
<tr>
<td>Niacin (mg)</td>
<td>19.0 (17.7-20.4)</td>
<td>18.8 (17.5-20.0)</td>
<td>20.0 (18.7-21.4)</td>
<td>16.1 (13.9-18.3)**</td>
</tr>
<tr>
<td>Riboflavin (mg)</td>
<td>1.7 (1.6-1.8)</td>
<td>1.7 (1.6-1.8)</td>
<td>1.8 (1.6-1.9)</td>
<td>1.7 (1.3-2.0)</td>
</tr>
<tr>
<td>Thiamin (mg)</td>
<td>1.5 (1.4-1.6)</td>
<td>1.5 (1.4-1.6)</td>
<td>1.6 (1.4-1.7)</td>
<td>2.2 (1.8-2.5)***</td>
</tr>
<tr>
<td><strong>Minerals and vitamin D</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>737 (673-800)</td>
<td>721 (656-787)</td>
<td>793 (720-867)</td>
<td>623 (577-669)***</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>315 (291-339)</td>
<td>298 (276-320)</td>
<td>314 (292-336)</td>
<td>343 (321-365)*</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>1,123 (1,048-1,198)</td>
<td>1,085 (1,016-1,155)</td>
<td>1,143 (1,075-1,212)</td>
<td>875 (814-936)***</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>2,579 (2,399-2,759)</td>
<td>2,484 (2,342-2,626)</td>
<td>2,629 (2,475-2,784)</td>
<td>2,774 (2,592-2,956)</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>2,768 (2,563-2,972)</td>
<td>2,605 (2,394-2,815)</td>
<td>2,784 (2,593-2,975)</td>
<td>2,422 (2,229-2,614)***</td>
</tr>
<tr>
<td>Vitamin D (µg)</td>
<td>3.4 (2.8-3.9)</td>
<td>4.3 (3.5-5.1)</td>
<td>5.0 (4.0-5.9)</td>
<td>1.4 (1.1-1.7)***</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>13 (12-14)</td>
<td>12 (11-13)</td>
<td>14 (13-15)</td>
<td>15 (14-16)*</td>
</tr>
<tr>
<td>Manganese (mg)</td>
<td>4.2 (3.9-4.6)</td>
<td>3.9 (3.5-4.3)</td>
<td>4.2 (3.9-4.6)</td>
<td>5.7 (5.3-6.1)***</td>
</tr>
<tr>
<td>Selenium (mg)</td>
<td>98 (90-106)</td>
<td>94 (86-101)</td>
<td>99 (92-105)</td>
<td>64 (58-69)***</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>9.2 (8.4-10.1)</td>
<td>8.5 (7.9-9.2)</td>
<td>9.5 (8.7-10.2)</td>
<td>7.0 (6.5-7.5)***</td>
</tr>
</tbody>
</table>
Table 4. Changes in food group intake, nutrient intake, and AHEI-2010 with body weight and composition, and metabolic outcomes in 219 overweight adults in a 16-week clinical trial comparing a low-fat vegan diet to usual diet (continued)

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>Vegan Group</th>
<th>Treatment Effectb</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Week 16</td>
<td>Baseline</td>
<td>Week 16</td>
</tr>
<tr>
<td>Copper (mg)</td>
<td>1.38 (1.24-1.53)</td>
<td>1.32 (1.20-1.44)</td>
<td>1.43 (1.32-1.55)</td>
<td>1.59 (1.49-1.69)*</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caffeine (mg)</td>
<td>121 (102-140)</td>
<td>122 (99-144)</td>
<td>116 (96-136)</td>
<td>98 (79-118)*</td>
</tr>
<tr>
<td>Alternative Healthy Eating Index 2010 (AHEI-2010)m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AHEI total score</td>
<td>62.9 (60.3-65.5)</td>
<td>61.7 (59.1-64.3)</td>
<td>62.3 (59.9-64.7)</td>
<td>68.3 (67.0-69.7)***</td>
</tr>
<tr>
<td>AHEI fruits score</td>
<td>3.0 (2.5-3.4)</td>
<td>3.1 (2.5-3.6)</td>
<td>3.1 (2.6-3.6)</td>
<td>4.7 (4.2-5.2)***</td>
</tr>
<tr>
<td>AHEI vegetables score</td>
<td>7.5 (7.0-8.1)</td>
<td>8.0 (7.5-8.5)</td>
<td>7.7 (7.2-8.3)</td>
<td>8.9 (8.5-9.2)***</td>
</tr>
<tr>
<td>AHEI nuts and legumes score</td>
<td>6.9 (6.1-7.7)</td>
<td>6.5 (5.7-7.3)</td>
<td>6.5 (5.8-7.2)</td>
<td>9.1 (8.7-9.6)***</td>
</tr>
<tr>
<td>AHEI red/processed meat score</td>
<td>6.7 (5.9-7.4)</td>
<td>6.7 (5.9-7.4)</td>
<td>7.2 (6.6-7.8)</td>
<td>10.0 (10.0-10.0)***</td>
</tr>
<tr>
<td>AHEI trans fat score</td>
<td>8.7 (8.3-9.0)</td>
<td>8.8 (8.5-9.1)</td>
<td>8.7 (8.4-9.0)</td>
<td>9.9 (9.8-10.0)***</td>
</tr>
<tr>
<td>AHEI long-chain fatty acids score</td>
<td>3.8 (3.1-4.5)</td>
<td>3.9 (3.2-4.6)</td>
<td>4.3 (3.6-5.0)</td>
<td>0.2 (0.02-0.4)***</td>
</tr>
<tr>
<td>AHEI PUFA score</td>
<td>8.1 (7.7-8.5)</td>
<td>8.2 (7.8-8.6)</td>
<td>7.6 (7.2-8.0)</td>
<td>5.3 (4.7-5.8)***</td>
</tr>
<tr>
<td>AHEI sugar-sweetened beverages and fruit juice score</td>
<td>6.6 (5.8-7.4)</td>
<td>6.9 (6.1-7.7)</td>
<td>6.5 (5.7-7.3)</td>
<td>7.2 (6.5-7.9)</td>
</tr>
<tr>
<td>AHEI whole grains score</td>
<td>6.3 (5.7-7.0)</td>
<td>5.0 (4.3-5.7)**</td>
<td>5.6 (5.0-6.3)</td>
<td>7.9 (7.4-8.4)***</td>
</tr>
<tr>
<td>AHEI sodium score</td>
<td>5.0 (4.4-5.6)</td>
<td>4.7 (4.1-5.3)</td>
<td>5.0 (4.4-5.6)</td>
<td>5.3 (4.7-5.9)</td>
</tr>
</tbody>
</table>

aData are means with 95% confidence intervals. Listed P values are for interaction between group and time assessed by repeated measures analysis of variance (ANOVA). *P < 0.05, **P < 0.01, and ***P < 0.001 for within-group changes from baseline assessed by paired comparison t tests.

bThe treatment effect size is the difference in mean improvement in outcomes, from baseline to week 16, between the vegan and control group, calculated with a t-test.

cBMI = body mass index.
dVAT = visceral adipose tissue.
eHOMA = Homeostatic Model Assessment for Insulin Resistance.
fPREDIM = PREDicted M.
gMET = metabolic equivalent.
hAs measured by 3-day dietary record (2 weekdays and 1 weekend day) at baseline and at 16 weeks.
iFood groups are defined in Figure 2, made up of individual or multiple relevant food subgroups from the 168 defined by the Nutrition Coordinating Center (NCC) Food Group Serving Count System within the Nutrition Data System for Research (NDSR), version 2017. Serving sizes are based on the 2000 Dietary Guidelines for Americans, except for those foods not included in the recommendations, for which Food and Drug Administration serving sizes have been used. Whole and refined grain ounce-equivalents are defined per the USDA Food Patterns Equivalents Database.16

jSFA = saturated fatty acid.
kMUFA = monounsaturated fatty acid.
lPUFA = polyunsaturated fatty acid.
mAlternative Healthy Eating Index 2010 (AHEI-2010) AHEI-2010 is used to assess dietary quality based on foods and nutrients linked to chronic disease risk. Higher scores are associated with lower chronic disease risk. AHEI-2010 scores were calculated for each participant in the AHEI categories listed in the table, as well as in total. Each category receives a score from 0 to 10. Total AHEI-2010 score is calculated by summarizing the category scores; total scores can thus range from 0-100.14 Alcohol use was excluded from the AHEI-2010 scores reported here, because both groups were instructed to limit alcohol.
### Table 5. Changes in food group intake and changes in anthropometric and metabolic outcomes in 219 overweight adults in a 16-week clinical trial comparing a low-fat vegan diet to usual diet[^12^]

<table>
<thead>
<tr>
<th>Food Group^c</th>
<th>Δ Body weight (kg)</th>
<th>Δ Fat mass (kg)</th>
<th>Δ VAT^d volume (cm^3)</th>
<th>Δ HOMA^e (dimensionless)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit juice</td>
<td>( r = -0.02; P = 0.766 )</td>
<td>( r = -0.05; P = 0.461 )</td>
<td>( r = -0.03; P = 0.626 )</td>
<td>( r = 0.07; P = 0.330 )</td>
</tr>
<tr>
<td>Whole fruit</td>
<td>( r = -0.04; P = 0.525^d )</td>
<td>( r = -0.01; P = 0.858^d )</td>
<td>( r = -0.01; P = 0.829^g )</td>
<td>( r = 0.10; P = 0.160^g )</td>
</tr>
<tr>
<td>Avocado</td>
<td>( r = 0.06; P = 0.372 )</td>
<td>( r = 0.14; P = 0.444 )</td>
<td>( r = 0.08; P = 0.226 )</td>
<td>( r = 0.01; P = 0.865 )</td>
</tr>
<tr>
<td>Dark green vegetables</td>
<td>( r = -0.10; P = 0.158 )</td>
<td>( r = -0.11; P = 0.123 )</td>
<td>( r = -0.07; P = 0.333 )</td>
<td>( r = -0.13; P = 0.085 )</td>
</tr>
<tr>
<td>Total nonstarchy</td>
<td>( r = -0.17; P = 0.011 )</td>
<td>( r = -0.18; P = 0.016^d )</td>
<td>( r = -0.10; P = 0.136^e )</td>
<td>( r = -0.04; P = 0.606^e )</td>
</tr>
<tr>
<td>Total starch</td>
<td>( r = -0.16; P = 0.022 )</td>
<td>( r = -0.13; P = 0.052 )</td>
<td>( r = -0.08; P = 0.270 )</td>
<td>( r = 0.02; P = 0.780 )</td>
</tr>
<tr>
<td>Legumes</td>
<td>( r = -0.38; P &lt; 0.0001 )</td>
<td>( r = -0.39; P &lt; 0.0001 )</td>
<td>( r = -0.25; P &lt; 0.0002 )</td>
<td>( r = -0.09; P = 0.215 )</td>
</tr>
<tr>
<td>Meat alternatives</td>
<td>( r = -0.25; P &lt; 0.0002 )</td>
<td>( r = -0.23; P = 0.006 )</td>
<td>( r = -0.17; P = 0.111 )</td>
<td>( r = -0.08; P = 0.243 )</td>
</tr>
<tr>
<td>Whole grains</td>
<td>( r = -0.28; P &lt; 0.0001 )</td>
<td>( r = -0.25; P &lt; 0.0002 )</td>
<td>( r = -0.13; P = 0.053 )</td>
<td>( r = -0.16; P = 0.029 )</td>
</tr>
<tr>
<td>Refined grains</td>
<td>( r = 0.14; P = 0.041 )</td>
<td>( r = 0.15; P = 0.028 )</td>
<td>( r = 0.12; P = 0.081 )</td>
<td>( r = 0.00; P = 0.986 )</td>
</tr>
<tr>
<td>Nuts and seeds</td>
<td>( r = 0.14; P = 0.039 )</td>
<td>( r = 0.15; P = 0.027 )</td>
<td>( r = 0.10; P = 0.149 )</td>
<td>( r = 0.11; P = 0.142 )</td>
</tr>
<tr>
<td>Nut and seed butters</td>
<td>( r = 0.12; P = 0.080^d )</td>
<td>( r = 0.11; P = 0.111^e )</td>
<td>( r = 0.03; P = 0.641^e )</td>
<td>( r = 0.07; P = 0.335^e )</td>
</tr>
<tr>
<td>Eggs</td>
<td>( r = 0.28; P &lt; 0.0001 )</td>
<td>( r = 0.24; P = 0.0003 )</td>
<td>( r = 0.23; P = 0.005 )</td>
<td>( r = -0.06; P = 0.379 )</td>
</tr>
<tr>
<td>Total high-fat dairy</td>
<td>( r = 0.31; P &lt; 0.0001 )</td>
<td>( r = 0.29; P &lt; 0.0001 )</td>
<td>( r = 0.18; P = 0.007 )</td>
<td>( r = 0.00; P = 0.950 )</td>
</tr>
<tr>
<td>Total low-fat dairy</td>
<td>( r = 0.20; P = 0.004 )</td>
<td>( r = 0.19; P = 0.006 )</td>
<td>( r = 0.13; P = 0.061 )</td>
<td>( r = 0.12; P = 0.096 )</td>
</tr>
<tr>
<td>Total meat</td>
<td>( r = 0.22; P = 0.009^d )</td>
<td>( r = 0.16; P = 0.016 )</td>
<td>( r = 0.14; P = 0.047 )</td>
<td>( r = 0.10; P = 0.153 )</td>
</tr>
<tr>
<td>Total fish and shellfish</td>
<td>( r = 0.24; P = 0.0004 )</td>
<td>( r = 0.23; P = 0.0006 )</td>
<td>( r = 0.11; P = 0.116 )</td>
<td>( r = 0.10; P = 0.160 )</td>
</tr>
<tr>
<td>Total poultry</td>
<td>( r = 0.32; P &lt; 0.0001 )</td>
<td>( r = 0.30; P &lt; 0.0001 )</td>
<td>( r = 0.17; P = 0.012 )</td>
<td>( r = 0.17; P = 0.021 )</td>
</tr>
<tr>
<td>Total meat, fish, and poultry</td>
<td>( r = 0.43; P &lt; 0.0001 )</td>
<td>( r = 0.38; P &lt; 0.0001 )</td>
<td>( r = 0.23; P = 0.006 )</td>
<td>( r = 0.21; P = 0.003 )</td>
</tr>
<tr>
<td>Added sugars</td>
<td>( r = 0.36; P &lt; 0.0001 )</td>
<td>( r = 0.30; P = 0.024^g )</td>
<td>( r = -0.08; P = 0.229^e )</td>
<td>( r = 0.09; P = 0.195^e )</td>
</tr>
</tbody>
</table>

[^12^]: (continued on next page)
female, and participants randomized to the vegan group were younger than control group participants (52.6 ± 12.8 years vs 56.5 ± 9.7 years; P = 0.01).

Table 6. Magnitude of treatment effect for food groups with significant correlations with changes in body weight in 219 overweight adults in a 16-week clinical trial comparing a low-fat vegan diet with usual diet

<table>
<thead>
<tr>
<th>Food group</th>
<th>Δ Daily servings</th>
<th>Δ Daily servings per 1-kg weight loss</th>
<th>Δ Visceral adipose tissue volume (cm³)</th>
<th>Δ HOMA (dimensionless)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole fruit</td>
<td>+2.0; P &lt; 0.001</td>
<td>+2.0; P &lt; 0.001</td>
<td>-0.809e</td>
<td>e0.0002</td>
</tr>
<tr>
<td>Legumes</td>
<td>+0.8; P &lt; 0.001</td>
<td>+0.7; P &lt; 0.001</td>
<td>-0.20; P &lt; 0.001</td>
<td>e0.009</td>
</tr>
<tr>
<td>Meat alternatives</td>
<td>+2.1; P = 0.009</td>
<td>+2.2; P = 0.01</td>
<td>e0.007d</td>
<td>e0.0007</td>
</tr>
<tr>
<td>Legumes and meat alternatives</td>
<td>+1.5; P &lt; 0.001</td>
<td>+1.4; P &lt; 0.001</td>
<td>-0.20; P &lt; 0.001</td>
<td>e0.009</td>
</tr>
<tr>
<td>Whole grains</td>
<td>+2.2; P = 0.002</td>
<td>+2.0; P &lt; 0.001</td>
<td>-0.08; P = 0.002</td>
<td>e0.001</td>
</tr>
<tr>
<td>Eggs</td>
<td>-0.8; P = 0.002</td>
<td>-1.0; P = 0.01</td>
<td>-1.2; P &lt; 0.001</td>
<td>e0.003</td>
</tr>
<tr>
<td>High-fat dairy</td>
<td>-1.2; P &lt; 0.001</td>
<td>-1.5; P = 0.003</td>
<td>e0.009d</td>
<td>e0.0007</td>
</tr>
<tr>
<td>Added oils</td>
<td>-1.5; P &lt; 0.001</td>
<td>-1.8; P &lt; 0.001</td>
<td>e0.008d</td>
<td>e0.0007</td>
</tr>
<tr>
<td>Added animal fats</td>
<td>-2.1; P = 0.008</td>
<td>-2.6; P = 0.03</td>
<td>e0.009d</td>
<td>e0.0007</td>
</tr>
</tbody>
</table>

aLinear regression model was used to determine the magnitude of treatment effect for each food group. Results are presented as a change in daily portion intake for each food group that is associated with a 1-kg weight loss, first unadjusted, then adjusted for energy intake. Bonferroni correction for multiple comparisons was used for change in body weight in 10 food groups, first unadjusted, then adjusted for changes in energy intake, at the P = 0.05/(10 × 2) = 0.0025.

Body Weight, Body Composition, Insulin Sensitivity, and Physical Activity

Data on physical activity, body composition, insulin sensitivity, food group intake, nutrient intake, and AHEI-2010 are shown in Table 4. No statistically significant change in physical activity was observed in either group. Associations between food group intake, body weight, body composition, and insulin sensitivity are shown in Table 5.

Body weight, fat mass, and visceral fat volume decreased in the vegan group, but not the control group. Treatment effects were −5.9 kg; 95% CI, −6.8 to −5.0 for body weight; −4.1 kg; 95% CI, −4.7 to −3.5 for fat mass; and −238.3 cm³; 95% CI, −316.7 to −159.9 for visceral fat volume; P < 0.001 for all. Insulin resistance as measured by HOMA-IR decreased as a result of the vegan intervention (treatment effect, −1.2; 95% CI, −2.2 to −0.3; P = 0.008), and insulin sensitivity, measured by PREDIM, improved (treatment effect, +0.87; 95% CI, +0.55 to +1.20; P < 0.001).

FOOD GROUP INTAKE

Fruits and Vegetables

Whole fruit intake increased as a result of the vegan diet intervention (treatment effect, +0.7 servings/day; 95% CI, +0.2 to +1.3; P = 0.008). Increased intake of whole fruit was associated with a decrease in body weight (r = −0.25, P = 0.0002). Intake of total nonstarchy and starchy vegetables also increased (respective treatment effects, +1.1 servings/day; 95% CI, +0.4 to +1.8; P = 0.003 and +0.3 servings/day; 95% CI, +0.1 to +0.5; P = 0.005), but increased vegetable intake was not significantly associated with weight loss.

Legumes and Meat Alternatives

Compared with controls, the vegan group increased intake of legumes (treatment effect, +0.8 servings/day; 95% CI, +0.5 to +1.0; P < 0.001) and meat alternatives, including tofu, tempeh, and veggie burgers (treatment effect, +1.0 servings/day; 95% CI, +0.6 to +1.4; P < 0.001). Increased legume consumption was associated with decreased weight (r = −0.38; P < 0.0001), fat mass (r = −0.39; P < 0.0001), and...
visceral adipose tissue ($r = -0.25; P = 0.0002$). Consuming more meat alternatives was associated with a decrease in body weight ($r = -0.25; P = 0.0002$).

**Grains, Nuts, and Seeds**

Whole grain intake decreased in the control group but increased in the vegan group (treatment effect, +1.5 oz Eq/day; 95% CI, +1.0 to +2.0; $P < 0.001$). Increased consumption of whole grains was associated with decreased body weight ($r = -0.28; P < 0.0001$) and fat mass ($r = -0.25; P = 0.0002$). Refined grain intake decreased only in the vegan group, with no significant difference between vegan and control groups (treatment effect, −0.6 oz Eq/day; 95% CI, −1.4 to +0.2; $P = 0.160$). Intake of whole nuts and seeds decreased in the vegan group compared with controls (treatment effect, −0.6 servings/day; 95% CI, −1.1 to −0.2; $P = 0.006$).

**Eggs and Dairy Products**

Relative to controls, the vegan group decreased intake of eggs, high-fat dairy products, and low-fat dairy products (treatment effect for eggs, −0.5 servings/day; 95% CI, −0.7 to −0.3; $P < 0.001$; high-fat dairy, −0.9 servings/day; 95% CI, −1.3 to −0.6; $P < 0.001$, and low-fat dairy, −0.3 servings/day; 95% CI, −0.4 to −0.2). Decreased egg intake was correlated with decreased weight ($r = 0.28; P < 0.0001$), and decreased high-fat dairy intake was associated with decreased weight ($r = 0.31; P < 0.0001$) and fat mass ($r = 0.29; P < 0.0001$).

**Meat, Fish, and Poultry**

Intake of total meat, fish/shellfish, and poultry decreased in the vegan group relative to controls (treatment effect, −3.5 servings/day; 95% CI, −4.2 to −2.9; $P < 0.001$). Reductions in the combined intake of total meat, fish, and poultry were associated with weight loss ($r = 0.43; P < 0.0001$) and a decrease in fat mass ($r = 0.38; P < 0.0001$).

**Added Fats**

Intake of added oils and animal fats decreased significantly as a result of the vegan intervention (treatment effect, −1.4 servings/day; 95% CI, −1.9 to −0.8; $P < 0.001$ for added oils and −0.7 servings/day; 95% CI, −1.1 to −0.3; $P = 0.002$ for added animal fats). Decreases in intake of added animal fats were associated with decreases in weight ($r = 0.28; P < 0.0001$) and fat mass ($r = 0.27; P = 0.0001$). Decreased intake of added oils also correlated with decreases in weight ($r = 0.34; P < 0.0001$) and fat mass ($r = 0.30; P < 0.0001$).

**Food Group Contributions to Weight Loss**

Exploratory treatment effects for food groups associated with weight loss are listed in Table 6. The following were significantly associated with a 1-kg weight loss in 16 weeks: increasing whole fruit consumption by 2.0 servings/day, legumes by 0.8 servings/day, meat alternatives by 2.1 servings/day, combined legumes and meat alternatives by 1.5 servings/day, and whole grains by 2.2 servings/day, and, conversely, decreasing consumption of total meat, fish, and poultry by 1.7 servings/day, eggs by 0.8 servings/day, high-fat dairy by 1.2 servings/day, added oils by 1.5 servings/day, and added animal fats by 2.1 servings/day. The relative contribution of food groups to weight loss, evaluated in a multivariable regression model constructed in a stepwise fashion using all food groups in Table 6 as candidate predictors, is shown in Table 1. The relative contribution of both food groups and nutrients to weight loss is shown in the exploratory multivariable model in Table 2.

**Energy and Nutrient Intake**

Although both groups reported decreased energy intake, the vegan group consumed significantly less energy, fat, saturated fat, cholesterol, and protein than the control group ($P < 0.001$ for all), but more carbohydrates ($P = 0.002$) and fiber ($P < 0.001$). Decreases in fat intake correlated with decreases in body weight ($r = +0.50; P < 0.001$), fat mass ($r = +0.46; P < 0.001$), and visceral fat volume ($r = +0.36; P < 0.001$), whereas insulin sensitivity, as measured by PREDIM, tended to improve with decreased fat intake ($r = −0.23; P = 0.002$). The macronutrient distribution of the vegan group was approximately 70%, 15%, and 15% energy from carbohydrate, fat, and protein, respectively.

Compared with the control group, the vegan group had significantly greater mean intakes of beta-carotene, vitamin C, lycopene, folate, thiamin, magnesium, iron, manganese, copper, phytic acid, and isoflavones, and significantly lower intakes of retinol, vitamin B12, niacin, calcium, phosphorus, vitamin D, selenium, choline, and zinc ($P < 0.05$ for all).

**Diet Quality**

The vegan group’s AHEI-2010 increased by 6.0 points on average in contrast to no significant change in the control group (treatment effect $+7.2$ [95% CI $+3.7$ to $+10.7$]; $P < 0.001$). This increase was attributable to an increased (improved) score in the following categories: fruits, vegetables, nuts and legumes, red/processed meat, trans fat, and whole grains. In contrast, the score decreased for polyunsaturated fatty acids and long-chain fatty acids because of decreased fat intake in the vegan group. Increases in AHEI-2010 scores were associated with decreases in body weight ($r = −0.20; P = 0.003$), fat mass ($r = −0.14; P = 0.03$), and HOMA-IR ($r = −0.17; P = 0.02$). That is, as AHEI-2010 score increased, weight, fat mass, and insulin resistance decreased.

**Discussion**

This secondary analysis examined how food group intake, nutrient intake, and diet quality changed after a 16-week, low-fat vegan diet intervention and determined whether those changes were associated with changes in body weight, body composition, and insulin sensitivity. Adopting a low-fat vegan diet resulted in substantial changes in food group and nutrient intake. It also resulted in improved diet quality, which was associated with weight loss, fat loss, and improved insulin sensitivity. Individual food groups correlated only with weight or fat loss; any associations with insulin sensitivity lost significance after Bonferroni correction. This secondary analysis thus helps illuminate which food groups and nutrients may have had the greatest contribution to the beneficial body composition outcomes seen in the primary trial and could inform future interventional research.

To the authors’ knowledge, this is the first study to examine the relationship between changes in food group intake and weight and metabolic outcomes in the context of a low-fat vegan diet. Those in the vegan group significantly increased

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legume intake, and consuming more legumes was the best single-food-group predictor of weight and fat loss. A 2015 meta-analysis of randomized controlled trials found that eating one serving of pulses daily reduced body weight by 1.74 kg on diets designed for weight loss (neutral energy balance) and 0.29 kg on diets designed for weight maintenance (neutral energy balance). Legumes may support weight loss by increasing post-meal satiety, possibly because of their high fiber and protein content; the soluble fiber in legumes also causes gel formation, slowing gastric emptying. Beans also have been shown to trigger the release of appetite-reducing peptide YY and may influence gut microbiota in ways that promote satiety. Legumes have been shown to improve glycemic control in previous research in type 2 diabetes; the lack of correlation between legume intake and insulin sensitivity here may be attributable to the modest change in intake (treatment effect: +0.8 servings per day, or slightly less than 0.5 cups cooked beans) in a study population without diabetes. Increased intake of meat alternatives, a category containing predominantly soy products in the software used for dietary analysis, was also associated with decreased weight. Similar results were seen in a meta-analysis of 22 randomized controlled trials of 870 overweight participants showing that use of soy products reduced body weight, body fat percentage, and waist circumference.

Decreases in body weight and fat mass associated with increased whole grain intake align with prior findings that diets high in whole grains are associated with favorable effects on weight status and body composition. No association was seen between refined grain intake and changes in body weight, in keeping with a 2019 meta-analysis of 43 prospective reports that found that high refined grain intake was not associated with weight gain, although high intakes (>90 g/day) were linked to a higher risk of overweight/obesity.

The findings for whole fruit are essentially consistent with previous research linking whole fruit intake with weight loss and decreases in body weight, waist circumference, and adiposity. The lack of significant association observed between changes in nonstarchy vegetable intake and body composition or insulin sensitivity was unexpected, because prospective cohort data suggest an inverse relationship with body weight. Although starchy vegetables such as potatoes have been linked in some prior studies to increased risk for diabetes, starchy vegetables had no observed effect on body composition or insulin sensitivity in this study, perhaps because potatoes are commonly consumed fried and in this report nonfried starchy vegetables were analyzed independently.

Decreases in egg intake were associated with decreases in body weight, consistent with a previous study in which high egg intake was associated with an increased risk of weight gain by 54% compared with low egg consumption. Similarly, previous research has shown that each increase in egg intake of 50 g/day (approximately one egg) increased the risk of weight gain by 24%. Similarly, decreased intake of high-fat dairy products was associated with reductions in body weight and fat mass, whereas low-fat dairy yielded no significant associations, consistent with a recent 12-week randomized clinical trial that showed weight gain when eating more than three servings/day of full-fat dairy and no significant change in body weight when consuming low-fat dairy. Interestingly, insulin sensitivity decreased with both full-fat and low-fat dairy in that 12-week trial.

The association seen between reduced intake of total meat, fish, and poultry and reduced body weight and fat mass aligns with findings from the National Health and Nutrition Examination Survey, demonstrating that higher total meat consumption (which included red meat, poultry, fish and shellfish, and other meat products) was linked with higher BMI, waist circumference, obesity, and central obesity. High consumption of poultry and red meat has been previously reported to increase the risk of weight gain, and high red meat intake has been shown to increase the risk of obesity and weight gain as well as metabolic syndrome and abdominal obesity. Results for fish have been mixed, with analysis of two studies showing decreased risk of abdominal obesity with fish intake, and other studies finding no effect on risk of weight gain or overweight/obesity. The lack of relationship between changes in the consumption of added sugars and changes in weight or metabolic outcomes in this study contrasts with the results of a 2012 meta-analysis of five randomized clinical trials, which found that decreasing intake of free sugars reduced body weight (<0.80 kg; P < 0.001). The modest reduction in added sugar in the vegan group relative to control subjects (−10.6 g/d, or approximately −2.5 teaspoons) may partly explain the null findings. Decreasing dietary fat decreases the energy density of the diet, which has been linked to body weight reduction in both observational and clinical trials, likely explaining the correlation between decreased added fat intake and weight loss.

As might be expected, nutrient intake changed substantially and in predictable ways. Those in the vegan group increased intakes of micronutrients commonly found in plant foods and decreased intakes of those found predominantly in animal foods. The mean intakes of both vegan and control groups met or exceeded the estimated average requirement (EAR) for vitamin B6, folate, niacin, riboflavin, thiamin, vitamin C, and iron. As expected, the vegan group’s mean intake of vitamin B12 from food did not meet the EAR, whereas the control group’s did. Mean intakes of both groups fell short of the EAR for calcium and vitamin D. Regarding macronutrients, exploratory analyses conducted in this study suggest that substantially decreasing fat and increasing fiber promote weight loss, consistent with previous research.

Diet quality findings from the current study align with previous studies. For example, a 22-week study in people with type 2 diabetes on a low-fat vegan diet showed significant increases in AHEI scores compared with a more conventional diabetes diet based on portion control. When data from both the low-fat vegan group and the portion-control group were pooled, AHEI was found to correlate with decreases in body weight and hemoglobin A1C.

Study strengths include the 16-week, randomized parallel controlled trial design, which facilitated assessment of changes in food group intake and associations with body weight, body composition, and insulin sensitivity. The low attrition rate preserved statistical power and suggests the diet was sustainable. Despite the intervention diet being associated with improvements in insulin resistance and insulin sensitivity in this trial, after Bonferroni correction, no
single food group correlated significantly with improvements in metabolic outcomes. Although this may be attributable to limitations of the study as described later, given that the low-fat vegan diet tested in the primary trial was associated with metabolic improvements, these findings suggest that the additive effects of individual food groups support weight management and metabolic health. The AHEI-2010 used in this study is a good measure of diet quality that has been previously correlated with the risk of chronic disease.

The study also has limitations. Other than animal products and fats, the interventions in this trial did not regulate consumption of specific food groups, or total caloric or other intake. Therefore, the reported associations of food groups and nutrient intake must be interpreted with caution, even after adjustment for other factors. Participants’ dietary intake was self-reported and thus subject to bias and imprecision.

Certain foods were missing from the NDSR database. Although data entries were created to match the macroelement content and source of the missing foods, it was impossible to match micronutrients. Some commercial ingredients in these custom entries, such as yellow pea protein used in some meat substitutes, were not assignable to a specific food group, so were not included in food group serving counts. Participants were predominantly female, so repeating the study with increased male representation would be beneficial. Repeating this intervention and assessing post-intervention adherence and efficacy could provide useful longer-term data and insight into effectiveness outside the research setting. Study participants were willing to make a dietary change and therefore may not be representative of the whole population but are likely representative of individuals seeking clinical care. Finally, the use of a control group allows for a possible influence of “attention placebo” in the intervention group, which could have affected their outcomes. Like all determinations of statistical significance, the Bonferroni correction is arbitrary and can create false negatives and thus should be interpreted with caution.

CONCLUSIONS
When compared with participants’ usual diets, intake of fruits, vegetables, legumes, meat alternatives, and whole grains increased on a low-fat vegan diet, whereas consumption of animal foods, nuts and seeds, and added fats decreased. Increases in plant-based food groups tended to be associated with weight loss, with legumes being the single food group most associated with weight and fat loss. Decreases in added fats and animal-based food groups also tended to be associated with weight loss.

Diet quality as measured by AHEI-2010 improved on the low-fat vegan diet relative to no diet change and was associated with beneficial weight and metabolic changes. Overall, these data suggest that consuming more low-fat plant food and less high-fat and animal-derived food is associated with weight loss, and that a low-fat vegan diet intervention can improve diet quality and insulin sensitivity.

References


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STATEMENT OF POTENTIAL CONFLICT OF INTEREST
L. Crosby, S. Levin, Z. Ali, D. N. Holtz, and H. Kahleova are employees of the Physicians Committee for Responsible Medicine, a nonprofit organization providing educational, research, and medical services related to nutrition. A. Green and M. Jardine are nutrition consultants for the Physicians Committee, and R. Holubkov is a biostatistical consultant for the Physicians Committee. M. Nguyen was an employee; P. Elliott, D. Goldstein, A. Freeman, and M. Bradshaw were clinical research interns; and E. Rembert was a clinical research consultant for the Physicians Committee when work on the paper commenced. L. Crosby declares that a trust for her benefit previously held stock in 3M, Abbot Labs, AbbVie, Johnson and Johnson, Mondelez, Nestle, and Walgreens; she is the author of a food and nutrition blog, Veggie Quest; and she is former publications editor and current chair of the Women’s Health Dietetic Practice Group within the Academy of Nutrition and Dietetics.

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AUTHOR CONTRIBUTIONS
L. Crosby and E. Rembert compiled the data. A. Green checked dietary data and ran nutrient analysis reports. R. Holubkov completed statistical analyses. L. Crosby, E. Rembert, N. D. Barnard, and H. Kahleova drafted the manuscript with contributions from S. Levin, Z. Ali, M. Jardine, M. Nguyen, P. Elliott, D. Goldstein, and A. Freeman, M. Bradshaw, and D. N. Holtz. All authors reviewed subsequent drafts of the manuscript.
Academy of Nutrition and Dietetics: Revised 2022 Standards of Practice and Standards of Professional Performance for Registered Dietitian Nutritionists (Competent, Proficient, and Expert) in Adult Weight Management

Colleen Tewksbury, PhD, MPH, RD, CSOWM, LDN; Robin Nwankwo, MPH, RDN, CDACES; Janet Peterson, DrPH, RDN, RCEP, FACSM

ABSTRACT
A person’s weight is an anthropometric measure factored into assessing health risk, not a measure of worth, ability, or overall health. Adult weight management is a spectrum of lifelong care services available for persons whose goals can be achieved through evidence-based, weight-related interventions and intersects most practice areas of nutrition. An adult weight management registered dietitian nutritionist (RDN) is responsible for providing a psychologically safe, accessible, and respectful setting and empowering care to those seeking nutrition services. This requires the RDN to act as an advocate by proactively seeking to identify personal and external weight biases, understanding the influence of those predispositions, and acknowledging how weight-related prejudices are intricately connected with systems that influence nutrition both inside and outside of health care. Increases in average weight influence potentially counterproductive discussions about judgment, an individual’s body, and relationship with health. RDNs are equipped to provide dynamic care and be on the forefront of implementing weight-inclusive built environments, policies, and person-centered communications to minimize harm and maximize benefit for the individual and society. The authors, Weight Management Dietetic Practice Group, and the Academy of Nutrition and Dietetics Quality Management Committee revised the Standards of Practice and Standards of Professional Performance for RDNs in Adult Weight Management to update established criteria of competent practice, further define core values, and set direction for future areas of opportunity. The Adult Weight Management Standards of Practice and Standards of Professional Performance are complementary tools intended for RDNs to benchmark and identify progressive routes and goals for professional advancement.


Editor’s note: Figures 1 and 2 that accompany this article are available online at www.jandonline.org

THE WEIGHT MANAGEMENT Dietetic Practice Group (WM DPG) of the Academy of Nutrition and Dietetics (Academy), under the guidance of the Academy Quality Management Committee, has revised the Standards of Practice (SOP) and Standards of Professional Performance (SOPP) for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management originally published in 2015. The revised document, Academy of Nutrition and Dietetics: Revised 2022 Standards of Practice and Standards of Professional Performance for Registered Dietitian Nutritionists (Competent, Proficient, and Expert) in Adult Weight Management, reflects advances in adult weight management practice during the past 7 years and replaces the 2015 Standards. This document builds on the Academy of Nutrition and Dietetics: Revised 2017 SOP in Nutrition Care and SOPP for RDNs. The Academy of Nutrition and Dietetics/Commission on Dietetic Registration’s (CDR) Code of Ethics for the Nutrition and Dietetics Profession, along with the Academy of Nutrition and Dietetics: Revised 2017 SOP in Nutrition Care and SOPP for RDNs and Revised 2017 Scope of Practice for the RDN guide the practice and performance of RDNs in all settings by describing: 1) how an RDN is uniquely qualified to provide weight management nutrition and dietetics services; 2) the knowledge, skills, and competencies an RDN needs to demonstrate for the provision of safe, effective, and quality adult weight management care and service at the competent, proficient, and expert levels; and 3) a systematic approach to benchmarking level of proficiency and determining paths for advancement in adult weight management.

Approved May 2022 by the Quality Management Committee of the Academy of Nutrition and Dietetics (Academy) and the Executive Committee of the Weight Management Dietetic Practice Group of the Academy. Scheduled review date: May 2028. Questions regarding the Standards of Practice and Standards of Professional Performance for Registered Dietitian Nutritionists in Adult Weight Management may be addressed to Academy Quality Management Staff: Dana Bueling Sowards, MS, manager, Quality Standards Operations; and Karen Hui, RDN, LDN, scope/standards of practice specialist, Quality Management, at quality@eatright.org.
All registered dietitians are nutritionists—but not all nutritionists are registered dietitians. The Academy’s Board of Directors and Commission on Dietetic Registration have determined that those who hold the credential Registered Dietitian (RD) may optionally use “Registered Dietitian Nutritionist” (RDN). The two credentials have identical meanings. In this document, the authors have chosen to use the term RDN to refer to both registered dietitians and registered dietitian nutritionists.

Scope of practice in nutrition and dietetics is composed of statutory and individual components, includes the code(s) of ethics (eg, Academy/CDR, other national organizations, and/or employers code of ethics), and encompasses the range of roles, activities, practice guidelines, and regulations within which RDNs perform. For credentialed practitioners, scope of practice is typically established within the practice act and interpreted and controlled by the agency or board that regulates the practice of the profession in a given state. An RDN’s statutory scope of practice can delineate the services an RDN is authorized to perform in a state where a practice act or certification exists. For more information, see www.eatrightpro.org/advocacy/licensure/licensure-map.

An RDN’s scope of practice is determined by education, training, credentialing, experience, and demonstrating and documenting competence to practice. Individual scope of practice in nutrition and dietetics has flexible boundaries to capture the breadth of the individual’s professional practice. Professional advancement beyond the core education and supervised practice to qualify for the RDN credential provides RDNs practice opportunities, such as expanded roles within an organization based on training and certifications, (eg, Certificate of Training in Obesity for Pediatrics and Adults; exercise science, project management, research coordination, health and wellness coaching, social and behavioral sciences); or additional credentials (eg, CDR’s Board Certified Specialist in Obesity and Weight Management [CSOWM]; Certified Diabetes Care and Education Specialist [CDCES], Certified Nutrition Support Clinician [CNSC], Certified Case Manager [CCM], or Certified Professional in Healthcare Quality [CPHQ]). The Scope of Practice Decision Algorithm (www.eatrightpro.org/scope) guides an RDN through a series of questions to determine whether a particular activity is within their scope of practice. The algorithm is designed to assist an RDN to critically evaluate their personal knowledge, skill, experience, judgment, and demonstrated competence using criteria resources.

The Centers for Medicare and Medicaid Services (CMS), Department of Health and Human Services Hospital and Critical Access Hospital conditions of Participation now allow a hospital and its medical staff the option of including RDNs or other clinically qualified nutrition professionals within the category of “non-physician practitioners" eligible for ordering privileges for therapeutic diets and nutrition-related services if consistent with state law and health care regulations. RDNs in hospital settings interested in obtaining ordering privileges must review state laws (eg, licensure, certification, and title protection), if applicable, and health care regulations to determine whether there are any barriers or state-specific processes that must be addressed. For more information, review the Academy’s practice tips that outline the regulations and implementation steps for obtaining ordering privileges (www.eatrightpro.org/diетorders/). For assistance, refer questions to the Academy’s State Affiliate organization.

Medical staff oversight of an RDN(s) occurs in one of two ways. A hospital has the regulatory flexibility to appoint an RDN(s) to the medical staff and grant the RDN(s) specific nutrition ordering privileges or can authorize the ordering privileges without appointment to the medical staff. To comply with regulatory requirements, an RDN’s eligibility to be considered for ordering privileges must be through the hospital’s medical staff rules, regulations, and bylaws, or other facility-specific process. The actual privileges granted will be based on the RDN’s knowledge, skills, experience, and specialist certification, if required, and demonstrated and documented competence.

The Long-Term Care Final Rule published October 4, 2016, in the Federal Register, now “allows the attending physician to delegate to a qualified dietitian or other clinically qualified nutrition professional the task of prescribing a resident’s diet, including a therapeutic diet, to the extent allowed by State law” and permitted by the facility’s policies. The qualified professional must be acting within the scope of practice as defined by state law; and is under the supervision of the physician that may include, for example, countersigning the orders written by the qualified dietitian or clinically qualified nutrition professional. RDNs who work in long-term care facilities should review the Academy’s updates on CMS that outline the regulatory changes to §483.60 Food and Nutrition Services www.eatrightpro.org/practice/quality-management/national-quality-accreditation-and-regulations/centers-for-medicare-and-medicaid-services. Review the state’s long-term care regulations to identify potential barriers to implementation; and identify considerations for developing the facility’s processes with the medical director and for orientation of attending physicians. The CMS State Operations Manual, Appendix PP—Guidance for Surveyors for Long-Term Care Facilities contains the revised regulatory language (new revisions are italicized and in red color), CMS periodically revises the State Operations Manual Conditions of Participation; obtain the current information at www.cms.gov/files/document/appendices-table-content.pdf.

ACADEMY QUALITY AND PRACTICE RESOURCES

The Academy’s Revised 2017 SOP in Nutrition Care and SOPP for RDNs reflect the minimum competent level of nutrition and dietetics practice and professional performance. The core standards serve as blueprints for the development of focus area SOP and SOPP for RDNs in competent, proficient, and expert levels of practice. The SOP in Nutrition Care is composed of four standards consistent with the Nutrition Care Process and clinical workflow elements as applied to the care of patients/clients in all settings.
The SOPP consist of standards representing six domains of professional performance: Quality in Practice, Competence and Accountability, Provision of Services, Application of Research, Communication and Application of Knowledge, and Utilization and Management of Resources. The SOP and SOPP for RDNs are designed to promote the provision of safe, effective, equitable, efficient, and quality food and nutrition care and services; facilitate evidence-based practice; and serve as a professional evaluation resource.

The SOP and SOPP for RDNs in Adult Weight Management indicators are measurable action statements that illustrate how each standard can be applied to practice, were revised with input and consensus of content experts representing diverse practice and geographic perspectives (Figures 1 and 2, available at www.jandonline.org). The SOP and SOPP for RDNs in Adult Weight Management were reviewed and approved by the Executive Committee of the WM DPG and the Academy Quality Management Committee.

Three Levels of Practice

The SOP and SOPP for RDNs are built on the Dreyfus model, which identifies levels of proficiency—novice, advanced beginner, competent, proficient, and expert (refer to Figure 3) during the acquisition and development of knowledge and skills. Upon attaining the credential, an RDN enters practice at the competent level and manages their professional development to achieve individual goals. In Academy focus areas, the three levels of practice are represented as competent, proficient, and expert to align with the model. Whereas an RDN may use this progression as a method to demonstrate increasing breadth and depth of knowledge and skills in order to justify a promotion or additional job title, job status is not to be confused with the level of practice described here. For example, status in job title alone is not necessarily indicative of a proficient or expert level of practice because this title does not measure competency nor scope. Figure 4 includes role examples of RDNs in adult weight management at different competency levels.

Competent Practitioner

A competent practitioner is an RDN who is either just starting practice after having obtained RDN registration by CDR or an experienced RDN recently transitioning their practice to a new focus area of nutrition and dietetics. A focus area of nutrition and dietetics practice is a defined area of practice that requires focused knowledge, skills, and experience that applies to all levels of practice. A competent practitioner consistently provides safe and reliable services by applying knowledge, skills, behavior, and values in accordance with accepted standards of the profession; acquires additional on-the-job skills; and engages in tailored continuing education to further enhance knowledge, skills, and judgment obtained in formal education. An RDN practicing in adult weight management may have responsibilities across several areas of practice, including, but not limited to public health and community nutrition, clinical (eg, diabetes and nephrology), consultation and business, research, education, and food and nutrition management and has a general awareness of the complexity of factors that influence weight (Figure 5).

Proficient Practitioner

A proficient practitioner is an RDN who typically has at least 3 years of adult weight management experience beyond credentialing and entry into the profession, consistently provides safe and reliable service, and has demonstrated operational job performance, knowledge, skills, judgment, and experience in a focus area of nutrition and dietetics practice. An RDN may acquire specialist credentials, such as the CSOWM, to demonstrate proficiency in this focus area of practice. The proficient-level practitioner, as with the competent practitioner, uses evidence-based tools in assessment, but further acknowledges the methodological limits and integrates in new instruments as they are systematically validated. The proficient RDN uses evidence-based resources to improve communication with patients/clients and other stakeholders including applied behavior theory, counseling skills, and public relations resources. The proficient RDN understands the complex nature and nuances of adult weight management and provides effective patient-/client-centered care (Figure 5). The proficient RDN leverages the interprofessional nature of adult weight management interventions.

Expert Practitioner

An expert practitioner is an RDN who is recognized within the profession and has mastered a high degree of skill in, and knowledge of, nutrition and dietetics. Expert practice is more complex, and the practitioner has a high degree of professional autonomy and responsibility. The experienced practitioner employs an analytical approach through observation, analysis, and integration. The individual at this level strives for additional knowledge, experience, and training. An expert demonstrates high-level problem solving and decision-making skills, including managing ambiguity in challenging situations by making effective quality decisions in a timely manner when all the information may not be available. Experts demonstrate quality practice and leadership and consider new opportunities that integrate nutrition and dietetics. An expert practitioner may have an expanded and/or specialist role and may possess an advanced credential(s), such as the CDR Advanced Practitioner Certification in Clinical
Standards of Practice are authoritative statements that describe practice demonstrated through nutrition assessment, nutrition diagnosis (problem identification), nutrition intervention (planning, implementation), and outcomes monitoring and evaluation (four separate standards) and the responsibilities for which RDNs are accountable. The Standards of Practice (SOP) for RDNs in Adult Weight Management presuppose that the RDN uses critical thinking skills; analytical abilities; theories; best-available research findings; current accepted nutrition, dietetics, and medical knowledge; and the systematic holistic approach of the Nutrition Care Process as they relate to the application of the standards. Standards of Professional Performance (SOPP) for RDNs in Adult Weight Management are authoritative statements that describe behavior in the professional role, including activities related to Quality in Practice; Competence and Accountability; Provision of Services; Application of Research; Communication and Application of Knowledge; and Utilization and Management of Resources (six separate standards).

SOP and SOPP are complementary standards and serve as evaluation resources. All indicators may not be applicable to all RDNs’ practice or to all practice settings and situations. RDNs operate within the directives of applicable federal and state laws and regulations as well as policies and procedures established by the organization in which they are employed. To determine whether an activity is within the scope of practice of the RDN, the practitioner compares their knowledge, skill, experience, judgment, and demonstrated competence with the criteria necessary to perform the activity safely, ethically, legally, and appropriately. The Academy of Nutrition and Dietetics Scope of Practice Decision Algorithm is specifically designed to assist practitioners with this process.

The term patient/client is used in the SOP as a universal term as these Standards relate to direct provision of nutrition care and services. Patient/client could also mean client/patient, resident, participant, consumer, or any individual or group who receives weight management care and services. Customer is used in the SOPP as a universal term. Customer could also mean client/patient/customer, family, participant, consumer, or any individual, group, or organization to which the RDN provides services. These services are provided to individuals 18 years of age and older. The SOP and SOPP are not limited to the clinical setting. In addition, it is recognized that the family and caregiver(s) of clients 18 years of age and older, including individuals with special health care needs, play critical roles in overall health and are important members of the team throughout the assessment and intervention process. The term appropriate is used in the standards to mean: Selecting from a range of best practice or evidence-based possibilities, one or more of which would give an acceptable result in the circumstances.

Each standard is equal in relevance and importance and includes a definition, a rationale statement, indicators, and examples of desired outcomes. A standard is a collection of specific outcome-focused statements against which a practitioner’s performance can be assessed. The rationale statement describes the intent of the standard and defines its purpose and importance in greater detail. Indicators are measurable action statements that illustrate how each specific standard can be applied in practice. Indicators serve to identify the level of performance of competent practitioners and to encourage and recognize professional growth.

Standard definitions, rationale statements, core indicators, and examples of outcomes found in the Academy of Nutrition and Dietetics: Revised 2017 SOP in Nutrition Care and SOPP for RDNs have been adapted to reflect three levels of practice (competent, proficient, and expert) for RDNs in adult weight management (see image below). In addition, the core indicators have been expanded to reflect the unique competence expectations for the RDN providing adult weight management.

Standards described as proficient level of practice in this document are not equivalent to the Commission on Dietetic Registration certification, Board Certified as a Specialist in Obesity and Weight Management. Rather, the Certified Specialist in Obesity and Weight Management designation recognizes the skill level of an RDN who has developed and demonstrated through successful completion of the certification examination, obesity and weight management knowledge and application beyond the competent practitioner and demonstrates, at a minimum, proficient level skills. An RDN with a Certified Specialist in Obesity and Weight Management designation is an example of an RDN who has demonstrated additional knowledge, skills, and experience in obesity and weight management by the attainment of a specialist credential.

*Figure 3.* Standards of Practice (SOP) and Standards of Professional Performance for Registered Dietitian Nutritionists (RDNs) (Competent, Proficient, and Expert) in Adult Weight Management.
Nutrition, or other focus area credential(s). An expert-level practitioner in adult weight management is a leader in the field, looked upon to uphold the presented standards, and expected to uplift RDNs working toward expertise. As recognized leaders in the field, the expert RDN mentors and sponsors students, other RDN colleagues, and members of the interprofessional team by providing guided training, nominating individuals for advancement opportunities, and providing a supportive environment that encourages professional autonomy and growth. Experts recognize that guiding and supporting RDNs is inadequate if that practice does not include persons from underrepresented groups in dietetics.22,23 Within the public domain, experts pave the way for responding to community needs and enacting policies and procedures to empower, drive positive change, and promote equity.

OVERVIEW

A person’s weight is an anthropometric measure factored into assessing health risk, not a measure of worth, ability, nor overall health. Adult weight management inherently intersects with each subspecialty of nutrition due to the prevalence of weight-related conditions and the ubiquity of weight in nutrition assessment. The professional role of the RDN is one of service—empowering persons to thrive through food and nutrition, a dynamic guiding principle that is at the core of adult weight management. Adult weight management is not synonymous with weight loss, rather a spectrum of lifelong care services available for people whose health and wellness goals can be achieved through evidence-based, weight-related interventions.16 When describing weight management interventions, categorizing progress or outcomes as success or failure reinforces a false pretense that care reaches an end at some point. The priority of effective adult weight management care as outlined in the SOP and SOPP is that the patient/client stays engaged in health-seeking activities.16,24 This includes not only staying engaged in weight-management services, but also following up with preventative services, using physical and mental health services and developing support systems for future challenges and celebrations. Any actions that undermine this overarching priority, regardless of intent, are contrary to adult weight management principles as outlined in the current document. RDNs in adult weight management value individual autonomy and recognize that patients/clients remain in control of their care at every step—asking permission, shared decision making, supporting goals rather than predetermining them. A meaningful patient-/client-provider relationship starts with intentional effort and action by the RDN before any patient/client interaction.

The adult weight management RDN is responsible for providing psychologically safe, accessible, and respectful settings to broach difficult topics, given that the interpretation of weight is often connected to biases, internalized stigma, and traumatic experiences.25 This requires the RDN to actively seek to identify personal and external biases, understand the influence of those predispositions, and how weight-related prejudices are connected with systems that influence nutritional status.26 Regularly completing validated, self-assessments for implicit biases facilitates awareness that informs developing the skills to modify communication styles to meet cultural, health literacy, and social needs of the patient/client.27,28

RDNs are well equipped to provide care and are the forefront of advocating for weight-inclusive built environments, policies, and person-centered communications to minimize harm and maximize benefit. Weight-inclusive or universal approaches center on creating a welcoming environment for persons of all weights and sizes to reduce access barriers for the patient/client.29–31 RDNs in adult weight management aim to identify and address biases, create space for diverse voices, and continue to facilitate inclusivity as a foundational expectation. The adult weight management RDN practices chronic disease management by listening to and centering the patient/client or community in all care-related decisions (Figure 5). Adult weight management RDNs respond to community needs and enact policies and procedures to empower patients/clients, drive positive change, and actively promote equity within the profession.

Recent estimates suggest more than 80% of US adults will have a body mass index ≥ 25 by 2030.32 Despite body mass index being a crude measure with its limitations, it is strongly correlated with more than 40 diseases and conditions and premature mortality.33 Evidence suggests modest weight reductions improve most chronic disease risk factors.33 Increases in average weight influence potentially counterproductive discussion about judgment, and an individual’s body and relationship with health. Productive care discussions and counseling are anchored by the guiding principles of adult weight management and focus on behaviors rather than outcomes. The RDN is positioned to meet the increasing demand for weight

Adult Weight Management Guiding Principles for RDN Practice and Professional Performance

1. Anthropometric measures such as weight are factored into assessing health risk, not a measure of worth, ability, or overall health.
2. Adult weight management is a spectrum of evidence-based interventions and intersects with most practice areas of nutrition and is not synonymous with weight loss.
3. Effective adult weight management is patient/client-centered and requires interprofessional support, as one health care practitioner cannot facilitate care alone.
4. Health care practitioners are responsible for providing a psychologically safe, accessible, and respectful setting and empowering care.
5. Advocates proactively to identify personal and external weight biases, understand the impact of those predispositions, and recognize how systematic weight-related prejudices are intricately connected.
6. The priority of effective adult weight management care is for the patient/client to remain engaged in life-long, health-seeking activities.
**Clinical Practitioner: Competent**
An RDN recently assigned to work in a clinic setting reviews applicable medical and Medical Nutrition Therapy resources related to adult weight management to guide practice and identify knowledge and skills for continuing education. The RDN uses the SOP and SOPP in Adult Weight Management to evaluate expected outcomes and the level of competence needed to provide quality care. The RDN identifies mentors for consultation and qualified practitioners to refer to individuals who require a level of care higher than that RDN can competently provide.

**Telehealth Practitioner: Proficient**
An RDN working in a telehealth setting who provides consultations regarding weight management to patients/clients refers to the SOP and SOPP in Adult Weight Management for resources and guidance for competent practice. The RDN consults with or refers patients/clients to an RDN or health care practitioner with specific expertise if necessary (eg, post metabolic and bariatric surgery, disordered eating, or comorbidities). The RDN routinely monitors all relevant state laws and regulations, the Academy of Nutrition and Dietetics telehealth resources, and organization policies regarding the practice of telehealth specifically considering requirements in the case that a patient/client lives in another state. As a result of the increasing number of patients/clients with weight management referrals, the RDN uses the SOP and SOPP to self-evaluate level of practice to determine areas to strengthen.

**Public Health Practitioner: Proficient**
An RDN working in a wellness center provides adult weight management nutrition care, including consulting and coaching. The RDN is adept at networking and familiar with community and public health opportunities for collaboration. The RDN maintains additional credentialing as an exercise specialist to provide high quality, comprehensive care. The RDN reviews the relevant SOP and SOPP to identify outcomes for competent practice, resources to review to increase knowledge, and possible continuing education activities to pursue.

**Academic: Expert**
An RDN faculty member reviews the SOP and SOPP in Adult Weight Management to gain additional familiarity to expand lecture content, training experiences, and research, including securing funding. The RDN uses the SOP and SOPP to identify areas in need for further study and conducts peer-reviewed, rigorous research to advance evidence-based practice. The RDN uses the SOP and SOPP to develop an academic plan for advancement, promotion, or tenure.

**Program Coordinator: Expert**
An RDN works as a program coordinator who oversees clinicians providing adult weight management care to patients/clients. The RDN considers the relevant SOP and SOPP when determining expertise needed at the program level, position descriptions, adult weight management standards of care, work assignments, and when assisting staff in evaluating competence and additional knowledge and/or skill needs in adult weight management. The RDN recognizes the SOP and SOPP as important tools for staff to assess their own competence, identify personal performance plans, and to guide quality improvement data monitoring and evaluation to optimize patient/client outcomes.

*For each role, an RDN updates the professional development plan to include applicable practice competencies for adult weight management care and services, including maintaining certification or licensure in appropriate areas outside of the scope of this document and referring to another focus area SOP and/or SOPP for related competencies.*

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**Figure 4.** Role examples of Standards of Practice (SOP) and Standards of Professional Performance (SOPP) for Registered Dietitian Nutritionists (RDNs) (Competent, Proficient, and Expert) in Adult Weight Management.
management services. Meeting this need requires innovative and forward-thinking modes of behavior change counseling delivery such as telehealth, in-community, or workplace-based interventions to serve a wide range of populations—including rural vs. urban needs, armed (military) services, prisons (both incarcerated persons and employees), or institutional living facilities. Additional skills in public health communications about weight are also critical. The RDN has the opportunity to communicate with the public in a way that increases awareness, corrects misinformation, and highlights a path forward.

A competent-level practitioner in adult weight management may be new to practice or recently adjusted practice to include more weight management services such as an oncology RDN offering more weight management services for survivorship programs of weight-related cancers. The proficient-level RDN in adult weight management has gained more weight-management-specific skills and knowledge and functions with increased autonomy. This individual has sufficient, or is working toward sufficient, knowledge and documented hours in weight management to qualify for the CSOWM. An expert-level practitioner may have an expanded or specialist role. Generally, the practice is more complex and assumes a higher level of responsibility in their tasks. Expert-level RDNs in adult weight management serve as a principal source of information for RDN colleagues and interprofessional team members. They promote the practice and expertise needed for quality adult weight management care. Adult weight management RDNs practice wherever chronic disease prevention and interventions are implemented—ambulatory settings, retail, community centers, private practice, and public health settings.

Adult weight management spans across disciplines and specialty areas. This includes referring or seeking assistance and expertise from other health care providers when necessary. An RDN is not expected to be an expert in all areas. Knowing the limits of one’s skills and knowledge is as important as being proficient in a given area. The SOP and SOPP for RDNs in Adult Weight Management were revised to update established criteria of competent practice, further define core values, and set direction for future areas of opportunity. The adult weight management SOP and SOPP are complementary tools intended for RDNs to assess aptitude and identify opportunities for advancement.

Figure 5. Multilevel factors that contribute to and shape clients and their goal setting. *LGBTQ+ = lesbian, gay, bisexual, transgender, queer, and addition spectrum of sex, gender, and sexual preference identities.
APPLICATION TO PRACTICE

Adult weight management care is provided in a variety of settings, and not specific only to weight management centers. RDNs working in areas that overlap with weight management can benefit from additional skill development. Training for a competent-level practitioner to increase skills specific to adult weight management includes CDR’s Certificate of Training in Obesity for Pediatrics and Adults. Knowledge and skills that are nonspecific to weight management, but are necessary for competent practitioners, center around the practice of inclusivity.35 Placing the person(s) being served at the center of care is necessary at every level (Figure 5). This includes actively listening to the desires and concerns of the patient/client, assisting with setting goals derived by the patient/client, and supporting the use of outcomes to further refine patient/client-derived strategies to facilitate behavior change. In addition, the adult weight management practitioner must consistently employ communication skills that refrain from perpetuating weight bias that stigmatize the patient/client. Continuous reflection and self-assessment are key to influential patient/client-centered relationships.

RDNs pursue additional knowledge, skills, and training, regardless of practice setting, to maintain currency and to expand individual scope of practice within the limitations of the statutory scope of practice, as defined by state law. The SOP and S OPP for RDNs in Adult Weight Management provide a guide for self-evaluation and expanding practice, a means of identifying areas for professional development, and a tool for demonstrating competence in delivering adult weight management nutrition and dietetic services. In addition, the standards can be used to assist RDNs in general clinical practice with maintaining minimum competence in the focus area and by RDNs transitioning their knowledge and skills to a new focus area of practice. RDNs initially practice at the level at which they are competent, and this will vary depending on education, training, and experience.36 RDNs should collaborate with other RDNs in adult weight management as learning opportunities and to promote consistency in practice and performance and continuous quality improvement. It is understood throughout the SOP and S OPP that RDNs of all levels will refer to appropriate medical providers as necessary. Figure 4 includes examples of how RDNs in different roles and levels of practice may use the SOP and S OPP in Adult Weight Management.

All RDNs, even those with significant experience in other practice areas, must begin at the competent level when practicing in a new setting or new focus area of practice. At the competent level, an RDN in adult weight management is learning the principles that underpin this focus area and is developing knowledge, skills, judgment, and gaining experience for safe and effective weight management practice. This RDN, who is new to the profession or is an experienced RDN, has a breadth of knowledge in nutrition and dietetics and may have proficient or expert knowledge/practice in another focus area. However, the RDN new to the focus area of adult weight management must accept the challenge of becoming familiar with the body of knowledge, practice guidelines, and available resources to support and ensure quality weight management-related nutrition and dietetics practice (Figure 6).

At the proficient level, an RDN has developed a more in-depth understanding of adult weight management practice and is more skilled at adapting and applying evidence-based guidelines and best practices than at the competent level. The proficient RDN is also able to modify practice according to unique situations (eg, metabolic and bariatric surgery, sports and human performance,17 diabetes,18 nephrology,19 and eating disorders20). The RDN at the proficient level may possess a CSOWM or other specialist credential(s).

At the expert level, the RDN thinks critically about weight management nutrition and dietetics, demonstrates a more intuitive understanding of the practice area, displays a range of highly developed clinical and technical skills, and makes decisions through a
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<tr>
<td>Academy of Nutrition and Dietetics Weight Management Dietetic Practice Group</td>
<td><a href="https://www.wmdpg.org/">https://www.wmdpg.org/</a></td>
<td>This dietetic practice group supports the highest level of professional practice in the prevention and treatment of overweight and obesity throughout the lifecycle. Members of the Weight Management Dietetic Practice Group receive no- or reduced-cost training by global experts, access to newsletters and research briefs, and continuing education. Members also have access to the most current Weight Management Interventions Scoping Review, which identifies and characterizes 139 peer-reviewed studies investigating weight management interventions.</td>
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<tr>
<td>Academy of Nutrition and Dietetics EatRight Store Weight Management</td>
<td><a href="https://www.eatrightstore.org/product-subject/weight-management">https://www.eatrightstore.org/product-subject/weight-management</a></td>
<td>This webpage provides various products from the Academy of Nutrition and Dietetics related to weight management, including but not limited to: The Complete Counseling Kit for Weight Loss Surgery, Counseling Overweight Adults: The Lifestyle Patterns Approach and Toolkit, Real Solutions Weight Loss Workbook, and Right Size for Me: A Weight Management Guide for African American Women.</td>
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<tr>
<td>American College of Sports Medicine</td>
<td><a href="http://www.acsm.org">www.acsm.org</a></td>
<td>The mission of the American College of Sports Medicine is to advance and integrate scientific research to provide educational and practical applications of exercise science and sports medicine. Resources to members include application of the Physical Activity Guidelines for Americans issued by the US Department of Health and Human Services and what they mean for clinicians.</td>
</tr>
<tr>
<td>American College of Sports Medicine Guidelines for Exercise Testing and Prescription</td>
<td><a href="https://www.acsm.org/read-research/books/acsms-guidelines-for-exercise-testing-and-prescription">https://www.acsm.org/read-research/books/acsms-guidelines-for-exercise-testing-and-prescription</a></td>
<td>The American College of Sports Medicine Guidelines provide standards on exercise testing and prescription within the scope of exercise specialists. This manual gives succinct summaries of recommended procedures for exercise testing and exercise prescription, including considerations and modifications in weight management.</td>
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Figure 6. Resources for registered dietitian nutritionists in adult weight management (not all-inclusive).
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<td>American Society for Metabolic and Bariatric Surgery</td>
<td><a href="https://asmbs.org/">https://asmbs.org/</a></td>
<td>American Society for Metabolic and Bariatric Surgery is the largest national society for metabolic and bariatric surgery, with members, including physicians and integrated health professionals. Registered dietitian nutritionists are eligible to apply for integrated health professional membership, which requires recommendation from a current surgeon member. Integrated health professional members receive reduced cost registration to conferences and <em>Surgery for Obesity and Related Diseases</em> journal, position papers, and implementation tools. Members have access to the Clinical Practice Guidelines for the Perioperative Nutritional, Metabolic, and Nonsurgical Support of the Bariatric Surgery Patient.</td>
</tr>
<tr>
<td>Commission on Dietetic Registration</td>
<td><a href="https://www.cdrnet.org/">https://www.cdrnet.org/</a></td>
<td>The purpose of the Commission on Dietetic Registration, as the credentialing agency and organization unit of the Academy of Nutrition and Dietetics, is to serve the public by establishing and enforcing standards for certification, recertification, and the Code of Ethics and by issuing credentials to individuals who meet these standards. Commission on Dietetic Registration offers advanced training in adult weight management, including the Certificate of Training in Obesity for Pediatrics and Adults. Commission on Dietetic Registration also offers the Interdisciplinary Specialist Certification in Obesity and Weight Management credential. Interprofessional team members with documented hours of specialty practice in weight management and at least 2 years of maintained credentialing are eligible to take the certification exam.</td>
</tr>
<tr>
<td>Handbook of Obesity Treatment, Second Edition</td>
<td><a href="https://www.guilford.com/books/Handbook-of-Obesity-Treatment/Wadden-Bray/9781462542901">https://www.guilford.com/books/Handbook-of-Obesity-Treatment/Wadden-Bray/9781462542901</a></td>
<td>This handbook gives a comprehensive understanding of the causes, consequences, and management of obesity. It provides guidelines for conducting psychosocial and medical assessments and for developing individualized treatment plans (eg, lifestyle, pharmacological, and surgical treatments).</td>
</tr>
<tr>
<td>National Weight Control Registry</td>
<td><a href="http://www.nwcr.ws/">http://www.nwcr.ws/</a></td>
<td>National Weight Control Registry is the largest prospective investigation of long-term successful weight loss maintenance. At the time of this publication, the National Weight Control Registry is tracking more than 10,000 individuals</td>
</tr>
</tbody>
</table>

*Figure 6. (continued) Resources for registered dietitian nutritionists in adult weight management (not all-inclusive).*
<table>
<thead>
<tr>
<th>Resource</th>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>who have lost significant amounts of weight and kept it off for long periods of time and continues to recruit individuals who have lost weight. Registered dietitian nutritionists can encourage clients who have experienced large weight losses to participate in this registry.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obesity Action Coalition</td>
<td><a href="https://www.obesityaction.org/">https://www.obesityaction.org/</a></td>
<td>Obesity Action Coalition is a nonprofit organization of more than 70,000 members, including clinicians, patients, and their support networks. The Obesity Action Coalition focuses on raising awareness and improving access to the prevention and treatment of obesity, providing evidence-based education on obesity and its treatments, eliminating weight bias and discrimination, elevating the conversation of weight and its influence on health, and offering a community of support for the persons affected. Members receive a newsletter, access to an annual conference, and tools, including media guides, weight bias training, and education materials.</td>
</tr>
<tr>
<td>Obesity Care Advocacy Network</td>
<td><a href="https://obesitycareadvocacynetwork.com/">https://obesitycareadvocacynetwork.com/</a></td>
<td>Obesity Care Advocacy Network is a diverse group of organizations, including the Academy of Nutrition and Dietetics, that have come together with the purpose of changing how we perceive and approach the problem of obesity in this nation. Leaders organize advocacy events (eg, legislative events and meetings with payers).</td>
</tr>
<tr>
<td>Obesity Medicine Association</td>
<td><a href="https://obesitymedicine.org">https://obesitymedicine.org</a></td>
<td>The Obesity Medicine Association offers education and resources to help implement evidence-based treatments in practice and provides networking and advocacy opportunities for the expansion of coverage of obesity treatment services. Members receive access to webinars, continuing education, and networking opportunities.</td>
</tr>
</tbody>
</table>

*Figure 6. (continued) Resources for registered dietitian nutritionists in adult weight management (not all-inclusive).*
RDNs in Adult Weight Management are measurable action statements that illustrate how each standard can be applied in practice (Figures 1 and 2, available at www.jandonline.org). Standards and indicators presented in boldface type originate from the Academy’s Revised 2017 SOP in Nutrition Care and SOPP for RDNs2 and apply to RDNs in all three levels. Additional indicators not in boldface type developed for this focus area are identified as applicable to all levels of practice. Where an indicator begins at a competent level, it is understood that all RDNs in weight management are accountable for practice within each of these indicators. However, the depth with which an RDN performs each activity will increase as the individual moves beyond the competent level. Attainment of expertise in one indicator does not assign or establish level of competence. Several levels of practice are considered in this document; thus, taking a holistic view of the SOP and SOPP for RDNs in Adult Weight Management is warranted.

RDNs review the SOP and SOPP in Adult Weight Management at determined intervals to evaluate their individual focus area knowledge, skill, and competence. Consistent self-evaluation helps identify opportunities to improve and enhance practice and professional performance and set measurable, skill-specific goals for professional development. This self-appraisal also enables adult weight management RDNs to use these Standards as part of the Professional Development Portfolio recertification process,39 which encourages CDR-credentialed nutrition and dietetics practitioners to incorporate self-reflection and learning needs assessment for development of a learning plan for improvement and commitment to lifelong learning. The CDR’s 5-year recertification cycle incorporates the use of essential practice competencies for determining professional development needs.40 In the 3-step process, the credentialed practitioner accesses the Competency Plan Builder (step 1), which is a digital tool that assists practitioners in creating education learning plan.41 It helps identify focus areas during each 5-year recertification cycle for verified CDR-credentialed nutrition and dietetics practitioners. The Activity Log (step 2) is used to log and document continuing professional education over the 5-year period. The Professional Development Evaluation (step 3) guides self-reflection and assessment of learning and how it is applied. The outcome is a completed evaluation of the effectiveness of the practitioner’s learning plan and continuing professional education. The self-assessment information can then be used in developing the plan for the practitioner’s next 5-year recertification cycle. For more information, see www.cdrnet.org/competencies-for-practitioners.

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<td>Rudd Center for Food Policy and Obesity</td>
<td><a href="https://uconnruddcenter.org/">https://uconnruddcenter.org/</a></td>
<td>Rudd Center for Food Policy and Obesity offers resources for both clinicians and patients, including general education materials, media gallery, and information and training on weight bias and stigma.</td>
</tr>
<tr>
<td>The Obesity Society</td>
<td><a href="https://www.obesity.org/">https://www.obesity.org/</a></td>
<td>The Obesity Society is an interprofessional organization of registered dietitian nutritionists, physicians, behavioral health clinicians, and researchers with an interest in obesity prevention and treatment. Members have access to continuing education, Obesity journal, and the annual conference: Obesity Week, as well as access to grants and subunits. Members can also access the 2013 Guideline for the Management of Overweight and Obesity in Adults.</td>
</tr>
</tbody>
</table>

Figure 6. (continued) Resources for registered dietitian nutritionists in adult weight management (not all-inclusive).
FROM THE ACADEMY

FUTURE DIRECTIONS
The SOP and SOPP for RDNs in Adult Weight Management are dynamic documents intended to allow practitioners to benchmark current proficiency and identify pathways for professional growth. Future revisions reflect changes and advances in practice, changes to dietetics education standards, regulatory changes, and outcomes of practice audits. Ongoing assessment and differentiation of the three practice levels in support of safe, effective, equitable, and quality practice in adult weight management is the intention of each revision to serve tomorrow’s practitioners and their patients/clients.

Future directions of adult weight management adapt to where care is needed, beyond traditional counseling settings. Forward-thinking care requires the RDN in adult weight management to remain current in evidence-based practices and to continually improve and stay abreast of rapidly changing needs.

SUMMARY
The principles of adult weight management overlap with nearly all areas of nutrition. Understanding the RDNs’ level of competence in adult weight management, consensus standards, and opportunities for development are critical in establishing the RDN as an authority in the field. RDNs are advised to conduct their practice based on the most recent edition of the Code of Ethics for the Nutrition and Dietetics Profession, the Scope of Practice for RDNs, and the SOP in Nutrition Care and SOPP for RDNs, along with applicable federal and state regulations and facility accreditation standards. The SOP and SOPP for RDNs in Adult Weight Management are complementary documents and are key resources for RDNs at all knowledge and performance levels. These standards are used by RDNs who provide adult weight management care to individuals to consistently improve and appropriately demonstrate competence and value as providers of safe, effective, equitable, and quality nutrition and dietetics care and services. These standards also serve as a professional resource for self-evaluation and professional development for RDNs specializing in weight management practice. These standards are reviewed and updated every 7 years.

Current and future initiatives of the Academy, as well as advances in weight management care and services, will provide information to use in future updates and in further clarifying and documenting the specific roles and responsibilities of RDNs at each level of practice. As a quality initiative of the Academy and the WM DPG, these standards are an application of continuous quality improvement and represent an important collaborative endeavor.

These standards have been formulated for use by individuals in self-evaluation, practice advancement, development of practice guidelines and specialist credentials, and as indicators of quality. These standards do not constitute medical or other professional advice, and should not be taken as such. The information presented in the standards is not a substitute for the exercise of professional judgment by the credentialed nutrition and dietetics practitioner. These standards are not intended for disciplinary actions, or determinations of negligence or misconduct. The use of the standards for any other purpose than that for which they were formulated must be undertaken within the sole authority and discretion of the user.

References


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STATEMENT OF POTENTIAL CONFLICT OF INTEREST
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AUTHOR CONTRIBUTIONS
Each author contributed to drafting and editing the components of the article (eg, article text and figures) and reviewed all drafts of the manuscript.
Standards of Practice for Registered Dietitian Nutritionists in Adult Weight Management

Standard 1: Nutrition Assessment

The registered dietitian nutritionist (RDN) uses accurate and relevant data and information to identify nutrition-related problems.

Rationale:
Nutrition screening is the preliminary step to identify individuals who require a nutrition assessment performed by an RDN. Nutrition assessment is a systematic process of obtaining and interpreting data in order to make decisions about the nature and cause of nutrition-related problems and provides the foundation for nutrition diagnosis. It is an ongoing, dynamic process that involves not only initial data collection, but also reassessment and analysis of patient/client or community needs. Nutrition assessment is conducted using validated tools based in evidence, the five domains of nutrition assessment, and comparative standards. Nutrition assessment may be performed via in-person, or facility/practitioner assessment application, or Health Insurance Portability and Accountability Act (HIPAA) compliant video conferencing telehealth platform.

Indicators for Standard 1: Nutrition Assessment

<table>
<thead>
<tr>
<th>Each RDN:</th>
<th>Bold Font Indicators are Academy Core RDN Standards of Practice Indicators</th>
<th>The “X” signifies the indicators for the level of practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Patient/client/population history: Assesses current and past information related to personal, medical, family, and psychosocial/social history</td>
<td>Competent: X  Proficient: X  Expert: X</td>
</tr>
<tr>
<td>1.1A</td>
<td>Reviews nutrition risk screening data (eg, malnutrition) from referring facility/provider or incorporates into nutrition assessment data collection using evidence-based screening tool</td>
<td>Competent: X  Proficient: X  Expert: X</td>
</tr>
<tr>
<td>1.1B</td>
<td>Assesses weight history through childhood, adolescence, and adulthood</td>
<td>Competent: X  Proficient: X  Expert: X</td>
</tr>
<tr>
<td>1.1B1</td>
<td>Identifies specific developmental stages when significant weight change occurred including key benchmarks related to weight status (eg, highest/lowest adult weight, usual body weight, pre/post pregnancy or menopause weight, gender transition)</td>
<td>Competent: X  Proficient: X  Expert: X</td>
</tr>
<tr>
<td>1.1B2</td>
<td>Identifies life events related to significant weight change (eg, marriage, birth, divorce, death, job changes)</td>
<td>Competent: X  Proficient: X  Expert: X</td>
</tr>
<tr>
<td>1.1B3</td>
<td>Compares history of previous weight-loss strategies/medical nutrition therapy including components of previous weight loss attempts most and least helpful for patient/client</td>
<td>Competent: X  Proficient: X  Expert: X</td>
</tr>
<tr>
<td>1.1B4</td>
<td>Considers previous behavioral and social environmental factors that impacts weight or health (eg, socioeconomic status, food access, transportation, physical safety, living conditions, social support, work schedule)</td>
<td>Competent: X  Proficient: X  Expert: X</td>
</tr>
<tr>
<td>1.1B5</td>
<td>Examines history of trauma as it relates to significant weight change (eg, sexual, physical and/or psychological trauma, internalized weight bias)</td>
<td>Competent: X  Expert: X</td>
</tr>
</tbody>
</table>

(continued on next page)

Figure 1. Standards of Practice for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.
### Indicators for Standard 1: Nutrition Assessment

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<tr>
<td>1.1C</td>
<td>Reviews medical and surgical history</td>
</tr>
<tr>
<td>1.1C1</td>
<td>Documents history of eating disorders, disordered eating patterns, and treatment (eg, night, binge and/or restrictive eating, purging, excessive exercise)</td>
</tr>
<tr>
<td>1.1C2</td>
<td>Documents history of tobacco, alcohol, and/or substance use, dependency, and treatment</td>
</tr>
<tr>
<td>1.1C3</td>
<td>Identifies metabolic and hormonal conditions that may be associated with weight status (eg, prediabetes, diabetes, polycystic ovary syndrome, thyroid disorders, cardiovascular disease, obstructive sleep apnea, and metabolic and bariatric surgery)</td>
</tr>
<tr>
<td>1.1C3i</td>
<td>Investigates potential physiological and sensory challenges associated with weight-related diagnosis (eg, altered gastrointestinal function related to hypotonia from cerebral palsy, gastroparesis related to diabetes, limited food acceptance related to sensory issues from autism)</td>
</tr>
<tr>
<td>1.1C4</td>
<td>Connects weight-related side effects to medications (eg, weight gain associated with anti-inflammatory, antihypertensives, antidepressants, antipsychotics; weight loss associated with diuretics, stimulants, medications taken specifically for weight loss)</td>
</tr>
<tr>
<td>1.1C5</td>
<td>Evaluates procedures impacting nutrition and weight status (eg, metabolic and bariatric surgery, amputations, and gastrointestinal, endocrinology, and gynecological surgery)</td>
</tr>
<tr>
<td>1.1D</td>
<td>Assesses family history</td>
</tr>
<tr>
<td>1.1D1</td>
<td>Retrieves family weight history including previous treatment (eg, weight loss attempts, metabolic and bariatric surgery)</td>
</tr>
<tr>
<td>1.1D2</td>
<td>Determines history of family weight-related conditions (eg, diabetes, polycystic ovarian syndrome, obstructive sleep apnea, genetic conditions)</td>
</tr>
<tr>
<td>1.1E</td>
<td>Reviews patient/client expressed goals of weight gain, loss or maintenance</td>
</tr>
<tr>
<td>1.1E1</td>
<td>Solicits motivation level to change relative to previous weight loss attempts (eg, Likert scale)</td>
</tr>
</tbody>
</table>

*Figure 1. (continued) Standards of Practice for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.*
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</tr>
<tr>
<td>Each RDN:</td>
</tr>
<tr>
<td>1.1E2 Notes reported patient/client self-efficacy relative to previous weight loss attempts</td>
</tr>
<tr>
<td>1.2 Anthropometric assessment: Assesses anthropometric indicators (eg, height, weight, body mass index [BMI], waist circumference, arm circumference), comparison to reference data (eg, percentile ranks/z-scores), and individual patterns and history</td>
</tr>
<tr>
<td>1.2A Uses standard procedures and equipment for height, weight, calculation of BMI, and waist circumference</td>
</tr>
<tr>
<td>1.2A1 Selects from scales, stadiometers, skinfold calipers, and other equipment appropriate to target population</td>
</tr>
<tr>
<td>1.2A2 Chooses gender- or ethnic-specific criteria when evaluating waist circumference and BMI</td>
</tr>
<tr>
<td>1.2B Assesses body composition when excess adipose and/or excess skin present</td>
</tr>
<tr>
<td>1.2C Calculates body composition with validated instruments, such as magnetic resonance imaging, dual-energy x-ray absorptiometry, and computed tomography, that segment adipose to determine adipose distribution</td>
</tr>
<tr>
<td>1.3 Biochemical data, medical tests, and procedure assessment: Assesses laboratory profiles (eg, acid-base balance, renal function, endocrine function, inflammatory response, vitamin/mineral profile, lipid profile), and medical tests and procedures (eg, gastrointestinal study, metabolic rate)</td>
</tr>
<tr>
<td>1.3A Collects results of routine diagnostic tests and therapeutic procedures (eg, complete blood count, comprehensive metabolic panel, blood pressure, heart rate, electrocardiogram)</td>
</tr>
<tr>
<td>1.3B Interprets complex diagnostic tests and therapeutic procedures (eg, endocrine markers, urinary analysis, sleep studies, upper gastrointestinal series, endoscopy, metabolomic markers)</td>
</tr>
<tr>
<td>1.3C Measures resting energy expenditure using appropriate method (eg, room calorimeter; validated indirect calorimetry)</td>
</tr>
<tr>
<td>1.4 Nutrition-focused physical examination (NFPE) may include visual and physical examination: Obtains and assesses findings from NFPE (eg, indicators of vitamin/mineral deficiency/toxicity, edema, muscle wasting, subcutaneous fat loss, altered body composition, oral health, feeding ability [suck/swallow/breathe], appetite, and affect)</td>
</tr>
</tbody>
</table>

Figure 1. (continued) Standards of Practice for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.
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<tr>
<td>1.4A</td>
<td>Assesses clinical signs of altered body composition (eg, skin turgor, fatigue, muscle cramps, dark urine, rapid weight change with fluid overload or loss, constipation, BMI or waist circumference changes)</td>
<td>X  X  X</td>
</tr>
<tr>
<td>1.4B</td>
<td>Notes clinical signs of undernutrition (eg, dry, brittle, or thinning hair and nails, irritability, inability to concentrate)</td>
<td>X  X  X</td>
</tr>
<tr>
<td>1.4C</td>
<td>Interprets clinical signs of malnutrition, including eating disorders (eg, hypothermia, bradycardia, lanugo, muscle wasting, tooth erosion, bony protrusions, parotid gland enlargement, gastrointestinal distress, nystagmus, ataxia, poor wound healing)</td>
<td>X  X</td>
</tr>
<tr>
<td>1.4D</td>
<td>Synthesizes complex health issues (eg, acute post-bariatric surgery nutrition complications, signs of Beri Beri such as executive functioning deficits, changes in gait; secondary hyperparathyroidism, dysphagia)</td>
<td>X</td>
</tr>
</tbody>
</table>

1.5 Food and nutrition-related history assessment (ie, dietary assessment)- Evaluates the following components:

<table>
<thead>
<tr>
<th>1.5A</th>
<th>Food and nutrient intake including composition and adequacy, meal and snack patterns, and appropriateness related to food allergies and intolerances</th>
<th>X  X  X</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5A1</td>
<td>Documents self-reported and/or confirmed food allergy or intolerance (eg, gluten sensitivity/intolerance, lactose intolerance/milk allergy)</td>
<td>X  X  X</td>
</tr>
<tr>
<td>1.5A2</td>
<td>Determines dietary preferences and practices (cultural practices, alcohol intake, strong dislikes or preferences)</td>
<td>X  X  X</td>
</tr>
<tr>
<td>1.5A3</td>
<td>Summarizes changes in usual intake as a result of deliberate weight-control measures, physical activity, medical conditions, illnesses, and injuries, or psychological factors (eg, depression, anxiety, post-traumatic stress disorder)</td>
<td>X  X  X</td>
</tr>
<tr>
<td>1.5A4</td>
<td>Identifies changes in usual intake related to chronic disease, psychiatric disease (eg, bipolar disorder, dissociative identity disorder) or psychotropic medications</td>
<td>X  X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.5B</th>
<th>Food and nutrient administration including current and previous diets and diet prescriptions and food modifications, eating environment, and enteral and parenteral nutrition administration</th>
<th>X  X  X</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5B1</td>
<td>Identifies external influences on eating patterns (eg, meal/snack access; night, split, extended work shifts)</td>
<td>X  X  X</td>
</tr>
</tbody>
</table>

(continued on next page)

Figure 1. (continued) Standards of Practice for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.
## Indicators for Standard 1: Nutrition Assessment

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</table>
| **1.5B2**  
Determines level of support needed for self-directed food selection, attainment, preparation, and intake (e.g., support of care providers, adaptive equipment, literacy tools) | Competent | Proficient | Expert |
| **1.5C**  
Medication and dietary supplement use, including prescription and over-the-counter medications, and integrative and functional medicine products | X | X | X |
| **1.5C1**  
Identifies the safety and efficacy of dietary supplement intake (e.g., macro- and micronutrients, fiber, bioactive substances, caffeine, herbals) | X | X | X |
| **1.5C2**  
Lists actual or potential drug/nutrient interactions | X | X | X |
| **1.5C3**  
Categorizes nutrition-related adverse side effects of medications including controlled substances | X | X | |
| **1.5C4**  
Determines adequacy of vitamin and mineral supplements including after metabolic and bariatric surgery | X | X | |
| **1.5D**  
Knowledge, beliefs, and attitudes (e.g., understanding of nutrition-related concepts, emotions about food/nutrition/health, body image, preoccupation with food and/or weight, readiness to change nutrition- or health-related behaviors, and activities and actions influencing achievement of nutrition-related goals) | X | X | X |
| **1.5D1**  
Assesses food preparation skills and knowledge | X | X | X |
| **1.5D2**  
Identifies beliefs and convictions around food (e.g., food combination, avoiding “white foods”) | X | X | X |
| **1.5D3**  
Determines ability to set and adhere to goals (e.g., visit attendance, recall of goals, self-monitoring, use of monitoring technology tools, self-efficacy) | X | X | X |
| **1.5D4**  
Assesses knowledge/ability to eat mindfully (e.g., intuitive eating, hunger cues, emotions, distractions, monitor/manage eating antecedents such as hunger, mood, location, work/life situations) | X | X | X |
| **1.5D5**  
Evaluates underlying barriers or failures that hinder follow through with nutrition therapy | X | X | |
| **1.5E**  
Food security defined as factors affecting access to a sufficient quantity of safe, healthful food and water, as well as food/nutrition-related supplies | X | X | X |
| **1.5E1**  
Identifies safe, healthful food/meal availability (e.g., financial resources, access to farms, markets, and/or groceries; access to kitchen, pantry, and equipment for safely cooking, serving, and storing food) | X | X | X |

(continued on next page)

**Figure 1. (continued)** Standards of Practice for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.
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</thead>
<tbody>
<tr>
<td>1.5E2</td>
<td>Checks for awareness and use of community resources for food (e.g., government-funded nutrition assistance programs, food bank, farmers market vouchers, shelters)</td>
<td>Competent</td>
</tr>
<tr>
<td>1.5F</td>
<td>Physical activity, cognitive and physical ability to engage in developmentally appropriate nutrition-related tasks (e.g., self-feeding, shopping, food preparation, and other activities of daily living) and breastfeeding</td>
<td>X</td>
</tr>
<tr>
<td>1.5F1</td>
<td>Determines functional status (e.g., mobility, activities of daily living, food preparation, food shopping)</td>
<td>X</td>
</tr>
<tr>
<td>1.5F2</td>
<td>Examines complex feeding needs (e.g., breastfeeding, enteral and parenteral nutrition, aspiration therapy devices)</td>
<td>X</td>
</tr>
<tr>
<td>1.5G</td>
<td>Other factors affecting intake and nutrition and health status (e.g., cultural, ethnic, religious, lifestyle influences, psychosocial, and social determinants of health)</td>
<td>X</td>
</tr>
<tr>
<td>1.5G1</td>
<td>Chronicles food-related beliefs, behaviors, and traditions</td>
<td>X</td>
</tr>
<tr>
<td>1.5G1i</td>
<td>Identifies disordered eating patterns (e.g., such as binge eating, use of compensatory behaviors, purging, laxative use) including access to and observations from interprofessional team members</td>
<td>X</td>
</tr>
<tr>
<td>1.5G1ii</td>
<td>Evaluates maladaptive behaviors (e.g., perfectionism, fear of eating unhealthy foods, hypervigilance)</td>
<td></td>
</tr>
<tr>
<td>1.5G2</td>
<td>Identifies family influences, cultural, ethnic, gender identity, and religious implications for weight management goals</td>
<td>X</td>
</tr>
<tr>
<td>1.5G3</td>
<td>Determines/compares the impact of social determinants of health (e.g., transportation, socioeconomic, education, culture) on goals</td>
<td>X</td>
</tr>
<tr>
<td>1.5G3i</td>
<td>Checks for the use of technologies that support weight management goals</td>
<td>X</td>
</tr>
<tr>
<td>1.6</td>
<td>Comparative standards: Uses reference data and standards to estimate nutrient needs and recommended body weight, body mass index, and desired growth patterns</td>
<td>X</td>
</tr>
<tr>
<td>1.6A</td>
<td>Identifies the most appropriate reference data and/or standards (e.g., international, national, state, institutional, and regulatory) based on practice setting and patient/client-specific factors (e.g., age and disease state)</td>
<td>X</td>
</tr>
</tbody>
</table>

---

*Figure 1. (continued) Standards of Practice for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.*
### Indicators for Standard 1: Nutrition Assessment

**Bold Font Indicators are Academy Core RDN Standards of Practice Indicators**

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<thead>
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<tbody>
<tr>
<td>1.6A1</td>
<td>Cites clinical practice recommendations for classification and guidelines for overweight and obesity, including BMI and waist circumference (e.g., World Health Organization guidelines for classifying level of obesity)</td>
<td>X</td>
</tr>
<tr>
<td>1.6A2</td>
<td>Uses recommendations from National Heart, Lung, and Blood Institute Practical Guide, American Diabetes Association Standards of Medical Care as benchmark tools when evaluating physical or clinical findings</td>
<td>X</td>
</tr>
<tr>
<td>1.6B</td>
<td>Estimates adequacy and appropriateness of food, beverage, and nutrient intake (e.g., macro- and micronutrients, meal patterns, calories, food allergies) using the Dietary Guidelines for Americans and the Dietary Reference Intakes</td>
<td>X</td>
</tr>
<tr>
<td>1.6B1</td>
<td>Determines adequacy of nutrient intake when Dietary Guidelines for Americans do not apply, (e.g., metabolic and bariatric surgery)</td>
<td>X</td>
</tr>
<tr>
<td>1.6C</td>
<td>Estimates resting metabolic rate using evidence-based formula (e.g., Mifflin-St Jeor Equation, Harris-Benedict)</td>
<td>X</td>
</tr>
</tbody>
</table>
| 1.7       | 1954.e7

**Physical activity habits and restrictions: Assesses physical activity, history of physical activity, and physical activity training**

| 1.7A      | Identifies factors affecting ability to engage in physical activity (e.g., safety, age, vision, weight, joint and other health issues, mental health, dexterity, surgery, amputations, paralysis, medication contraindication) | X | X | X |
| 1.7B      | Identifies factors affecting access to physical activity and environmental safety (e.g., physical and climatic, walkability of neighborhood, proximity to parks/green space, access to physical activity facilities/programs) | X | X | X |
| 1.7C      | Describes physical activity level relative to current guidelines (e.g., frequency, intensity, time, and type) | X | X | X |
| 1.7D      | Lists sedentary time (e.g., screen time, sedentary occupation, commute) | X | X | X |
| 1.7E      | Outlines patient/client physical activity knowledge, readiness to change, barriers, for: • short- and long-term goals • barriers to implementation and meeting personal and/or recommended goals • self-efficacy • use of emerging technologies with physical activity | X | X | X |

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<tr>
<td>1.7F</td>
<td>Calculates physical activity-related energy expenditure (eg, planned physical activity, activities of daily living, occupational activity, leisure time activity, transportation)</td>
</tr>
<tr>
<td>1.8</td>
<td>Collects data and reviews data collected and/or documented by the nutrition and dietetics technician, registered (NDTR), other health care practitioner(s), patient/client, or staff for factors that affect nutrition and health status</td>
</tr>
</tbody>
</table>
| 1.8A      | Identifies contributing factors, examples are:  
- physical activity limitations  
- social or living situation  
- cultural food habits  
- food allergies/intolerances  
- disordered eating/eating disorder  
- use of technology | X X X |
| 1.8B      | Reviews information on mental health diagnoses as contributes to weight history in developing nutrition plan of care | X X |
| 1.8C      | Uses complex decision making and experience to draw conclusions from results of tests, procedures, and evaluations in the context of integrated disease management | X X |
| 1.8C1     | Uses an interprofessional approach to identify highly complex issues important in nutrition diagnosis (eg, medical, psychological, behavioral, other therapies) | X X |
| 1.9       | Uses collected data to identify possible problem areas for determining nutrition diagnoses | X X X |
| 1.10      | Documents and communicates: | |
| 1.10A     | Date and time of assessment | X X X |
| 1.10B     | Pertinent data (eg, medical, social, behavioral) | X X X |
| 1.10C     | Comparison to appropriate standards | X X X |
| 1.10D     | Patient/client/population perceptions, values and motivation related to presenting problems | X X X |
| 1.10E     | Changes in patient/client/population perceptions, values and motivation related to presenting problems | X X X |
| 1.10F     | Reason for discharge/discontinuation or referral, if appropriate | X X X |

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Figure 1. (continued) Standards of Practice for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.
Examples of Outcomes for Standard 1: Nutrition Assessment
- Appropriate assessment tools and procedures are used in valid and reliable ways
- Appropriate and pertinent data are collected
- Effective interviewing methods are used
- Data are organized and in a meaningful framework that relates to nutrition problems
- Use of assessment data leads to the determination that a nutrition diagnosis/problem does or does not exist
- Problems that require consultation with or referral to another provider are recognized
- Documentation and communication of assessment are complete, relevant, accurate, and timely

Standard 2: Nutrition Diagnosis
The registered dietitian nutritionist (RDN) identifies and labels specific nutrition problem(s)/diagnosis(es) that the RDN is responsible for treating.

Rationale:
Analysis of the assessment data leads to identification of nutrition problems and a nutrition diagnosis(es), if present. The nutrition diagnosis(es) is the basis for determining outcome goals, selecting appropriate interventions, and monitoring progress. Diagnosing nutrition problems is the responsibility of the RDN.

Indicators for Standard 2: Nutrition Diagnosis

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<tr>
<td><strong>Each RDN:</strong></td>
<td>Competent</td>
</tr>
<tr>
<td>2.1 Diagnoses nutrition problems based on evaluation of assessment data and identifies supporting concepts (ie, etiology, signs, and symptoms)</td>
<td>X</td>
</tr>
<tr>
<td>2.1A Integrates interprofessional data into nutrition diagnosis (eg, biochemical, weight influencing medications, trauma, psychological history)</td>
<td></td>
</tr>
<tr>
<td>2.1B Formulates diagnosis with concurrent nutrition-related conditions (eg, diabetes, kidney disease, neuropathy, surgery)</td>
<td></td>
</tr>
<tr>
<td>2.2 Prioritizes the nutrition problem(s)/diagnosis(es) based on severity, safety, patient/client needs and preferences, ethical considerations, likelihood that nutrition intervention/plan of care will influence the problem, discharge/transitions of care needs, and patient/client/advocate perception of importance</td>
<td>X</td>
</tr>
<tr>
<td>2.2A Uses evidence-based protocols and guidelines for obesity to prioritize nutrition diagnosis in order of importance or urgency</td>
<td>X</td>
</tr>
</tbody>
</table>
| 2.2B Prioritizes weight-management-related nutrition diagnoses considering:  
  - concurrent conditions (eg, chronic diseases, genetic disorders, sensory processing disorders, behavioral health issues, pica, eating disorders)  
  - hospitalizations and/or surgery  
  - lifestyle factors (eg, work schedule, eating environment)  
  - socioeconomic status (eg, access to food, homelessness)  
  - food behaviors, food beliefs  
  - patient/client preferences and goals | | X | X |

*Figure 1. (continued) Standards of Practice for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.*
Indicators for Standard 2: Nutrition Diagnosis

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<td><strong>Each RDN:</strong></td>
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</tr>
<tr>
<td>- resources and support systems for weight management (eg, family, work, social network)</td>
<td></td>
</tr>
<tr>
<td>- readiness for change</td>
<td></td>
</tr>
<tr>
<td>2.2C Determines the primary nutrition diagnosis for concurrent disease states and complications (eg, heart failure, cancer, renal disease)</td>
<td></td>
</tr>
<tr>
<td>2.3 Communicates the nutrition diagnosis(es) to patients/clients/advocates, community, family members or other health care professionals when possible and appropriate</td>
<td>X</td>
</tr>
<tr>
<td>2.3A Provides evidence to substantiate the nutrition diagnosis</td>
<td>X</td>
</tr>
<tr>
<td>2.3B Uses appropriate and timely communication methods within HIPPA guidelines</td>
<td>X</td>
</tr>
<tr>
<td>2.4 Documents the nutrition diagnosis(es) using standardized terminology and clear, concise written statement(s) (eg, using Problem [P], Etiology [E], and Signs and Symptoms [S] [PES statement(s)] or Assessment [A], Diagnosis [D], Intervention [I], Monitoring [M], and Evaluation [E] [ADIME statement(s)])</td>
<td>X</td>
</tr>
<tr>
<td>2.5 Re-evaluates and revises nutrition diagnosis(es) when additional assessment data become available</td>
<td>X</td>
</tr>
</tbody>
</table>

Examples of Outcomes for Standard 2: Nutrition Diagnosis
- Nutrition Diagnostic Statements accurately describe the nutrition problem of the patient/client and/or community in a clear and concise way
- Documentation of nutrition diagnosis(es) is relevant, accurate and timely
- Documentation of nutrition diagnosis(es) is revised as additional assessment data become available

Standard 3: Nutrition Intervention/Plan of Care
The registered dietitian nutritionist (RDN) identifies and implements appropriate, person-centered interventions designed to address nutrition-related problems, behaviors, risk factors, environmental conditions, or aspects of health status for an individual, target group, or the community at large.

Rationale:
Nutrition intervention consists of two interrelated components — planning and implementation.
- Planning involves prioritizing the nutrition diagnoses, conferring with the patient/client and others, reviewing practice guidelines, protocols and policies, setting goals and defining the specific nutrition intervention strategy.
- Implementation is the action phase that includes carrying out and communicating the intervention/plan of care, continuing data collection, and revising the nutrition intervention/plan of care strategy, as warranted, based on change in condition and/or the patient/client/population response.

An RDN implements the interventions or assigns components of the nutrition intervention/plan of care to professional, technical and support staff in accordance with knowledge/skills/judgment, applicable laws and regulations, and organization policies. The RDN collaborates with or refers to other health care professionals and resources. The nutrition intervention/plan of care is ultimately the responsibility of the RDN.

Figure 1. (continued) Standards of Practice for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.
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<tr>
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</tr>
<tr>
<td><strong>Each RDN:</strong></td>
</tr>
<tr>
<td><strong>Plans the Nutrition Intervention/Plan of Care:</strong></td>
</tr>
<tr>
<td>3.1 <strong>Addresses the nutrition diagnosis(es) by determining and prioritizing appropriate interventions for the plan of care</strong></td>
</tr>
<tr>
<td>3.1A Prioritization considerations may include:</td>
</tr>
<tr>
<td>- concurrent conditions</td>
</tr>
<tr>
<td>- hospitalizations and/or surgery</td>
</tr>
<tr>
<td>- lifestyle factors (eg, work schedule, eating environment)</td>
</tr>
<tr>
<td>- socioeconomic status (eg, access to food, homelessness)</td>
</tr>
<tr>
<td>- food behaviors, food beliefs</td>
</tr>
<tr>
<td>- patient/client preferences and goals</td>
</tr>
<tr>
<td>- resources and support systems for weight management (eg, family, work, social network)</td>
</tr>
<tr>
<td>3.1B Prioritizes based on challenges that impact nutrition status (eg, genetic disorders, sensory processing disorders, behavioral and mental health issues, pica, eating disorders)</td>
</tr>
<tr>
<td>3.1C Prioritizes acute behavioral, nutrition- and/or weight-related condition interventions (eg, primary hyperparathyroidism, post-surgical Beri Beri)</td>
</tr>
<tr>
<td>3.2 <strong>Bases intervention/plan of care on best available research/evidence and information, evidence-based guidelines, and best practices (eg, Academy Position Papers, Academy Evidence Analysis Library Adult Weight Management Evidence-Based Nutrition Practice Guideline, National Guidelines-Dietary Guidelines for Americans, American Heart Association/American College of Cardiology/The Obesity Society Guideline for the Management of Overweight and Obesity in Adults, Physical Activity Guidelines for Americans, American College of Sports Medicine)</strong></td>
</tr>
<tr>
<td>3.2A Recognizes the need for use of adjusted intervention guidelines for patients/clients (eg, intellectual and/or developmental disabilities [eg, Prader-Willi syndrome, Down syndrome], psychiatric medication use, concurrent health conditions)</td>
</tr>
<tr>
<td>3.3 <strong>Refers to policies and procedures, protocols, and program standards</strong></td>
</tr>
<tr>
<td>3.3A Manages care to align with current policies, procedures, and standards (eg, American College of Surgeons Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program Standards)</td>
</tr>
<tr>
<td>3.4 <strong>Collaborates with patient/client/advocate/population, community, caregivers, interprofessional&lt;sup&gt;a&lt;/sup&gt; team, and other health care professionals</strong></td>
</tr>
</tbody>
</table>

(continued on next page)

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<tr>
<td><strong>3.5</strong></td>
<td><strong>Works with patient/client/advocate/population, community, and caregivers to identify goals, preferences, discharge/transitions of care needs, plan of care and expected outcomes</strong></td>
</tr>
<tr>
<td>3.5A</td>
<td>Discusses with patient/client the relationship between weight and health, physical activity, behavior change, and disease prevention</td>
</tr>
<tr>
<td>3.5B</td>
<td>Encourages patient/client to play an active role in goal setting for behavior change</td>
</tr>
<tr>
<td>3.5C</td>
<td>Identifies barriers to successful implementation (eg, patient/client follow through, food availability and preparation issues, social support, readiness to change, financial considerations, realistic expectations, food knowledge, duration of treatment, and commitment to process)</td>
</tr>
<tr>
<td>3.5D</td>
<td>Identifies and supports strategies to address lapses in engagement or behaviors and identifies recovery strategies</td>
</tr>
<tr>
<td>3.5E</td>
<td>Discusses with the patient/client physiological processes of weight regulation in helping the patient/client set realistic expectations of different treatment options</td>
</tr>
<tr>
<td><strong>3.6</strong></td>
<td><strong>Collaborates with patient/client to develop measurable goals</strong></td>
</tr>
<tr>
<td>3.6A</td>
<td>Considers the resources, preferences, and abilities of the patient/client (eg, cultural needs, health literacy, food security, food preparation skills)</td>
</tr>
<tr>
<td>3.6B</td>
<td>Assists medically cleared patient/client with establishing physical activity goals and devising plans</td>
</tr>
<tr>
<td>3.6C</td>
<td>Tailors nutrition prescription to meet nutrient and energy needs</td>
</tr>
<tr>
<td>3.6C1</td>
<td>Adjusts nutrition needs based on concurrent conditions (eg, metabolic and bariatric surgery, medication use, metabolic conditions, other chronic diseases, habitual level of physical activity)</td>
</tr>
<tr>
<td><strong>3.7</strong></td>
<td><strong>Defines time and frequency of care (eg, intensity, duration, and follow-up)</strong></td>
</tr>
<tr>
<td><strong>3.8</strong></td>
<td><strong>Uses standardized terminology for describing interventions</strong></td>
</tr>
<tr>
<td><strong>3.9</strong></td>
<td><strong>Identifies resources and referrals needed</strong></td>
</tr>
<tr>
<td>3.9A</td>
<td>Establishes, maintains, and uses a directory of referral programs, providers, resources, and tools to support patient/client needs (eg, RDNs with expertise, interprofessional team members, technology-based apps, community support groups, physical activity resources, bariatric specialist)</td>
</tr>
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</table>

(continued on next page)
**Indicators for Standard 3: Nutrition Intervention/Plan of Care**

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<tr>
<td>3.9B</td>
<td>Facilitates obtaining resources/referrals for concurrent needs (eg, behavioral/psychological, communication, dysphasia management, skills training for care providers/family, feeding team)</td>
</tr>
<tr>
<td>Implement the Nutrition Intervention/Plan of Care:</td>
<td></td>
</tr>
<tr>
<td>3.10 Collaborates with colleagues, interprofessional team, and other health care professionals</td>
<td>X</td>
</tr>
<tr>
<td>3.10A Refers to other members of interprofessional team when need is outside scope of practice or experience of RDN (eg, exercise physiologist, behavioral health professionals, RDN with expertise)</td>
<td>X</td>
</tr>
<tr>
<td>3.10B Participates in communications within the interprofessional team</td>
<td>X</td>
</tr>
<tr>
<td>3.10C Facilitates and fosters active communication, learning, partnerships, and collaboration within the interprofessional team and other providers</td>
<td></td>
</tr>
<tr>
<td>3.10D Directs or leads the interprofessional team and others</td>
<td></td>
</tr>
<tr>
<td>3.10E Identifies and seeks out opportunities for interprofessional and interagency collaboration</td>
<td></td>
</tr>
<tr>
<td>3.11 Communicates and coordinates the nutrition intervention/plan of care</td>
<td>X</td>
</tr>
<tr>
<td>3.11A Ensures that the patient/client and, as appropriate, family/significant others/caregivers, understand and can articulate goals and other relevant aspects of plan of care</td>
<td>X</td>
</tr>
<tr>
<td>3.11B Communicates plan of care to other health care professionals involved in implementation of the plan</td>
<td>X</td>
</tr>
<tr>
<td>3.11C Coordinates care for the patient/client with other members of the health care team (eg, physician, pharmacist, exercise specialist, non-clinical administrative staff)</td>
<td></td>
</tr>
<tr>
<td>3.12 Initiates the nutrition intervention/plan of care</td>
<td>X</td>
</tr>
<tr>
<td>3.12A Uses approved clinical privileges, physician/non-physician practitioner-driven orders (ie, delegated orders), protocols, or other facility-specific processes for order writing or for provision of nutrition-related services consistent with applicable specialized training, competence, medical staff, and/or organizational policy</td>
<td>X</td>
</tr>
<tr>
<td>3.12A1 Implements, initiates, or modifies orders for therapeutic diet, nutrition-related pharmacotherapy management, nutrition-related services (eg, medical foods/nutrition/dietary supplements, food texture modifications, enteral and parenteral nutrition, intravenous fluid infusions, laboratory tests, medications, and education and counseling)</td>
<td>X</td>
</tr>
</tbody>
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<td>3.12A1i</td>
<td>Recommends and/or provides education and counseling on prescribed or over-the-counter weight management medications</td>
</tr>
<tr>
<td>3.12A1ii</td>
<td>Modifies orders to manage concurrent conditions (eg, end-stage renal disease, chronic heart failure, eating disorders, metabolic conditions) with privileges, delegated orders, or protocol</td>
</tr>
<tr>
<td>3.12A1iii</td>
<td>Facilitates fluid management interventions (eg, post-metabolic and bariatric surgery, congestive heart failure)</td>
</tr>
<tr>
<td>3.12A2</td>
<td>Manages nutrition support therapies (eg, formula selection, rate adjustments, addition of designated medications and vitamin/mineral supplements to parenteral nutrition solutions or supplemental water for enteral nutrition)</td>
</tr>
<tr>
<td>3.12A3</td>
<td>Initiates and performs nutrition-related services (eg, bedside swallow screenings, inserting and monitoring nasoenteric feeding tubes, and indirect calorimetry measurements, or other permitted services)</td>
</tr>
<tr>
<td>3.12B</td>
<td>Addresses topics with patient/client as outlined in nutrition prescription when developing the plan of care (eg, access to food, food selection and preparation, meal planning, portion control, physical activity goals, socioeconomic status, social support, motivation, barriers to change)</td>
</tr>
<tr>
<td>3.12C</td>
<td>Uses advanced behavior change techniques to facilitate patient/client self-management (eg, motivational interviewing, cognitive behavioral therapy, health behavior change models)</td>
</tr>
<tr>
<td>3.12D</td>
<td>Implements critical thinking and synthesis to guide decision making in concurrent conditions (eg, pre/post metabolic and bariatric surgery, post-bariatric surgery vitamin deficiencies)</td>
</tr>
<tr>
<td>3.12E</td>
<td>Balances multifactorial, unpredictable conditions (eg, poorly managed diabetes, eating disorders with medical complications, reactive hypoglycemia)</td>
</tr>
<tr>
<td>3.13</td>
<td>Assigns activities to NDTR and other professional, technical and support personnel in accordance with qualifications, organizational policies/protocols, and applicable laws and regulations</td>
</tr>
<tr>
<td>3.13A</td>
<td>Supervises professional, technical and support personnel</td>
</tr>
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</tr>
<tr>
<td>3.14 Continues data collection</td>
<td></td>
</tr>
<tr>
<td>3.14A Identifies specific data to be collected for the patient/client, including weight change, biochemical, behavioral, and lifestyle factors, using standardized, validated data collection methods wherever possible</td>
<td>X</td>
</tr>
<tr>
<td>3.14B Uses a prescribed/standardized format for recording data</td>
<td>X</td>
</tr>
<tr>
<td>3.14C Uses data obtained from validated measures (eg, Impact of Weight on Quality of Life-Lite Questionnaire, Weight Control Strategies Scale)</td>
<td></td>
</tr>
<tr>
<td><strong>3.15 Documents:</strong></td>
<td></td>
</tr>
<tr>
<td>3.15A Date and time</td>
<td>X</td>
</tr>
<tr>
<td>3.15B Specific and measurable treatment goals and expected outcomes</td>
<td>X</td>
</tr>
<tr>
<td>3.15C Recommended interventions</td>
<td>X</td>
</tr>
<tr>
<td>3.15D Patient/client/advocate/caregiver/community receptiveness</td>
<td>X</td>
</tr>
<tr>
<td>3.15E Referrals made and resources used</td>
<td>X</td>
</tr>
<tr>
<td>3.15F Patient/client/advocate/caregiver/community comprehension</td>
<td>X</td>
</tr>
<tr>
<td>3.15G Barriers to change</td>
<td>X</td>
</tr>
<tr>
<td>3.15H Other information relevant to providing care and monitoring progress over time</td>
<td>X</td>
</tr>
<tr>
<td>3.15I Plans for follow up and frequency of care</td>
<td>X</td>
</tr>
<tr>
<td>3.15J Rationale for discharge or referral if applicable</td>
<td>X</td>
</tr>
</tbody>
</table>

### Examples of Outcomes for Standard 3: Nutrition Intervention/Plan of Care

- Goals and expected outcomes are appropriate and prioritized
- Patient/client/advocate/population, care givers, and interprofessional teams collaborate and are involved in developing nutrition intervention/plan of care
- Appropriate individualized patient/client-centered nutrition intervention/plan of care, including nutrition prescription, is developed
- Nutrition intervention/plan of care is delivered, and actions are carried out as intended
- Discharge planning/transition of care needs are identified and addressed
- Documentation of nutrition intervention/plan of care uses Specific, Measurable, Achievable, Relevant, and Time-Bound (S.M.A.R.T.) goals and is:
  - Comprehensive
  - Accurate
  - Dated and Timed

Figure 1. (continued) Standards of Practice for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.
Standard 4: Nutrition Monitoring and Evaluation

The registered dietitian nutritionist (RDN) monitors and evaluates indicators and outcomes data directly related to the nutrition diagnosis, goals, preferences, and intervention strategies to determine the progress made in achieving desired results of nutrition care and whether planned interventions should be continued or revised.

Rationale:

Nutrition monitoring and evaluation are essential components of an outcomes management system in order to assure quality, patient-/client-/population-centered care and to promote uniformity within the profession in evaluating the efficacy of nutrition interventions. Through monitoring and evaluation, the RDN identifies important measures of change or patient/client/patient outcomes relevant to the nutrition diagnosis and nutrition intervention/plan of care; describes how best to measure these outcomes; and intervenes when intervention/plan of care requires revision.

<table>
<thead>
<tr>
<th>Indicators for Standard 4: Nutrition Monitoring and Evaluation</th>
<th>Bold Font Indicators are Academy Core RDN Standards of Practice Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Each RDN:</strong> Monitors progress:</td>
<td>The “X” signifies the indicators for the level of practice</td>
</tr>
<tr>
<td>4.1 Monitors progress:</td>
<td>Competent</td>
</tr>
<tr>
<td>4.1A Assesses patient/client/advocate/population understanding and engagement with nutrition intervention/plan of care</td>
<td>X</td>
</tr>
<tr>
<td>4.1A1 Reviews progress of patient-centered goals</td>
<td>X</td>
</tr>
<tr>
<td>4.1A2 Determines whether barriers are present and impacting the patient’s/client’s engagement with the nutrition intervention/plan of care</td>
<td>X</td>
</tr>
<tr>
<td>4.1B Determines whether the nutrition intervention/plan of care is being implemented as prescribed</td>
<td>X</td>
</tr>
<tr>
<td>4.1B1 Builds flexibility into intervention plan to consider special situations (eg, holidays, major life events/changes)</td>
<td>X</td>
</tr>
<tr>
<td>4.1B2 Sets scheduled reviews with patient/client and other health care professionals based on protocol, patient/client needs, and/or payor considerations</td>
<td>X</td>
</tr>
<tr>
<td>4.1B3 Communicates data with other health care professionals as needed for interprofessional care</td>
<td>X</td>
</tr>
<tr>
<td>4.1B4 Modifies nutrition intervention in the face of concurrent conditions (eg, pre/post metabolic and bariatric surgery, end-stage renal disease, diabetes, chronic heart failure, eating disorders)</td>
<td>X</td>
</tr>
<tr>
<td>4.1B5 Identifies need for complementary therapies or interventions to optimize care</td>
<td>X</td>
</tr>
</tbody>
</table>

*Figure 1. (continued) Standards of Practice for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.*
<table>
<thead>
<tr>
<th>Each RDN:</th>
<th>Measures outcomes:</th>
<th>Competent</th>
<th>Proficient</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2</td>
<td>Selects the standardized nutrition care measurable outcome indicator(s)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.2A1</td>
<td>Assesses anthropometric measures (eg, weight, BMI, waist circumference, rate of weight change)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.2A2</td>
<td>Evaluates body composition measures (eg, fat mass)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.2A3</td>
<td>Monitors laboratory measures (eg, lipid panel, comprehensive metabolic panel)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.2A4</td>
<td>Considers behavioral measures (eg, activity level, eating behaviors, cognitive functioning, goal attainment)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.2A5</td>
<td>Assesses quality of life measures (eg, activity and daily living)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.2A6</td>
<td>Applies standardized subspecialty measures (eg, Sigstad scoring)</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>4.2A7</td>
<td>Ensures accuracy of weight management-specific measures</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>4.2A8</td>
<td>Analyzes gut hormones and gut bacteria measures in the research setting</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2B</td>
<td>Identifies positive or negative outcomes including impact on potential needs for discharge/transitions of care</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.2B1</td>
<td>Documents progress in meeting patient-centered goals</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.2B2</td>
<td>Identifies unintended consequences (eg, excessive rate of weight loss) or the use of inappropriate methods of achieving goals (eg, excessive laxative use)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.2B3</td>
<td>Identifies potential revision of interventions based on outcomes</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.2B4</td>
<td>Recognizes underlying factors interfering with intervention outcomes including access to resources to determine future treatment recommendations</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>4.2B5</td>
<td>Develops action plan in complex cases based on the effect of all interventions on patient’s/client’s overall health outcome</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>Compares monitoring data with nutrition prescription and established goals or reference standard (eg, American Heart Association/American College of Cardiology/The Obesity Society Adult Obesity Guidelines)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.3A1</td>
<td>Compares and analyzes monitoring data in consideration of patient’s/client’s changing needs or goals over time (eg, cultural, health literacy, social)</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. (continued) Standards of Practice for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.
### Indicators for Standard 4: Nutrition Monitoring and Evaluation

**Bold Font Indicators are Academy Core RDN Standards of Practice Indicators**

**The “X” signifies the indicators for the level of practice**

<table>
<thead>
<tr>
<th>Each RDN:</th>
<th>The “X” signifies the indicators for the level of practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.3A2</strong> Conducts comprehensive data analysis to identify trends in collaboration with interprofessional team</td>
<td>Competent</td>
</tr>
<tr>
<td><strong>4.3B</strong> Evaluates impact of the sum of all interventions on overall patient/client/population health outcomes and goals</td>
<td><strong>X</strong></td>
</tr>
<tr>
<td><strong>4.3B1</strong> Completes analysis of individual interventions for each identified problem compared with reference standards</td>
<td></td>
</tr>
<tr>
<td><strong>4.3B2</strong> Compares trends of independent and dependent variables and their relationship with health outcomes and goals</td>
<td></td>
</tr>
<tr>
<td><strong>4.3C</strong> Evaluates progress/regression and drivers of factors related to interventions</td>
<td><strong>X</strong></td>
</tr>
<tr>
<td><strong>4.3C1</strong> Identifies factors that facilitate or impede progress (eg, emotional, social, cognitive, behavioral, environmental factors; motivators and incentives to change and/or consequences to change)</td>
<td><strong>X</strong></td>
</tr>
<tr>
<td><strong>4.3C2</strong> Uses multiple resources to assess progress (eg, clinical data, self-monitoring tools, changes in body weight/body composition, medication changes)</td>
<td></td>
</tr>
<tr>
<td><strong>4.3C3</strong> Identifies changes to patient/client cognitive, physical, environmental status that could interfere with plan of care</td>
<td></td>
</tr>
<tr>
<td><strong>4.3C4</strong> Identifies factors beyond nutrition that are interfering with the interventions (eg, pregnancy, physical activity, mental health and eating disorder) and recommends referral(s)</td>
<td></td>
</tr>
<tr>
<td><strong>4.3D</strong> Evaluates evidence that the nutrition intervention/plan of care is maintaining or influencing a desirable change in the patient/client/population behavior or status</td>
<td><strong>X</strong></td>
</tr>
<tr>
<td><strong>4.3D1</strong> Assesses factors that reflect a change in the patient/client behavior or status (eg, physical, social, cognitive, clinical)</td>
<td><strong>X</strong></td>
</tr>
<tr>
<td><strong>4.3D2</strong> Evaluates the patient/client response to treatment and incorporates findings into future individualized treatment recommendations</td>
<td></td>
</tr>
<tr>
<td><strong>4.3D3</strong> Evaluates patient/client outcomes in relation to goals</td>
<td><strong>X</strong></td>
</tr>
<tr>
<td><strong>4.3D3i</strong> Evaluates underlying factors interfering with intervention outcomes and access to services (eg, prognosis, psychological factors, resources) and analyzes this impact on future recommendations</td>
<td></td>
</tr>
</tbody>
</table>

*(continued on next page)*

**Note:** The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.
### Indicators for Standard 4: Nutrition Monitoring and Evaluation

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</tr>
</thead>
<tbody>
<tr>
<td><strong>Each RDN:</strong></td>
<td></td>
</tr>
<tr>
<td>4.3D3ii</td>
<td>Reassesses and modifies, if applicable, an action plan in complex cases based on effects of all interventions on patient’s/client’s overall health outcomes</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.3E</td>
<td>Supports conclusions with evidence</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.3E1</td>
<td>Demonstrates that prescribed intervention is successful/unsuccessful through documentation of clinical, cognitive, and psychosocial indicators</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>4.4 Adjusts nutrition intervention/plan of care strategies, if needed, in collaboration with patient/client/population/advocate/caregiver and interprofessional team</strong></td>
<td></td>
</tr>
<tr>
<td>4.4A</td>
<td>Improves or adjusts intervention/plan of care strategies based upon outcomes data, trends, best practices, and comparative standards</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.4A1</td>
<td>Collaborates with patient/client to modify goals and assigned actions based on new information and/or feedback from the patient/client</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.4A2</td>
<td>Uses intervention strategies to encourage greater independence in food choices and empower the patient/client to take control of their health and achieve wellness</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.4A3</td>
<td>Uses critical thinking and synthesis skills in decision making with concurrent conditions and in managing multiple intervention approaches</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.4A4</td>
<td>Makes adjustments in supportive services as needed (eg, training of direct providers, collaboration with health care professionals)</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.4A5</td>
<td>Designs the nutrition strategy in multifactorial, unpredictable, and dynamic conditions using evidence-based standards</td>
</tr>
<tr>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>4.5 Documents:</strong></td>
<td></td>
</tr>
<tr>
<td>4.5A</td>
<td>Date and time</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.5B</td>
<td>Indicators measured, results, and the method for obtaining measurement</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.5C</td>
<td>Criteria to which the indicator is compared (eg, nutrition prescription/goal or a reference standard)</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.5D</td>
<td>Factors facilitating or hampering progress</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

*(continued on next page)*

Figure 1. (continued) Standards of Practice for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.
Indicators for Standard 4: Nutrition Monitoring and Evaluation

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>4.5E</td>
<td>Other positive or negative outcomes</td>
<td>Competent</td>
</tr>
<tr>
<td>4.5F</td>
<td>Adjustments to the nutrition intervention/plan of care and justification, if indicated</td>
<td></td>
</tr>
<tr>
<td>4.5G</td>
<td>Future plans for nutrition care, nutrition monitoring and evaluation, follow up, referral, or discharge</td>
<td></td>
</tr>
</tbody>
</table>

Examples of Outcomes for Standard 4: Nutrition Monitoring and Evaluation

- The patient/client outcome(s) directly relate to the nutrition diagnosis and the goals established in the nutrition intervention/plan of care. Examples include, but are not limited to:
  - Nutrition outcomes (eg, change in knowledge, behavior, food, or nutrient intake)
  - Clinical and health status outcomes (eg, change in laboratory values, body weight, blood pressure, risk factors, signs and symptoms, clinical status, infections, complications, morbidity, and mortality)
  - Patient/client/population-centered outcomes (eg, quality of life, satisfaction, self-efficacy, self-management, functional ability)
  - Health care utilization and cost effectiveness outcomes (eg, change in medication, special procedures, planned/unplanned clinic visits, preventable hospital admissions, length of hospitalizations, fewer sick days, lower health care premiums, increased worker productivity, morbidity, and mortality)

- Monitoring reflects use of standardized outcome measures
- Nutrition intervention/plan of care and documentation is revised, if indicated
- Documentation of nutrition intervention/plan of care uses Specific, Measurable, Achievable, Relevant, and Time-Bound (S.M.A.R.T.) goals and is:
  - Comprehensive
  - Accurate
  - Dated and Timed

*Advocate: An advocate is a person who provides support and/or represents the rights and interests at the request of the patient/client. The person may be a family member or an individual not related to the patient/client who is asked to support the patient/client with activities of daily living or is legally designated to act on behalf of the patient/client, particularly when the patient/client has lost decision-making capacity. (Adapted from definitions within The Joint Commission Glossary of Terms and the Centers for Medicare and Medicaid Services, Hospital Conditions of Participation).*

*Interprofessional: The term interprofessional is used in this evaluation resource as a universal term. It includes a diverse group of team members (eg, physicians, nurses, dietitian nutritionists, physician assistants, pharmacists, behavioral health providers, exercise specialists, and occupational and physical therapists), depending on the needs of the customer. Interprofessional could also mean interdisciplinary or multidisciplinary.

*Non-physician practitioner: A non-physician practitioner may include a physician assistant, nurse practitioner, clinical nurse specialist, certified registered nurse anesthetist, certified nurse-midwife, clinical social worker, clinical psychologist, anesthesiologist’s assistant, qualified diettian or qualified nutrition professional. Disciplines considered for privileging by a facility’s governing body and medical staff must be in accordance with state law. The term privileging is not referenced in the Centers for Medicare and Medicaid Services long-term care (LTC) regulations. With publication of the Final Rule revising the Conditions of Participation for LTC facilities effective November 2016, post-acute care settings, such as skilled and LTC facilities, may now allow a resident’s attending physician the option of delegating order writing for therapeutic diets, nutrition supplements or other nutrition-related services to the qualified diettian or clinically qualified nutrition professional, if consistent with state law, and organization policies.*

Figure 1. (continued) Standards of Practice for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The terms patient, client, customer, individual, person, group, or population are used interchangeably with the actual term used in a given situation, depending on the setting and the population receiving care or services.
Standards of Professional Performance for Registered Dietitian Nutritionists in Adult Weight Management

**Standard 1: Quality in Practice**

The registered dietitian nutritionist (RDN) provides quality services using a systematic process with identified ethics, leadership, accountability, and dedicated resources.

**Rationale:**

Quality practice in nutrition and dietetics is built on a solid foundation of education and supervised practice, credentialing, evidence-based practice, demonstrated competence, and adherence to established professional standards. Quality practice requires systematic measurement of outcomes, regular performance evaluations, and continuous improvement.

**Indicators for Standard 1: Quality in Practice**

<table>
<thead>
<tr>
<th>Bold Font Indicators are Academy Core RDN Standards of Professional Performance Indicators</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Each RDN:</td>
<td>Competent</td>
</tr>
<tr>
<td>1.1 Complies with applicable laws and regulations as related to their area(s) of practice</td>
<td>X</td>
</tr>
<tr>
<td>1.1A Complies with federal, state, and local laws and regulations related to adult weight management and patient/client care (eg, Health Insurance Portability and Accountability Act [HIPAA], food safety, telehealth)</td>
<td>X</td>
</tr>
<tr>
<td>1.1A1 Complies with state licensure laws (eg, continuing education requirements, mandatory abuse reporting requirements)</td>
<td>X</td>
</tr>
<tr>
<td>1.2 Performs within individual and statutory scope of practice and applicable laws and regulations</td>
<td>X</td>
</tr>
<tr>
<td>1.2A Integrates concurrent professional license/certification/credential scopes of practice and applicable laws and regulations with RDN (eg, exercise professional, mental health care provider, health coach, physician, or pharmacist)</td>
<td>X</td>
</tr>
<tr>
<td>1.3 Adheres to sound business and ethical billing practices applicable to the role and setting</td>
<td>X</td>
</tr>
<tr>
<td>1.3A Complies with applicable payment and reimbursement requirements</td>
<td>X</td>
</tr>
<tr>
<td>1.3B Discloses any financial conflicts of interest (eg, dietary supplements, products, services, investments, ownership, partnership)</td>
<td>X</td>
</tr>
<tr>
<td>1.4 Uses national quality and safety data (eg, National Academies of Sciences, Engineering, and Medicine: Health and Medicine Division, National Quality Forum, Institute for Healthcare Improvement, Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program [MBSAQIP]) to improve the quality of services provided and to enhance customer-centered services</td>
<td>X</td>
</tr>
<tr>
<td>1.4A Participates in national, state, local, and organization quality improvement initiatives</td>
<td>X</td>
</tr>
</tbody>
</table>

(continued on next page)
<table>
<thead>
<tr>
<th>Each RDN:</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1.4B</td>
<td>Coordinates efforts to maximize adult weight management services using national quality and safety data</td>
<td>X X</td>
</tr>
<tr>
<td>1.4C</td>
<td>Designs quality improvement initiatives related to adult weight management services (eg, MBSAQIP)</td>
<td>X</td>
</tr>
<tr>
<td>1.5</td>
<td>Uses a systematic performance improvement model that is based on practice knowledge, evidence, research, and science for delivery of the highest quality services</td>
<td>X X X</td>
</tr>
<tr>
<td>1.5A</td>
<td>Identifies performance improvement (PI) criteria to monitor the delivery of services</td>
<td>X X X</td>
</tr>
<tr>
<td>1.5B</td>
<td>Contributes to the design of performance improvement activities, collaborating with other health care practitioners to address process and outcome goals</td>
<td>X X</td>
</tr>
<tr>
<td>1.5C</td>
<td>Leads in the design, training, implementation, and evaluation of performance improvement activities</td>
<td>X</td>
</tr>
<tr>
<td>1.6</td>
<td>Participates in or designs an outcomes-based management system to evaluate safety, effectiveness, quality, person-centeredness, equity, timeliness, and efficiency of practice</td>
<td>X X X</td>
</tr>
<tr>
<td>1.6A</td>
<td>Involves colleagues and others, as applicable, in systematic outcomes management</td>
<td>X X X</td>
</tr>
<tr>
<td>1.6A1</td>
<td>Collaborates with interprofessional team in promoting and measuring quality of adult weight management nutrition care and services using systemic outcomes management systems (eg, Academy of Nutrition and Dietetics Health Informatics Infrastructure [ANDHII], MBSAQIP)</td>
<td>X X X</td>
</tr>
<tr>
<td>1.6A2</td>
<td>Coordinates interprofessional team to evaluate and improve patient/client outcomes</td>
<td>X X</td>
</tr>
<tr>
<td>1.6A3</td>
<td>Leads in the development, training, implementation, and evaluation of outcomes-based management systems</td>
<td>X</td>
</tr>
<tr>
<td>1.6B</td>
<td>Defines expected outcomes</td>
<td>X X X</td>
</tr>
<tr>
<td>1.6B1</td>
<td>Selects outcomes that are relevant to adult weight management</td>
<td>X X X</td>
</tr>
<tr>
<td>1.6B2</td>
<td>Identifies validated quality outcomes to measure (eg, quality of life, mood, internalized weight stigma, biological markers, program-specific measures)</td>
<td>X X</td>
</tr>
</tbody>
</table>

(continued on next page)

Figure 2. (continued) Standards of Professional Performance for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The term customer is used in this evaluation resource as a universal term. Customer could also mean client/patient/customer, family, participant, consumer, or any individual, group, or organization to which the RDN provides service. Adult weight management is nonspecific to a particular setting or practice area. Therefore, many of the described indicators are transferable to other nutrition practice areas or are intentionally nondescript to allow for flexibility in application to professional performance in any given area.
## Indicators for Standard 1: Quality in Practice

<table>
<thead>
<tr>
<th>Bold Font Indicators are Academy Core RDN Standards of Professional Performance Indicators</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Each RDN:</strong></td>
<td>Competent</td>
</tr>
<tr>
<td>1.6B</td>
<td>Determines desired nutrition-specific outcomes using available benchmarking data (eg, National Health and Nutrition Examination Survey [NHANES], MBSAQIP, Centers for Disease Control and Prevention [CDC])</td>
</tr>
<tr>
<td>1.6C</td>
<td>Uses indicators that are specific, measurable, attainable, realistic, and timely (S.M.A.R.T.)</td>
</tr>
<tr>
<td>1.6D</td>
<td>Measures quality of services in terms of structure, process, and outcomes</td>
</tr>
<tr>
<td>1.6D1</td>
<td>Evaluates aggregate patient/client clinical outcomes (eg, body mass index, biometric, medication, behavior, fitness changes)</td>
</tr>
<tr>
<td>1.6D2</td>
<td>Evaluates the provision of adult weight management care and services (eg, staff to patient/client ratio, reimbursement data, and patient/client satisfaction survey results)</td>
</tr>
<tr>
<td>1.6D3</td>
<td>Analyzes quality data using appropriate statistical approaches (eg, parametric, nonparametric, regression analyses)</td>
</tr>
<tr>
<td>1.6E</td>
<td>Incorporates electronic clinical quality measures to evaluate and improve care of patients/clients at risk for malnutrition or with malnutrition (<a href="http://www.eatrightpro.org/emeasures">www.eatrightpro.org/emeasures</a>)</td>
</tr>
<tr>
<td>1.6F</td>
<td>Documents outcomes and patient reported outcomes (eg, PROMIS®)</td>
</tr>
<tr>
<td>1.6G</td>
<td>Participates in, coordinates, or leads program participation in local, regional or national registries and data warehouses used for tracking, benchmarking, and reporting service outcomes</td>
</tr>
<tr>
<td>1.6G1</td>
<td>Contributes data directly to national, regional, state, and/or local data registries</td>
</tr>
<tr>
<td>1.6G2</td>
<td>Analyzes and uses information for strategic planning</td>
</tr>
<tr>
<td>1.7</td>
<td>Identifies and addresses potential and actual errors and hazards in provision of services or brings to attention of supervisors and team members as appropriate</td>
</tr>
<tr>
<td>1.7A</td>
<td>Ensures safe care for the adult weight management patient/client in collaboration with the interprofessional team (eg, prescription medications, dietary supplements, rate of weight loss, weight-inclusive equipment and facilities)</td>
</tr>
</tbody>
</table>

*(continued on next page)*

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**Figure 2. (continued) Standards of Professional Performance for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management.** Note: The term *customer* is used in this evaluation resource as a universal term. *Customer* could also mean client/patient/customer, family, participant, consumer, or any individual, group, or organization to which the RDN provides service. Adult weight management is nonspecific to a particular setting or practice area. Therefore, many of the described indicators are transferable to other nutrition practice areas or are intentionally nondescript to allow for flexibility in application to professional performance in any given area.
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</tr>
<tr>
<td>Each RDN:</td>
</tr>
<tr>
<td>1.7B Contributes to the development of protocols to identify, address, and prevent errors and physical hazards in the delivery of adult weight management services (eg, anthropometric measurement collection, physical assessment, nutrition intervention)</td>
</tr>
<tr>
<td>1.7C Designs and implements protocols to identify, address, and prevent errors and physical hazards in the delivery of adult weight management services (eg, safe patient handling, anthropometric measurement collection, interprofessional coordination)</td>
</tr>
<tr>
<td>1.7D Addresses and resolves deviations from protocols in accordance with institutional, local, state, and national regulatory requirements</td>
</tr>
<tr>
<td>1.8 Compares actual performance to performance goals (ie, Gap Analysis, SWOT Analysis [Strengths, Weaknesses, Opportunities, and Threats], PDCA Cycle [Plan-Do-Check-Act], DMAIC [Define, Measure, Analyze, Improve, Control])</td>
</tr>
<tr>
<td>1.8A Compares individual performance to self-directed goals and expected outcomes</td>
</tr>
<tr>
<td>1.8B Compares department/organization performance to goals and expected outcomes (eg, internal goals, national programs and standards)</td>
</tr>
<tr>
<td>1.8C Collects and analyzes performance data using appropriate comparison cohorts and statistical methods</td>
</tr>
<tr>
<td>1.9 Evaluates interventions and workflow process(es) and identifies service and delivery improvements</td>
</tr>
<tr>
<td>1.9A Reports and documents action plan to address identified gaps in care and/or service performance</td>
</tr>
<tr>
<td>1.9B Engages patients/clients and other stakeholders in intervention evaluations (eg, satisfaction surveys, focus groups)</td>
</tr>
<tr>
<td>1.9C Applies evaluation data and/or collaborates with interprofessional team to identify adult weight management program/service improvements</td>
</tr>
<tr>
<td>1.9D Leads in the development, testing, and redesign of program/service evaluation systems</td>
</tr>
</tbody>
</table>

(continued on next page)

Figure 2. (continued) Standards of Professional Performance for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The term customer is used in this evaluation resource as a universal term. Customer could also mean client/patient/customer, family, participant, consumer, or any individual, group, or organization to which the RDN provides service. Adult weight management is nonspecific to a particular setting or practice area. Therefore, many of the described indicators are transferable to other nutrition practice areas or are intentionally nondescript to allow for flexibility in application to professional performance in any given area.
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<th>Each RDN:</th>
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<tbody>
<tr>
<td><strong>1.10</strong> Improves or enhances patient/client/population care and/or services working with others based on measured outcomes and established goals</td>
<td><strong>X</strong></td>
</tr>
<tr>
<td><strong>1.10A</strong> Contributes to the evaluation of systems, processes, and programs to ensure organization values and evidence-based practices are followed</td>
<td><strong>X</strong></td>
</tr>
<tr>
<td><strong>1.10B</strong> Reviews and coordinates adult weight management process improvements based on quality improvement findings</td>
<td><strong>X</strong></td>
</tr>
<tr>
<td><strong>1.10C</strong> Directs the development and management of systems, processes, and programs in adult weight management for continued quality improvement</td>
<td><strong>X</strong></td>
</tr>
</tbody>
</table>

#### Examples of Outcomes for Standard 1: Quality in Practice
- Actions are within scope of practice and applicable laws and regulations
- National quality standards and best practices are integrated into adult weight management care protocols
- Conducts a quality improvement assessment to address increases in adverse care events
- Disseminates quality data related to adult weight management outcomes
- Sets quality-related adult weight management performance goals for the department/program
- Adapts practice as a result of quality improvement outcomes

### Standard 2: Competence and Accountability

The registered dietitian nutritionist (RDN) demonstrates competence in and accepts accountability and responsibility for ensuring safe, quality practice and services.

**Rationale:**
Competence and accountability in practice includes continuous acquisition of knowledge, skills, experience, and judgment in the provision of safe, quality customer-centered service.

### Indicators for Standard 2: Competence and Accountability

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<table>
<thead>
<tr>
<th>Each RDN:</th>
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<tbody>
<tr>
<td><strong>2.1</strong> Adheres to the code(s) of ethics (eg, Academy/Commission on Dietetic Registration (CDR), other national organizations, and/or employer code of ethics)</td>
<td><strong>X</strong></td>
</tr>
<tr>
<td><strong>2.2</strong> Integrates the Standards of Practice (SOP) and Standards of Professional Performance (SOPP) into practice, self-evaluation, and professional development</td>
<td><strong>X</strong></td>
</tr>
</tbody>
</table>

(continued on next page)

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<tr>
<td><strong>Each RDN:</strong></td>
</tr>
<tr>
<td>2.2A</td>
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<tr>
<td>2.2B</td>
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<tr>
<td>2.2C</td>
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<tr>
<td>2.2D</td>
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<tr>
<td>2.3</td>
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<tr>
<td>2.4</td>
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<tr>
<td>2.4A</td>
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<td>2.4B</td>
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<td>2.4C</td>
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<tr>
<td>2.5</td>
</tr>
<tr>
<td>2.5A</td>
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<tr>
<td>2.5B</td>
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<tr>
<td>2.5C</td>
</tr>
<tr>
<td>2.6</td>
</tr>
<tr>
<td>2.6A</td>
</tr>
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## Indicators for Standard 2: Competence and Accountability

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<tbody>
<tr>
<td>2.6B</td>
<td>Engages in continuing education opportunities and training in adult weight management and related areas according to professional development plan and career goals (e.g., Weight Management Dietetic Practice Group Symposium, Food &amp; Nutrition Conference &amp; Expo)</td>
</tr>
<tr>
<td>2.6C</td>
<td>Completes advanced adult weight management training or certifications (e.g., CDR Certificate of Training in Obesity for Pediatrics and Adults, CDR Certified Specialist in Obesity and Weight Management [CSOWM])</td>
</tr>
<tr>
<td>2.6D</td>
<td>Designs and facilitates adult weight management training or certifications</td>
</tr>
</tbody>
</table>

### 2.7 Engages in evidence-based practice and uses best practices

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<tbody>
<tr>
<td>2.7A</td>
<td>Integrates evidence-based practice and research evidence in delivering quality care (e.g., Academy, Academy Evidence Analysis Library [EAL], American College of Sports Medicine, The Obesity Society, the American Society for Metabolic and Bariatric Surgery, position papers, and best practices)</td>
</tr>
<tr>
<td>2.7B</td>
<td>Discloses when practices are not evidence-based when discussing patient-centered care</td>
</tr>
<tr>
<td>2.7C</td>
<td>Recognizes and informs patient/client or organization of strengths and limitations of current information, research, and evidence when making recommendations</td>
</tr>
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</table>

### 2.8 Participates in peer review of others as applicable to role and responsibilities

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<tbody>
<tr>
<td>2.8A</td>
<td>Conducts review of professional activities (e.g., clinical chart review, scholarly articles, chapters, books, programs, and guidelines)</td>
</tr>
<tr>
<td>2.8B</td>
<td>Serves on an editorial board for scholarly review (e.g., manuscripts, chapters, and books)</td>
</tr>
</tbody>
</table>

### 2.9 Mentors and/or precepts others

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<tr>
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<tbody>
<tr>
<td>2.9A</td>
<td>Mentors and/or precepts students and interns including persons from underrepresented populations</td>
</tr>
<tr>
<td>2.9B</td>
<td>Mentors RDNs and other health care professionals including persons from underrepresented populations</td>
</tr>
<tr>
<td>2.9C</td>
<td>Develops opportunities for students, interns, and professionals in adult weight management practice</td>
</tr>
</tbody>
</table>

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Indicators for Standard 2: Competence and Accountability

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<tbody>
<tr>
<td>Each RDN:</td>
<td>Competent</td>
</tr>
<tr>
<td>2.9D Facilitates professional mentoring and development activities for RDNs and health care professionals</td>
<td></td>
</tr>
<tr>
<td>2.10 Pursues opportunities (education, training, credentials, certifications) to advance practice in accordance with laws and regulations, and requirements of practice setting</td>
<td>X</td>
</tr>
<tr>
<td>2.10A Identifies and implements a plan for advancing knowledge and practice (eg, specialty certification, research participation, speaking engagements)</td>
<td>X</td>
</tr>
<tr>
<td>2.10B Serves on committees to develop programs, tools, and resources</td>
<td></td>
</tr>
<tr>
<td>2.10C Develops education, training, and credential opportunities in adult weight management</td>
<td></td>
</tr>
</tbody>
</table>

Examples of Outcomes for Standard 2: Competence and Accountability

- Practice reflects:
  - Code(s) of ethics (eg, Academy/CDR, other national organizations, and/or employer code of ethics)
  - Scope of Practice, Standards of Practice and Standards of Professional Performance
  - Evidence-based practice and best practices
  - CDR Essential Practice Competencies and Performance Indicators
- Incorporates strategies for interactions with individuals/groups from diverse cultures and backgrounds
- Completes annual weight bias self-assessment (eg, Project Implicit, Weight Bias Internalization Scale, Fat Phobia Scale)
- Competence is demonstrated and documented
- Self-evaluations are conducted regularly to reflect commitment to lifelong learning and professional development and engagement
- Completes required continuing education to maintain a license
- Professional development needs are identified and pursued
- Education, training, credentials, certifications are completed to advance practice
- CDR recertification requirements are met

Standard 3: Provision of Services

The registered dietitian nutritionist (RDN) provides safe, quality service based on patient/client expectations, and needs, and the mission, vision, principles, and values of the organization/business.

Rationale:

Quality programs and services are designed, executed, and promoted based on the RDN’s knowledge, skills, experience, judgment, and competence in addressing the needs and expectations of the organization/business and its patients/clients.

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<tr>
<td><strong>Each RDN:</strong></td>
</tr>
<tr>
<td>3.1</td>
</tr>
<tr>
<td>3.1A</td>
</tr>
<tr>
<td>3.1A1</td>
</tr>
<tr>
<td>3.1A2</td>
</tr>
<tr>
<td>3.1B</td>
</tr>
<tr>
<td>3.1B1</td>
</tr>
<tr>
<td>3.1B2</td>
</tr>
<tr>
<td>3.1B3</td>
</tr>
<tr>
<td>3.1C</td>
</tr>
<tr>
<td>3.1C1</td>
</tr>
<tr>
<td>3.1C2</td>
</tr>
<tr>
<td>3.1D</td>
</tr>
<tr>
<td>3.1D1</td>
</tr>
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<tr>
<td>3.1D2</td>
<td>Develops, implements, and evaluates programs and services aimed at promoting health equity related to social determinants of health (eg, economic stability, education access and quality, social context)</td>
</tr>
<tr>
<td>3.2</td>
<td>Promotes public access and referral to credentialed nutrition and dietetics practitioners for quality food and nutrition programs and services</td>
</tr>
<tr>
<td>3.2A</td>
<td>Contributes to or designs referral systems that promote access to qualified, credentialed nutrition and dietetics practitioners</td>
</tr>
<tr>
<td>3.2A1</td>
<td>Coordinates referral process</td>
</tr>
<tr>
<td>3.2A2</td>
<td>Designs and manages referral processes and systems</td>
</tr>
<tr>
<td>3.2B</td>
<td>Refers customers to appropriate providers when requested services or identified needs exceed the RDN’s individual scope of practice</td>
</tr>
<tr>
<td>3.2B1</td>
<td>Builds relationships, verifies expertise, and refers to other health care practitioners as appropriate (eg, specialist RDN, behavioral health specialist, qualified fitness professional)</td>
</tr>
<tr>
<td>3.2B2</td>
<td>Establishes and maintains referral networks</td>
</tr>
<tr>
<td>3.2B3</td>
<td>Supports referring care team member(s) with training (eg, nutrition, weight sensitivity, scope and efficacy of adult weight management services, practical application of evidence and guidelines)</td>
</tr>
<tr>
<td>3.2C</td>
<td>Monitors effectiveness of referral systems and modifies as needed to achieve desirable outcomes</td>
</tr>
<tr>
<td>3.2C1</td>
<td>Manages and evaluates the effectiveness of referral processes and tools</td>
</tr>
<tr>
<td>3.3</td>
<td>Contributes to or designs customer-centered services</td>
</tr>
<tr>
<td>3.3A</td>
<td>Assesses needs, beliefs/values, goals, resources of the customer, including social determinants of health</td>
</tr>
<tr>
<td>3.3A1</td>
<td>Develops awareness of popular culture adult weight management messaging, trends, and programs supporting patient/client goals (eg, popular diets, supplements, fitness programs)</td>
</tr>
<tr>
<td>3.3A2</td>
<td>Participates in or conducts needs assessment considering social determinants of health in collaboration with interprofessional team and community stakeholders</td>
</tr>
</tbody>
</table>

*(continued on next page)*

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<th>Indicator</th>
<th>Details</th>
<th>Competent</th>
<th>Proficient</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3B</td>
<td>Uses knowledge of the customer’s/target population’s health conditions, cultural beliefs, and business objectives/services to guide design and delivery of customer-centered services</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.3B1</td>
<td>Incorporates social determinants of health (see definition at: <a href="http://www.eatrightpro.org/definitions">www.eatrightpro.org/definitions</a>) and behavior change strategies (eg, stages of change, motivational interviewing, cognitive behavioral therapy) in program delivery</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.3B2</td>
<td>Participates in design of services</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.3B3</td>
<td>Determines evidence-based theoretical frameworks in developing service design (eg, health belief model, social cognitive theory, transtheoretical theory, socio ecological model)</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>3.3C</td>
<td>Communicates principles of disease prevention and behavioral change appropriate to the customer or target population</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.3C1</td>
<td>Adapts education approach to accommodate patients’/clients’ cultural beliefs regarding weight status in relationship to health</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.3C2</td>
<td>Communicates with the public on adult weight management-related disease prevention and behavioral change principles (eg, social media, media interviews, print media, education programs)</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.3C3</td>
<td>Designs and implements adult weight management public relations and communications strategic campaign</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>3.3D</td>
<td>Collaborates with the customers to set priorities, establish goals, and create customer-centered action plans to achieve desirable outcomes</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.3D1</td>
<td>Collaborates with patient/client and interprofessional team to ensure that adult weight management plans are reflective of evidence-based approaches and reinforce continuity of care (eg, schedules follow up for action plan adjustments and goal achievement)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.3D2</td>
<td>Adapts practice approach to minimize patient/client barriers and meet needs (eg, visit setting, patient/client-preferred terminology, major life changes)</td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<th>Each RDN:</th>
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<tbody>
<tr>
<td><strong>3.3E</strong> Involves customers in decision making</td>
<td>Competent</td>
</tr>
<tr>
<td>3.3E1 Establishes the role and responsibilities of patients/clients in collaborative decision making</td>
<td>X</td>
</tr>
<tr>
<td>3.3E2 Reviews information shared by patient/client/family/caregiver with interprofessional team for planning and problem solving to support consistency in treatment plans to assure person-centered care</td>
<td>X</td>
</tr>
<tr>
<td>3.3E3 Facilitates patient/client advisory board or focus groups for feedback on care and service delivery design and to inform opportunities for improvement</td>
<td>X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>3.4</strong> Executes programs/services in an organized, collaborative, cost effective, and customer-centered manner</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4A Collaborates and coordinates with peers, colleagues, stakeholders, and within interprofessional teams</td>
</tr>
<tr>
<td>3.4A1 Serves as a consultant for issues related to adult weight management (eg, expert witness, industry, fitness/wellness, business)</td>
</tr>
<tr>
<td>3.4A2 Facilitates the coordination between patients/clients and other care providers (eg, transfer of care processes, enrollment with a care manager, coordinating admission/discharge)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>3.4B</strong> Uses and participates in, or leads in the selection, design, execution, and evaluation of client/customer programs and services (eg, nutrition screening system, medical and retail foodservice, electronic health records, interprofessional programs, community education, grant management)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4B1 Delivers adult weight management programs and services that integrate nutrition with physical activity, health promotion, and wellness</td>
</tr>
<tr>
<td>3.4B2 Plans and implements programs of adult weight management services</td>
</tr>
<tr>
<td>3.4B3 Directs systems of adult weight management services (eg farm to table collaborations, family-based nutrition programs, postbariatric support groups, primary care service integration)</td>
</tr>
</tbody>
</table>

*Figure 2. (continued) Standards of Professional Performance for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The term customer is used in this evaluation resource as a universal term. Customer could also mean client/patient/customer, family, participant, consumer, or any individual, group, or organization to which the RDN provides service. Adult weight management is nonspecific to a particular setting or practice area. Therefore, many of the described indicators are transferable to other nutrition practice areas or are intentionally nondescript to allow for flexibility in application to professional performance in any given area.*
### Indicators for Standard 3: Provision of Services

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<tbody>
<tr>
<td><strong>Each RDN:</strong></td>
<td>Competent</td>
</tr>
<tr>
<td><strong>3.4C</strong> Uses and develops or contributes to selection, design and maintenance of policies, procedures (eg, discharge planning/ transitions of care, emergency planning), protocols, standards of care, technology resources (eg, Health Insurance Portability and Accountability Act (HIPAA)-compliant telehealth platforms), and training materials that reflect evidence-based practice in accordance with applicable laws and regulations</td>
<td>X</td>
</tr>
<tr>
<td><strong>3.4C1</strong> Reviews guidelines to inform development and maintenance of policies, procedures, and training materials (eg, best practices, trends, and national and international guidelines)</td>
<td></td>
</tr>
<tr>
<td><strong>3.4C2</strong> Develops, monitors, evaluates, and improves protocols, guidelines, and practice tools</td>
<td>X</td>
</tr>
<tr>
<td><strong>3.4D</strong> Uses and participates in or develops processes for order writing and other nutrition-related privileges, in collaboration with the medical staff, or medical director (eg, post-acute care settings, dialysis center, public health, community, free-standing clinic settings), consistent with state practice acts, federal and state regulations, organization policies, and medical staff rules, regulations, and bylaws</td>
<td>X</td>
</tr>
<tr>
<td><strong>3.4D1</strong> Uses processes for privileges or other facility-specific processes related to (but not limited to) implementing physician/non-physician practitioner-driven delegated orders or protocols, initiating or modifying orders for therapeutic diets, medical foods/nutrition supplements, dietary supplements, enteral and parenteral nutrition, laboratory tests, medications, and adjustments to fluid therapies or electrolyte replacements</td>
<td>X</td>
</tr>
<tr>
<td><strong>3.4D1i</strong> Participates in the development of protocols for privileges or other facility-specific processes</td>
<td>X</td>
</tr>
<tr>
<td><strong>3.4D1ii</strong> Advocates, negotiates, and implements facility-specific privileges for nutrition-related order writing</td>
<td></td>
</tr>
<tr>
<td><strong>3.4D2</strong> Uses privileging for provision of nutrition-related services, including (but not limited to) initiating and performing bedside swallow screenings, monitoring nasoenteric feeding tubes, providing home enteral nutrition or infusion management services (eg, ordering formula and supplies), and indirect calorimetry measurements</td>
<td>X</td>
</tr>
</tbody>
</table>

(continued on next page)

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**Figure 2. (continued) Standards of Professional Performance for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management.** Note: The term *customer* is used in this evaluation resource as a universal term. Customer could also mean client/patient/ customer, family, participant, consumer, or any individual, group, or organization to which the RDN provides service. Adult weight management is nonspecific to a particular setting or practice area. Therefore, many of the described indicators are transferable to other nutrition practice areas or are intentionally nondescript to allow for flexibility in application to professional performance in any given area.
## Indicators for Standard 3: Provision of Services

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<tbody>
<tr>
<td><strong>3.4D2i</strong> Participates in the development of guidelines for privileges or other facility-specific processes</td>
<td>X</td>
</tr>
<tr>
<td><strong>3.4D2ii</strong> Advocates, negotiates, and establishes privileges or other facility-specific processes (e.g., calorimetry, swallow screening, monitoring nasoenteric feeding tubes)</td>
<td>X</td>
</tr>
<tr>
<td><strong>3.4E</strong> Complies with established billing regulations, organization policies, grant funder guidelines, if applicable to role and setting, and adheres to ethical and transparent financial management and billing practices</td>
<td>X X X</td>
</tr>
<tr>
<td><strong>3.4E1</strong> Develops and uses tools to monitor adherence to billing regulations and ethical billing practices</td>
<td>X X</td>
</tr>
<tr>
<td><strong>3.4E2</strong> Leads in establishing a culture of financial transparency and accountability</td>
<td></td>
</tr>
<tr>
<td><strong>3.4F</strong> Communicates with the interprofessional team and referring party consistent with the HIPAA rules for use and disclosure of patient’s/ client’s protected health information (PHI)</td>
<td>X X X</td>
</tr>
<tr>
<td><strong>3.4F1</strong> Develops tools to monitor adherence to HIPAA rules and/or address breaches in the protection of PHI</td>
<td>X X</td>
</tr>
<tr>
<td><strong>3.4F2</strong> Serves on PHI regulatory oversight board, Institutional Review Board (IRB) or ethics committee</td>
<td>X</td>
</tr>
<tr>
<td><strong>3.5</strong> Assigns professional, technical, and support personnel appropriately in the delivery of customer-centered care or services in accordance with laws, regulations, and organization policies and procedures</td>
<td>X X X</td>
</tr>
<tr>
<td><strong>3.5A</strong> Participates in assigning activities, including direct care to patients/ clients, consistent with the qualifications, experience, and competence of professional, technical, and support personnel</td>
<td>X X X</td>
</tr>
<tr>
<td><strong>3.5A1</strong> Delegates patient/client population tasks as needed</td>
<td>X X</td>
</tr>
<tr>
<td><strong>3.5A2</strong> Facilitates continuing education opportunities for team development and promotion for delivery of care or services</td>
<td>X X</td>
</tr>
<tr>
<td><strong>3.5A3</strong> Manages professional, technical, and support personnel</td>
<td>X</td>
</tr>
</tbody>
</table>

(continued on next page)

**Figure 2. (continued) Standards of Professional Performance for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management.** Note: The term customer is used in this evaluation resource as a universal term. Customer could also mean client/patient/customer, family, participant, consumer, or any individual, group, or organization to which the RDN provides service. Adult weight management is nonspecific to a particular setting or practice area. Therefore, many of the described indicators are transferable to other nutrition practice areas or are intentionally nondescript to allow for flexibility in application to professional performance in any given area.
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<tbody>
<tr>
<td>3.6</td>
<td>Designs and implements food delivery systems to meet the needs of clients</td>
</tr>
<tr>
<td>3.6A</td>
<td>Collaborates in or leads the design of food delivery systems to address health care needs and outcomes (including nutrition status), ecological sustainability, and to meet the culture and related needs and preferences of target populations (ie, health care patients/clients, employee groups, visitors to retail venues, schools, child and adult day care centers, community feeding sites, farm to institution initiatives, local food banks)</td>
</tr>
<tr>
<td>3.6A1</td>
<td>Evaluates effectiveness of foodservice planning and delivery for patient/clients to identify areas for improvement in adult weight management</td>
</tr>
<tr>
<td>3.6A2</td>
<td>Leads in design, implementation, and improvement of foodservice delivery mechanisms</td>
</tr>
<tr>
<td>3.6A3</td>
<td>Serves as a consultant to organization/program leadership in determining foodservice system to support adult weight management population</td>
</tr>
<tr>
<td>3.6B</td>
<td>Participates in, consults/collaborates with, or leads the development of menus to address health, nutritional, and cultural needs of target population(s) consistent with federal, state or funding source regulations or guidelines</td>
</tr>
<tr>
<td>3.6B1</td>
<td>Participates in the development of menus</td>
</tr>
<tr>
<td>3.6B2</td>
<td>Leads in the development of menus</td>
</tr>
<tr>
<td>3.6C</td>
<td>Participates in, consults/collaborates with, or leads interprofessional process for determining medical foods/nutritional supplements, dietary supplements, enteral and parenteral nutrition formularies, and delivery systems for target population(s)</td>
</tr>
<tr>
<td>3.6C1</td>
<td>Identifies products to be maintained in formulary (eg, enteral nutrition for metabolic and bariatric surgery, nutritional supplements, vitamin and mineral supplements) in accordance with best practice for the spectrum of the adult weight management population (eg, Academy, American Society for Parenteral and Enteral Nutrition [ASPEN], American Society for Metabolic and Bariatric Surgery [ASMBS])</td>
</tr>
<tr>
<td>3.6C2</td>
<td>Evaluates formulary for costs, medication interactions, payer coverage, safety, efficacy, and patient/client need(s)</td>
</tr>
<tr>
<td>3.6C3</td>
<td>Negotiates agreements for maintaining formulary</td>
</tr>
</tbody>
</table>

(continued on next page)

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### Indicators for Standard 3: Provision of Services

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</tr>
</thead>
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<tr>
<td>3.7</td>
<td>Maintains records of services provided</td>
</tr>
<tr>
<td>3.7A</td>
<td>Documents according to organization policies, procedures, standards, and systems including electronic health records</td>
</tr>
<tr>
<td>3.7A1</td>
<td>Participates in the design of charting tools and methods (eg, Assessment, Diagnosis, Intervention, and Monitoring/ Evaluation [ADIME], Subjective, Objective, Assessment and Plan [SOAP])</td>
</tr>
<tr>
<td>3.7A2</td>
<td>Leads in the design of organization charting tools and methods</td>
</tr>
<tr>
<td>3.7B</td>
<td>Implements data management systems to support interoperable data collection, maintenance, and utilization</td>
</tr>
<tr>
<td>3.7B1</td>
<td>Serves as a superuser to Information Services in implementing, maintaining, and using data collection systems</td>
</tr>
<tr>
<td>3.7B2</td>
<td>Designs and builds data management systems (eg, electronic health records, electronic medical records [EMR], REDcap)</td>
</tr>
<tr>
<td>3.7C</td>
<td>Uses data to document outcomes of services (ie, staff productivity, cost/benefit, budget compliance, outcomes, quality of services) and provide justification for maintenance or expansion of services</td>
</tr>
<tr>
<td>3.7C1</td>
<td>Compares outcomes data against targets and evidence-based/best practice</td>
</tr>
<tr>
<td>3.7C2</td>
<td>Analyzes and uses data to communicate value of nutrition services in relation to patients/clients and organization outcomes/goals</td>
</tr>
<tr>
<td>3.7C3</td>
<td>Directs and manages systematic processes to document outcomes of services</td>
</tr>
<tr>
<td>3.7C4</td>
<td>Designs and outlines data driven strategies for program expansion as appropriate</td>
</tr>
<tr>
<td>3.7D</td>
<td>Uses data to demonstrate program/service achievements and compliance with accreditation standards, laws, and regulations</td>
</tr>
<tr>
<td>3.7D1</td>
<td>Prepares and presents reports for organization/program and accrediting bodies (eg, communicating the value of nutrition services)</td>
</tr>
<tr>
<td>3.7D2</td>
<td>Represents the organization/program during surveys and demonstration of compliance with accreditation standards, laws, and regulations</td>
</tr>
</tbody>
</table>

(continued on next page)
### Indicators for Standard 3: Provision of Services

**Bold Font Indicators are Academy Core RDN Standards of Professional Performance Indicators**

<table>
<thead>
<tr>
<th>Each RDN:</th>
<th>Competent</th>
<th>Proficient</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advocates for provision of quality food and nutrition services as part of public policy</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.8A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicates with policy makers regarding the benefit/cost of quality food and nutrition services</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.8A1</td>
<td>Advocates with federal, state, and local representatives regarding benefit/cost of adult weight management services on health care costs (e.g., responds to Academy Action Alerts and other calls to action via Action Center, letters, emails, and/or phone calls)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.8A2</td>
<td>Initiates and coordinates grassroots advocacy activities (e.g., materials development, presentations, interactions with policy makers)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.8A3</td>
<td>Develops and revises policies, statutes, and administrative rules and regulations for legislative consideration.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3.8B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advocates in support of food and nutrition programs and services</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.8B1</td>
<td>Participates in patient/client advocacy activities (e.g., lobbying local restaurants and agencies for menu changes, support groups, fundraising activities, coalition participation)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.8B2</td>
<td>Leads advocacy/activities (e.g., authors articles, delivers presentations, fundraising activities)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.8C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advocates for protection of the public through multiple avenues of engagement (e.g., legislative action, establishing effective relationships with elected leaders and regulatory officials, participation in various Academy committees, workgroups and task forces, Dietetic Practice Groups, Member Interest Groups, and State Affiliates)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.8C1</td>
<td>Advocates for policies that reduce or prohibit discrimination and bias (e.g., weight, race, ethnicity, gender, sex, sexual orientation, and age inclusive environments and practices)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.8C2</td>
<td>Identifies and addresses gaps in health care, resources, or services for remediation through regulatory action and/or policy (e.g., safe walking paths, anti-discriminatory policies at health centers, stigma reducing coalition)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.8C3</td>
<td>Designs advocacy campaigns to support societal, policy and environmental changes</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

(continued on next page)

**Figure 2. (continued)** Standards of Professional Performance for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The term customer is used in this evaluation resource as a universal term. Customer could also mean client/patient/customer, family, participant, consumer, or any individual, group, or organization to which the RDN provides service. Adult weight management is nonspecific to a particular setting or practice area. Therefore, many of the described indicators are transferable to other nutrition practice areas or are intentionally nondescript to allow for flexibility in application to professional performance in any given area.
Examples of Outcomes for Standard 3: Provision of Services

- Program/service design and systems reflect organization/business mission, vision, principles, values, and customer needs
- Includes customers participation in establishing program/service goals and creates customer-focused action plans and/or nutrition interventions (eg, in-person or via telehealth)
- Coordinates adult weight management care of clients/patients in a clinical setting
- Meets with legislators and local leaders to pass legislation that supports the provision of adult weight management care
- Authors editorial publication advocating for structural changes to increase access to adult weight management services
- Serves on advisory committee to develop electronic medical record documentation tools which focus on adult weight management
- Menus reflect the cultural, health and/or nutritional needs of target population(s) and consideration of ecological sustainability
- Evaluations reflect expected outcomes and established goals
- Effective screening and referral services are established or implemented as designed
- Professional, technical, and support personnel are supervised when providing nutrition care to customers
- Ethical and transparent financial management and billing practices are used per role and setting

Standard 4: Application of Research

The registered dietitian nutritionist (RDN) applies, participates in, and/or generates research to enhance practice. Evidence-based practice incorporates the best available research/evidence and information in the delivery of nutrition and dietetics services.

Rationale:
Application, participation, and generation of research promote improved safety and quality of nutrition and dietetics practice and services.

Indicators for Standard 4: Application of Research

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<tbody>
<tr>
<td>Each RDN:</td>
<td>Competent</td>
</tr>
<tr>
<td>4.1 Reviews best available research/evidence and information for application to practice</td>
<td>X</td>
</tr>
<tr>
<td>4.1A Understands basic research design and methodology, data collection, interpretation of results, application and use of the Academy EAL</td>
<td>X</td>
</tr>
<tr>
<td>4.1B Applies findings from peer-reviewed publications in adult weight management to practice (eg, evidence-based guidelines, practice guidelines)</td>
<td>X</td>
</tr>
<tr>
<td>4.1C Evaluates strength of original research, including limitations and potential bias, and evidence-based guidelines to answer questions and inform decisions</td>
<td>X</td>
</tr>
<tr>
<td>4.1D Serves as a reviewer of original research and/or evidence-based guidelines relevant to adult weight management</td>
<td>X</td>
</tr>
</tbody>
</table>

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</thead>
<tbody>
<tr>
<td><strong>4.2</strong> Uses best available research/evidence and information as the foundation for evidence-based practice</td>
<td>Competent</td>
</tr>
<tr>
<td>4.2A Applies evidence-based practice guidelines to provide safe, effective, consistent quality patient/client care</td>
<td>X</td>
</tr>
<tr>
<td>4.2B Analyzes and applies the available scientific literature in situations where evidence-based practice guidelines for adult weight management are not established</td>
<td>X</td>
</tr>
<tr>
<td>4.2C Manages concurrent conditions using advanced training, available research, and emerging theories (eg, diabetes, chronic kidney disease, postoperative metabolic and bariatric surgery complications)</td>
<td></td>
</tr>
<tr>
<td><strong>4.3</strong> Integrates best available research/evidence and information with best practices, clinical and managerial expertise, and customer values</td>
<td>X</td>
</tr>
<tr>
<td><strong>4.4</strong> Contributes to the development of new knowledge and research in nutrition and dietetics</td>
<td>X</td>
</tr>
<tr>
<td>4.4A Participates in journal clubs, interprofessional discussion groups, professional supervision, and the Academy’s Research Network</td>
<td>X</td>
</tr>
<tr>
<td>4.4B Contributes to research and scholarly writing (eg, named author or editor, coordinator, interventionist)</td>
<td>X</td>
</tr>
<tr>
<td>4.4C Serves as advisor, preceptor, and/or committee member (eg, undergraduate, graduate, or clinical research)</td>
<td>X</td>
</tr>
<tr>
<td>4.4D Participates in development, updating, implementation, and/or reporting of practice-based research (eg, EAL, guidelines, position statements)</td>
<td></td>
</tr>
<tr>
<td>4.4E Conducts research related to adult weight management as the primary investigator or co-investigator</td>
<td>X</td>
</tr>
<tr>
<td>4.4F Serves as committee chair for graduate-level research</td>
<td>X</td>
</tr>
<tr>
<td>4.4G Leads novel research and program approaches to fill knowledge gaps (eg, EAL questions)</td>
<td>X</td>
</tr>
<tr>
<td><strong>4.5</strong> Promotes application of research in practice through alliances or collaboration with food and nutrition and other professionals and organizations</td>
<td>X</td>
</tr>
<tr>
<td>4.5A Collaborates with interprofessional and/or interorganizational teams to perform nutrition research and disseminate outcomes related to adult weight management</td>
<td>X</td>
</tr>
<tr>
<td>4.5B Consults as the nutrition expert in interprofessional alliances</td>
<td>X</td>
</tr>
<tr>
<td>4.5C Leads interprofessional and/or interorganizational research activities</td>
<td></td>
</tr>
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Figure 2. (continued) Standards of Professional Performance for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The term customer is used in this evaluation resource as a universal term. Customer could also mean client/patient/customer, family, participant, consumer, or any individual, group, or organization to which the RDN provides service. Adult weight management is nonspecific to a particular setting or practice area. Therefore, many of the described indicators are transferable to other nutrition practice areas or are intentionally nondescript to allow for flexibility in application to professional performance in any given area.
Examples of Outcomes for Standard 4: Application of Research

- Evidence-based practice, best practices, clinical and managerial expertise, and patient/client values are integrated in the delivery of nutrition and dietetics services
- Patients/clients receive appropriate services based on the effective application of best available research/evidence and information
- Best available research/evidence and information is used as the foundation of evidence-based practice
- Serves as a dissertation committee member for a graduate studying adult weight management
- Completes applications and secures extramural funding for translational research in adult weight management
- Authors primary research submission to a peer-reviewed journal
- Serves as a peer-reviewer for a high impact factor adult weight-management-related journal

Standard 5: Communication and Application of Knowledge

The registered dietitian nutritionist (RDN) effectively applies knowledge and expertise in communications.

Rationale:
The RDN works with others to achieve common goals by effectively sharing and applying unique knowledge, skills, and expertise in food, nutrition, dietetics, and management services.

Indicators for Standard 5: Communication and Application of Knowledge

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<tbody>
<tr>
<td>Each RDN:</td>
<td>Competent</td>
</tr>
<tr>
<td>5.1</td>
<td>Communicates and applies current knowledge and information based on evidence</td>
</tr>
<tr>
<td>5.1A</td>
<td>Demonstrates critical thinking and problem-solving skills when communicating with others</td>
</tr>
<tr>
<td>5.1B</td>
<td>Communicates and applies content of complex ideas effectively (eg, written communications, presentations, media, online forums, social media content, professional networking groups)</td>
</tr>
<tr>
<td>5.1C</td>
<td>Evaluates public health trends and epidemiological reports related to overweight and obesity prevalence, prevention, and treatment, and applies data in clinical practice, professional activities, and work settings</td>
</tr>
<tr>
<td>5.1D</td>
<td>Consults as an expert on complex adult weight management issues with other professionals, organizations, and community (eg, expert witness testimony, media interviews, commercial consulting)</td>
</tr>
<tr>
<td>5.2</td>
<td>Selects appropriate information and the most effective communication method or format that considers patient-/client-centered care and the needs of the individual/group/population</td>
</tr>
<tr>
<td>5.2A</td>
<td>Uses communication methods (eg, oral, print, one-on-one, group, visual, electronic, and social media) targeted to various audiences</td>
</tr>
</tbody>
</table>

Figure 2. (continued) Standards of Professional Performance for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The term customer is used in this evaluation resource as a universal term. Customer could also mean client/patient/customer, family, participant, consumer, or any individual, group, or organization to which the RDN provides service. Adult weight management is nonspecific to a particular setting or practice area. Therefore, many of the described indicators are transferable to other nutrition practice areas or are intentionally nondescript to allow for flexibility in application to professional performance in any given area.
### Indicators for Standard 5: Communication and Application of Knowledge

**Bold Font Indicators are Academy Core RDN Standards of Professional Performance Indicators**

<table>
<thead>
<tr>
<th>Each RDN:</th>
<th>The “X” signifies the indicators for the level of practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5.2B</strong> Uses information technology to communicate, disseminate, manage knowledge, and support decision making</td>
<td>Competent</td>
</tr>
<tr>
<td><strong>5.2C</strong> Evaluates with patients/clients the quality and applicability of inquiries or beliefs (eg, social media trends, fad diets, discussion for interventions)</td>
<td></td>
</tr>
<tr>
<td><strong>5.2D</strong> Participates in the development of a structured communication strategy for adult weight management</td>
<td></td>
</tr>
<tr>
<td><strong>5.2E</strong> Selects and updates web-based adult weight management tools/resources</td>
<td></td>
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<tr>
<td><strong>5.2F</strong> Leads in development and oversight of a communications strategy</td>
<td></td>
</tr>
<tr>
<td><strong>5.2G</strong> Leads in the advancement of technology/informatics in adult weight management</td>
<td></td>
</tr>
</tbody>
</table>

**5.3 Integrates knowledge of food and nutrition with knowledge of health, culture, social sciences, communication, informatics, sustainability, and management**

| | Competent | Proficient | Expert |
|-----------|----------------------------------------------------------|

**5.4 Shares current, evidence-based knowledge, and information with various audiences**

| | Competent | Proficient | Expert |
|-----------|----------------------------------------------------------|

**5.4A Guides patients/clients, families, students, and interns in the application of knowledge and skills**

| | Competent | Proficient | Expert |
|-----------|----------------------------------------------------------|

**5.4A1 Applies appropriate teaching methodology**

| | | |
| | X | X |

**5.4A2 Designs and provides training curriculum (eg, experientials, didactic simulation, case studies) to advance adult weight management skills**

| | | |
| | | X |

**5.4B Assists individuals and groups to identify and secure appropriate and available educational and other resources and services**

| | Competent | Proficient | Expert |
|-----------|----------------------------------------------------------|

**5.4B1 Recommends current, evidence-based, culturally and religiously appropriate adult weight management educational resources**

| | Competent | Proficient | Expert |
|-----------|----------------------------------------------------------|

**5.4B2 Develops and manages systematic process to identify, track, and update resources available to patients/clients or health care practitioners**

| | | |
| | X | X |

**5.4C Uses professional writing and verbal skills in all types of communications**

| | Competent | Proficient | Expert |
|-----------|----------------------------------------------------------|

**5.4C1 Employs effective, ethical language for the target audience in communicating adult weight management concepts and messages across all venues (eg, media, social media, marketing claims)**

| | | |
| | X | X |

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<table>
<thead>
<tr>
<th>Indicators for Standard 5: Communication and Application of Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bold Font Indicators are Academy Core RDN Standards of Professional Performance Indicators</strong></td>
</tr>
<tr>
<td>Each RDN:</td>
</tr>
<tr>
<td>5.4D</td>
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<tr>
<td>5.5</td>
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<tr>
<td>5.5A</td>
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<td>5.5B</td>
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<tr>
<td>5.5C</td>
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<td>5.6C</td>
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<td>5.6D</td>
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<tr>
<td>5.7</td>
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<td>5.7A</td>
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Figure 2. (continued) Standards of Professional Performance for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The term customer is used in this evaluation resource as a universal term. Customer could also mean client/patient/customer, family, participant, consumer, or any individual, group, or organization to which the RDN provides service. Adult weight management is nonspecific to a particular setting or practice area. Therefore, many of the described indicators are transferable to other nutrition practice areas or are intentionally nondescript to allow for flexibility in application to professional performance in any given area.
Indicators for Standard 5: Communication and Application of Knowledge

<table>
<thead>
<tr>
<th>Bold Font Indicators are Academy Core RDN Standards of Professional Performance Indicators</th>
<th>The “X” signifies the indicators for the level of practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each RDN:</td>
<td>Competent</td>
</tr>
<tr>
<td>5.7B Participates in local and regional adult health/weight management coalitions and projects</td>
<td>X</td>
</tr>
<tr>
<td>5.7C Participates in state and national organizations; and public and/or industry advisory boards</td>
<td></td>
</tr>
<tr>
<td>5.7D Leads in adult weight management-related program planning and conferences (eg, international, national, regional, local)</td>
<td></td>
</tr>
<tr>
<td>5.7E Serves in leadership role with professional and community-based organizations</td>
<td></td>
</tr>
</tbody>
</table>

Examples of Outcomes for Standard 5: Communication and Application of Knowledge

- Expertise in food, nutrition, dietetics, and management is demonstrated and shared
- Technology is used to support practice
- Professional communication is through e-mail, texting, and social media tools
- Individuals, groups, and stakeholders:
  - Receive current and appropriate information and patient/client-centered service
  - Demonstrate understanding of information and behavioral strategies received
  - Know how to obtain additional guidance from the RDN or other RDN-recommended resources
- Leadership is demonstrated through active professional and community involvement
- Serves as an Academy Spokesperson as an expert in adult weight management
- Presents on adult weight management at local Academy affiliate event
- Serves as an advisory board member of a university or school

Standard 6: Utilization and Management of Resources

The registered dietitian nutritionist (RDN) uses resources effectively and efficiently.

Rationale:
The RDN demonstrates leadership through strategic management of time, finances, facilities, supplies, technology, natural and human resources.

Indicators for Standard 6: Utilization and Management of Resources

<table>
<thead>
<tr>
<th>Bold Font Indicators are Academy Core RDN Standards of Professional Performance Indicators</th>
<th>The “X” signifies the indicators for the level of practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each RDN:</td>
<td>Competent</td>
</tr>
<tr>
<td>6.1 Uses a systematic approach to manage resources and improve outcomes</td>
<td>X</td>
</tr>
<tr>
<td>6.1A Collaborates in operational planning to secure resources and services</td>
<td>X</td>
</tr>
</tbody>
</table>

Figure 2. (continued) Standards of Professional Performance for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The term customer is used in this evaluation resource as a universal term. Customer could also mean client/patient/customer, family, participant, consumer, or any individual, group, or organization to which the RDN provides service. Adult weight management is nonspecific to a particular setting or practice area. Therefore, many of the described indicators are transferable to other nutrition practice areas or are intentionally nondescript to allow for flexibility in application to professional performance in any given area.
## Indicators for Standard 6: Utilization and Management of Resources

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<thead>
<tr>
<th>Each RDN:</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>6.1B</strong> Directs delivery of nutrition services in adult weight management-related programs</td>
<td>Competent</td>
</tr>
<tr>
<td><strong>6.2</strong> Evaluates management of resources with the use of standardized performance measures and benchmarking as applicable</td>
<td>X</td>
</tr>
<tr>
<td><strong>6.2A</strong> Uses the Standards of Excellence Metric Tool to self-assess quality in leadership, organization, practice, and outcomes for an organization (<a href="http://www.eatrightpro.org/excellencetool">www.eatrightpro.org/excellencetool</a>)</td>
<td>X</td>
</tr>
<tr>
<td><strong>6.2B</strong> Ensures efficient delivery of adult weight management nutrition programs (eg, budget, staff, facility, inventory, supplies)</td>
<td></td>
</tr>
<tr>
<td><strong>6.2C</strong> Leads operational review reflecting evaluation of performance and benchmarking data</td>
<td></td>
</tr>
<tr>
<td><strong>6.3</strong> Evaluates safety, effectiveness, efficiency, productivity, sustainability practices, and value while planning and delivering services and products</td>
<td>X</td>
</tr>
<tr>
<td><strong>6.3A</strong> Participates in evaluation and selection of tools and new products (eg, medical foods/nutritional supplements, dietary supplements, food/meals, web-based programs, and monitoring systems)</td>
<td>X</td>
</tr>
<tr>
<td><strong>6.3B</strong> Evaluates programs in meeting the needs of target population (eg, safety, effectiveness, value, and opportunities for improvement)</td>
<td></td>
</tr>
<tr>
<td><strong>6.3C</strong> Directs evaluation of program enhancements</td>
<td></td>
</tr>
<tr>
<td><strong>6.4</strong> Participates in quality assurance and performance improvement (QAPI), documents outcomes and best practices relative to resource management</td>
<td>X</td>
</tr>
<tr>
<td><strong>6.4A</strong> Recommends and/or modifies program to achieve targeted outcomes (eg, budgeted vs actual hours, actual vs budgeted revenue, actual vs projected patient/client volumes)</td>
<td></td>
</tr>
<tr>
<td><strong>6.4B</strong> Leads in design and implementation of QAPI activities</td>
<td></td>
</tr>
<tr>
<td><strong>6.5</strong> Measures and tracks trends regarding internal and external patient/client outcomes (eg, satisfaction, key performance indicators)</td>
<td>X</td>
</tr>
<tr>
<td><strong>6.5A</strong> Analyzes data for effective and efficient use of resources and patient/client satisfaction and communicates results</td>
<td></td>
</tr>
<tr>
<td><strong>6.5B</strong> Implements, monitors, and evaluates changes based on collected data and analysis</td>
<td></td>
</tr>
</tbody>
</table>

*(continued on next page)*

**Figure 2.** (*continued*) Standards of Professional Performance for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management. Note: The term *customer* is used in this evaluation resource as a universal term. Customer could also mean client/patient/customer, family, participant, consumer, or any individual, group, or organization to which the RDN provides service. Adult weight management is nonspecific to a particular setting or practice area. Therefore, many of the described indicators are transferable to other nutrition practice areas or are intentionally nondescript to allow for flexibility in application to professional performance in any given area.
Examples of Outcomes for Standard 6: Utilization and Management of Resources

- Authors a 3-year operational plan for their organization/department
- Implements data tracking systems that capture quality outcomes
- Resources are cost-effective and efficiently managed
- Documentation of resource use is consistent with operational goals
- Data are used to promote, improve, and validate services, and organization practices
- Directs or manages the design and delivery of adult weight management nutrition services, and holds responsibility for accurate management of grants when applicable
- Manages or coordinates an organization’s adult weight management program/service (eg, physician, pharmacist, RDN, nurse, and other disciplines according to the needs of the organization)
- Outcomes are measured, documented, and disseminated
- Identifies and tracks key performance indicators in alignment with organizational mission, vision, principles, and values

*PROMIS: The Patient-Reported Outcomes Measurement Information System (PROMIS) ([https://commonfund.nih.gov/promis/](https://commonfund.nih.gov/promis/index)) is a reliable, precise measure of patient-reported health status for physical, mental, and social well-being. PROMIS is a web-based resource and is publicly available.

*Interprofessional: The term *interprofessional* is used in this evaluation resource as a universal term. It includes a diverse group of team members (eg, physicians, nurses, dietitian nutritionists, physician assistants, pharmacists, behavioral health providers, exercise specialists, and occupational and physical therapists), depending on the needs of the customer. Interprofessional could also mean interdisciplinary or multidisciplinary.

*Medical staff: A *medical staff* is composed of doctors of medicine or osteopathy and may in accordance with state law, including scope of practice laws, include other categories of physicians, and non-physician practitioners who are determined to be eligible for appointment by the governing body.*

*Non-physician practitioner: A *non-physician practitioner* may include a physician assistant, nurse practitioner, clinical nurse specialist, certified registered nurse anesthetist, certified nurse-midwife, clinical social worker, clinical psychologist, anesthesiologist’s assistant, qualified dietitian or qualified nutrition professional. Disciplines considered for privileging by a facility’s governing body and medical staff must be in accordance with state law.*

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**Figure 2. (continued) Standards of Professional Performance for Registered Dietitian Nutritionists (RDNs) in Adult Weight Management.** Note: The term *customer* is used in this evaluation resource as a universal term. Customer could also mean client/patient/customer, family, participant, consumer, or any individual, group, or organization to which the RDN provides service. Adult weight management is nonspecific to a particular setting or practice area. Therefore, many of the described indicators are transferable to other nutrition practice areas or are intentionally nondescript to allow for flexibility in application to professional performance in any given area.
The Academy proudly acknowledges the following 50-year members:

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Arizona—Diane Frederick Bedsworth, Beth E. Janda, Carolyn Haessig La Potin, Deborah A. Laitenberger, Karren S. Moreland, J. Douglas Roiil, Karen I. Sell, Joanne B. Shearer, Deborah W. Silverman, Julie B. West
Arkansas—Bonnie J. Bradley, Maxine B. Freeman
Colorado—Patricia B. Boyd, Mary Lee Chin, Shirley K. Lippincott, Lorrie A. Wellman
Connecticut—Marie A. Hise, Debra G. Swanson
D.C.—Gloria J. Clark
Florida—Eileen C. Block, Michele Ciccacoz, Janet B. Levings, Janis R. Nai, Martha J. Phillips, Kathleen D. Schaml, Christine A. Stapel, Kathleen P. Waddell, Linda K. Wiley
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Iowa—Janice M. Steele
Kansas—Mary K. Flanagan, Christine R. Gleason, Helen M. Ramsey, Judy A. Wegman
Kentucky—Alice C. Collins, Lois J. Hill
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South Dakota—Ileen S. Desmond, Thecla M. Holzbaumer
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Washington—Janet T. Oliver, Carolynn H. Scalse, Julie A. Smith
Wisconsin—Lynn M. Abitz, Esther G. Fahn
Wyoming—Ann W. Hunter, Doreen V. Ward

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Nicole Larson, PhD, MPH, RDN, LD, Receives 2022 Huddleson Award

Nicole Larson, PhD, MPH, RDN, LD

Nicole Larson, PhD, MPH, RDN, LD is the recipient of this year’s 37th annual Huddleson Award for the article, “Barriers to Accessing Healthy Food and Food Assistance During the COVID-19 Pandemic and Racial Justice Uprisings: A Mixed-Methods Investigation of Emerging Adults’ Experiences” which was featured in the September 2021 issue of the Journal of the Academy of Nutrition and Dietetics (2021:121 (9):1679-1694).

Dr. Larson is currently a Senior Research Associate in the Division of Epidemiology and Community Health in the School of Public Health at the University of Minnesota, Minneapolis, MN. She is an instructor for two courses within the School of Public Health and advises graduate students in the Master of Public Health Nutrition and Nutrition Master of Science programs.

Dr. Larson is a nutritional epidemiologist and registered dietitian with expertise in the eating behaviors of child, adolescent, and young adult populations. Her research focuses on the identification of factors within social and physical environments that may be modified to promote healthy lifestyle behaviors and reduce barriers to the attainment of health equity among diverse populations. Much of her work is designed to inform the development of population-based strategies to help young people and their families who experience food insecurity and other barriers to accessing adequate healthy food.

Dr. Larson’s current work includes serving as project director for a longitudinal study of eating and activity behaviors among young people, an instructor, and training coordinator for the REACH T32 program that provides mentorship and support for predoctoral and postdoctoral trainees in the field of eating and activity research.

Dr. Larson served as a member of the Board of Editors of the Journal of the Academy of Nutrition and Dietetics (JAND) from 2008-2017 and continues to serve as an ad hoc reviewer for JAND along with other journals. She currently serves on the Board of Editors for the Journal of Adolescent Health. Larson’s professional memberships include the Academy of Nutrition and Dietetics, the Society for Nutrition Education and Behavior; and the American Public Health Association.

Dr. Larson has received numerous awards and honors including the Elaine R. Monsen Award for Outstanding Research Literature from the Journal of the Academy of Nutrition and Dietetics in 2018.

Dr. Larson has authored or co-authored 160 peer-reviewed research articles, sixteen professional publications and book chapters, and 57 poster or podium presentations.

Larson received her bachelor’s degree in Dietetics and Nutrition Science from St. Catherine University, St. Paul, MN and completed a Dietetic Internship at the Minneapolis Veterans Affairs Medical Center. She completed a Masters of Public Health in Nutrition from the School of Public Health, University of Minnesota and went on to participate in two Pre-doctoral fellowships; Larson completed the Leadership Education in Adolescent Health Training Program and Adolescent Health Protection Training in the Division of General Pediatrics and Adolescent Health and in the Center for Adolescent Nursing, School of Nursing both at the University of Minnesota. Larson received her PhD in Nutrition from the College of Food, Agriculture and Natural Resource Sciences, University of Minnesota, St. Paul, MN.

The coauthors for the article include Tricia Alexander, MPH, RD, LD, a graduate research assistant, Jaime C. Slaughter-Acey, PhD, MPH an associate professor; Rachel Widome, PhD, MHS an associate professor, Dianne Neumark-Sztainer, PhD, MPH, RD a professor all who are in the Division of Epidemiology and Community Health, School of Public Health, University of Minnesota, Minneapolis, MN. and Jerica Berge, PhD, MPH, a professor in the Department of Family Medicine and Community Health , University of Minnesota, Minneapolis, MN. Ms. Alexander is currently pursuing a PhD in epidemiology and had a large role in carrying out the research described within the article; she was involved both as an interviewer and coder of the transcripts that were used to identify themes.

The prestigious Huddleson Award honors a registered dietitian who was the lead author of a peer-reviewed article that made an important contribution to the dietetics profession and that was published in the Journal of the Academy of Nutrition and Dietetics during the previous calendar year.

The award, bestowed by the Academy of Nutrition and Dietetics Foundation, is awarded annually to a registered dietitian for an outstanding research article published in JAND. The Huddleson Award recognizes the significant contributions that registered dietitians make to the dietetics profession and to the advancement of nutrition science and practice.
named for Mary Pascoe Huddleson, editor of the Journal from 1927 to 1946. The award carries a $1,000 honorarium, and the winner is recognized during the Journal of the Academy of Nutrition and Dietetics Board of Editors Webinar.

All relevant manuscripts published in the Journal over the past year are considered by the Senior and Associate Editors to develop a list of the top 5-7 papers. Impact of the paper, relevance of the topic and quality of the research are key criteria. Once the top contenders have been identified, these are sent to the Board of Editors for their consideration and evaluation. The list is rank ordered and sent back to the Editor in Chief for final tally and the winner is identified.

**2022 Huddleson Award Nominees**

Additional manuscripts and their first authors nominated for the award this year include:

- “Native Youth Participating in the Together on Diabetes 12-Month Home-Visiting Program Reported Improvements in Alternative Healthy Eating Index-2010 Diet Quality Domains Likely to Be Associated with Blood Pressure and Glycemic Control” Kirstie Ducharme-Smith MS, RD, LDN
- “Introducing Dietary Self-Monitoring to Undergraduate Women via a Calorie Counting App Has No Effect on Mental Health or Health Behaviors: Results from a Randomized Controlled Trial” Samantha L. Hahn PhD, MPH, RD
- “Use of an Observational Comparative Strategy Demonstrated Construct Validity of a Measure to Assess Adherence to the Satter Division of Responsibility in Feeding” Barbara Lohse, PhD, RDN
- “Evidence That Changes in Community Food Environments Lead to Changes in Children’s Weight: Results from a Longitudinal Prospective Cohort Study” Punam Ohri-Vachaspati PhD, RD
THE 19TH ANNUAL ELAINE R. Monsen Award for Outstanding Research Literature has been awarded to Teresa T. Fung, ScD, RD. Dr. Fung is professor and director of the didactic program in dietetics at Simmons University, Boston, Massachusetts. She has been at Simmons since 2000 and teaches both undergraduate and graduate courses while maintaining research collaboration at the Harvard School of Public Health where she is an adjunct professor.

Dr. Fung graduated from Cornell University, Ithaca, New York with her undergraduate and master’s in nutrition and completed her dietetic internship at Yale-New Haven Hospital, New Haven, Connecticut. She stayed and practiced as a clinical nutrition specialist (RD) working in a variety of nutrition specialties. In 2000, Dr. Fung completed a dual doctor of science degree in nutrition and epidemiology at the Harvard TH Chan School of Public Health.

Dr. Fung believes in preparing students for a fast-paced and dynamic workplace. In that light her teaching focuses on providing students with the most updated technical knowledge, skills for critical thinking, problem-solving, as well as locating and evaluating scientific information. Her areas of expertise include nutritional epidemiology, diet assessment and development of non-communicable conditions (eg, diabetes, cancer, cardiovascular disease, obesity, frailty, and frailty).

Dr. Fung’s research interests include studying how diet influences the risk of developing major chronic diseases. Her research has focused on methodology that assesses the quality of the entire diet, in particular the development of diet quality indexes. She also examines the association of these diet quality measures and risk of chronic disease such as diabetes, cancer, cardiovascular disease, elderly fracture, and weight change. She collaborates with the Harvard School of Public Health and her work has been funded by the National Institutes of Health. She was the principal investigator for the U.S. module in a grant funded by FHI Solutions which was a recipient of a Bill & Melinda Gates Foundation grant to develop a diet quality index that can be applicable in different settings around the world. The resulting Global Diet Quality Score is an easy to use metric and was able to reflect nutrient adequacy in lower/middle income countries and non-communicable disease risk in the U.S.

Dr. Fung’s current research includes examining the association between lifestyle predictors of healthy geriatric frailty in women. She is particularly interested in studying the interaction between healthy food components and the level of food processing on frailty development.

As Dr. Fung acknowledges, “We don’t want to give too complicated recommendations to people, but we need to give what is the most impactful.” She is working to answer this using epidemiological data collected by the Harvard TH Chan School of Public Health to examine these relationships. Dr. Fung has authored or coauthored numerous abstracts, book chapters, and journal articles in addition to presenting nationally and internationally.

Dr. Fung is a member of the Academy of Nutrition and Dietetics and the American Society of Nutrition. She is currently a member of the editorial board for the Journal of the Academy of Nutrition and Dietetics. She has served on the Academy of Nutrition and Dietetics (AND) Council on Research and been a reviewer of Academy scholarship applications. Dr. Fung is an associate editor for the Journal of Nutrition and a panelist for the U.S. News and World Reports Best Diet rankings. She has previously been on a Technical Expert Committee at the United States Department of Agriculture to evaluate scientific evidence on dietary patterns and health outcomes.

Dr. Fung has received numerous honors including the Simmons University “Toby Sloane Award for Student Centerness,” the “Excellence in Oncology Nutrition Research Award” from the Academy of Nutrition and Dietetics Oncology Nutrition Di- etetics Practice Group, and the “Academic Mid-Career Nutrition Leadership” award from the Dannon Institute.

The Monsen Award recognizes a body of research that encompasses a major component of the recipient’s professional efforts. The work benefits the profession and the world, and the research is published in a recognized, peer-reviewed, scientific journal of quality, including the Journal of the Academy of Nutrition and Dietetics. The award winner must be a member of the Academy of Nutrition and Dietetics. This award honors Elaine Monsen, PhD in appreciation of her exceptional contribution to research literature in nutrition and dietetics throughout her 20 years as editor-in-chief of the Journal of the American Dietetic Association. The Journal congratulates Teresa Fung on this recognition of her career-long achievements.
References
FNCE® 2023 Call for Educational Sessions

The Academy is looking for innovative educational sessions that resonate with professionals, students, educators, and other members of the nutrition and dietetics field.

We are accepting proposals online through November 15, 2022.

Each year, the Academy receives hundreds of proposals for FNCE® sessions. To stand out and improve your chances of acceptance, be sure to consider these key questions:

- What perspectives and experiences will make your presentation unique?
- What outcomes will you highlight?
- Does current science or evidence support your proposal?
- How will your proposed session advance professional skills?

To submit a proposal or to find planning tips and guidelines, visit www.eatrightFNCE.org/program/present-fnce
**ACADEMY CALENDAR**

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**FROM THE ACADEMY**

**People & Events**

**National Cancer Institute Dietary Assessment Primer Now Available**

The National Cancer Institute (NCI) is pleased to announce the availability of a web-based Dietary Assessment Primer. Various types of self-report instruments have been developed to assess dietary intake. Each has distinct features as well as strengths and limitations. The Dietary Assessment Primer:

- Describes the major types of instruments that rely on individuals reporting their own diets;
- Provides guidance on using the instruments alone or in combination to address different research questions;
- Compares key features of the main self-report dietary assessment instruments;
- Explains and provides guidance regarding validity, measurement error, and calibration in the context of dietary assessment;
- Provides expanded information about particular key topics in dietary assessment; and
- Includes a Glossary of key terms and an extensive list of References and Resources.

The Dietary Assessment Primer is located at http://dietassessmentprimer.cancer.gov. The NCI scientific leads for this important new resource are Susan Krebs-Smith, PhD, RD; Amy Subar, PhD, MPH, RD; Jill Reedy, PhD, MPH, RD; Fran Thompson, PhD, MPH; and TusaRebecca Schap, PhD, MPH, RD, all in the NCI Applied Research Program’s Risk Factor Monitoring and Methods Branch (RFMMB); Anne Brown Rodgers, science writer; and Sharon Kirkpatrick, PhD, MHS, RD, formerly in the RFMMB and currently assistant professor at the University of Waterloo School of Public Health and Health Systems.

**ANNOUNCEMENTS**

**Coronavirus Information Center**

So that Journal readers have access to breaking news and research about the Novel Coronavirus (COVID-19 r 2019-nCoV), we are pleased to post these links to the following resources:


Here, you will find expert guidance, current travel precautions, interactive maps, tips for clinicians, patient education materials, and open access content from numerous other research journals on this topic.
Obesity and Weight Management Multidisciplinary Study Guide

Hone your skills at your own pace with specialized presentations, comprehensive resource lists, case studies, review questions, and more!

This interactive, evidence-based online course — presented by experts from across the healthcare spectrum — reviews best practices in weight management, and the diagnosis and treatment of individuals with obesity. Included are 11 modules — each with their own practice exam — covering the healthcare discipline spectrum: nutrition, bariatrics, medical assessment, physical activity, psychology, pregnancy, pediatrics, public health, intervention, monitoring, and interprofessional healthcare.

Learning Objectives:

1. Explain the relationship between obesity and other health conditions based upon related discipline areas
2. Identify the needs of, and treatment options for, patients with obesity, using skills from various disciplines
3. Implement effective weight management techniques to patients via multidisciplinary perspective

CPEU: 8.0
CPE Level: 2
Suggested Learning Need Codes: 3030, 4040, 5370, 6010

Learn more at eatrightSTORE.org
Physical and mental health outcomes of an integrated cognitive behavioural and weight management therapy for people with an eating disorder characterised by binge eating and a high body mass index: a randomized controlled trial.


Eating disorders (ED) are characterized by food, weight, body shape concerns, and behaviors such as binge eating and extreme dietary restriction. Bulimia nervosa (BN) and binge eating disorder (BED) and Other Specified Feeding or Eating Disorders (OSFED) are among the most common ED diagnoses and are often associated with higher BMI. Current guidelines recommend a multidisciplinary approach to treatment of ED. The current single-blind, randomized controlled study utilizes the Healthy Approach to Weight Management and Food in Eating Disorders (HAPIFED), which is a novel approach integrating Cognitive Behavioral Therapy-Enhanced (CBT-E) with Behavioral Weight Loss Therapy (BWLT) for persons with recurrent binge eating episodes in addition to a high BMI. The current study tested the efficacy of group based HAPIFED to group-based CBT-E for individuals with varied ED and BMI ≥27kg/m² and <40kg/m². The main outcome was maintained weight loss at 12-month follow up. Secondary outcomes included improvements in indicators of metabolic health, physical and mental health related quality of life, general psychopathology, severity in binge eating, global self-reported ED symptoms, and remission to ED diagnoses. Researchers hypothesized that participants receiving HAPIFED would have better indicators of metabolic and physical health and similar improvements in general and psychiatric symptoms compared to those receiving CBT-E. All participants were followed up at baseline, three months, six months, and twelve months. Assessments included sociodemographic data, anthropometry, blood tests, general psychological symptomology, ED diagnoses, and validated questionnaires assessing self-reports of general and ED symptoms affecting quality of life. The final sample (n=98) showed no significant differences in treatment between the two groups (HAPIFED and CBT-E) for all primary and secondary outcomes. However, both interventions showed positive time-effect improvements in stress and ED symptoms from baseline.

CLINICAL NUTRITION

Possible Non-neurological Health Benefits of the Ketogenic Diet: Review of Scientific Reports over the Past Decade.


The ketogenic diet (KD) is a very low carbohydrate diet and has been used since the 1920s as a therapy for drug-resistant epilepsy. The KD diet has generated significant interest of late as emerging evidence suggests that ketone bodies can exert pleiotropic effects on mitochondrial functioning, function of signaling mediators, and contribute to endogenous antioxidant defenses. The current narrative review discusses research papers over the last 10 years evaluating the use of KD unrelated to the nervous system. The researchers discuss topics such as the use of KD in individuals with excessive body weight, KD combined with physical activity for weight loss, the use of KD in patients with Type 2 Diabetes, and the use of KD for those at risk for cardiovascular disease. In the cited studies, short periods of very low-calorie KD were effective, and effects were maintained even after increasing calories and comparing them to similar diets (i.e., Mediterranean diet, low fat, reduced calorie, very low calorie diet, and low calorie diet). Current evidence confirms that positive anthropometry changes and beneficial changes to blood lipid levels obtained during very low-calorie KD can be sustained long term (12-24 months).

CULINARY

Edible Flowers as a Source of Dietary Fibre (Total Insoluble and Soluble) as a Potential Athlete’s Dietary Supplement.


The diet of active persons should include many nutrients in sufficient quantities, including protein and fiber. Low intake of nutrients may result in poor sports performance, prolonged recovery time, potential for more injuries, and higher levels of fatigue. Dietary fiber has long been recognized as an essential component of a healthy diet, but many adults do not meet the recommendations for fiber, and low fiber intake has been correlated with a higher risk for chronic diseases. Edible flowers have grown in popularity lately and offer a wide variety of applicability in many countries. Edible flowers contain bioactive compounds which may include polyphenols, and are good sources of vitamins, minerals, essential oils, and antioxidants. The aim of this study was to determine the content of dietary fiber (total, soluble, insoluble) and dietary protein in selected edible flowers. The review continues to provide information regarding total protein and fiber for multiple different types of common, edible flowers, and correlations between total fiber and protein in each flower type. The present review provides valuable information that alternative sources of fiber and protein can be used to increase protein and fiber intake after physical activity.

GERONTOLOGY

Long Term Physical Activity Improves Quality of Life Perception, Healthy Nutrition, and Daily Life Management in Elderly: A Randomized Controlled Trial.


Quality of life while aging is closely linked to the concept that both the physical and psychological health of individuals and their community. Age is a non-modifiable risk factor during which the worsening of functional capacities and the increase in disease risk are expected and natural. Current literature shows that regular physical activity (PA) prevents the occurrence of several disease in older adults, and there is a consensus that regular PA leads to “successful aging” (e.g., maintenance of both physical and cognitive abilities). The aim of this interventional study was to demonstrate that a 24-month multi-modal PA program improves quality of life, nutritional status, and daily life management more than low-impact PA program. Researchers hypothesized that choosing a healthy, active lifestyle, induced by a period of...
moderate-to-high PA may lead to better life satisfaction, promoting good life practices and “successful aging”. This two year, randomized controlled trial enrolled 244 participants, > 50 years, who had a sedentary to normal activity lifestyle. Perceived quality of life, nutritional status, and weekly level of PA were assessed using three different validated questionnaires at baseline, six, 12, and 24 months. Participants randomly assigned to the experimental group performed three sessions per week for one hour each. The exercise program was individualized based on baseline physical performance, health status, and exercise responses. The control group performed three sessions of low-impact PA (i.e., stretching, balance exercises, and posture and coordination education). Both groups were supervised by qualified and trained personal trainers. Results of the study noted that all outcomes measured (i.e. quality of life, nutritional status, and daily life management) increased significantly in the experimental group compared to control group. Those in the control group exhibited worsening nutritional outcomes and maintenance of quality of life. The present study confirms the potential impact of long-term-moderate-to-high intensity PA on several aspects of life and “successful aging”.

**PEDIATRIC**

A Narrative Review of Toxic Heavy Metal Content of Infant and Toddler Foods Evaluation of United States Policy.


Concerns have been raised in multiple, independent studies that inorganic contaminants, such as heavy metals, have been found in many foods for infants and young children. Reports from the US House of Representatives Subcommittee on Economic and Consumer Policy suggest subpar testing practices, lenient standards, and limited oversight of some of the largest baby food manufacturers. This is a concerning public health issue as many baby/child food manufacturers hold a certain amount of consumer trust. Exposure to heavy metals is carcinogenic to all, but especially infants, toddlers, and children. The present narrative review discusses heavy metals (i.e., arsenic, lead, mercury, cadmium), toxicity of heavy metals, occurrence of heavy metals, analysis and quantification of heavy metals, current policy standards for heavy metals, and discusses establishing new action levels for heavy metals. The review also reviews organic and clean label certification standards and policy. The current review highlights gaps in understanding at the public level and inconsistent assessment protocol regarding heavy metals at the government and scientific level. The authors conclude that future studies regarding heavy metals in baby/child foods should strive to follow reproducible risk assessment methods rather than hazard presence-based models, at least until authoritative action limits and threshold comparisons can be set for these particular food items.

**PUBLIC HEALTH**

Racial/Ethnic Disparities in Food Pantry Use and Barriers in Massachusetts during the First Year of the COVID-19 Pandemic.


Approximately 10.9% of Americans experienced food insecurity in 2019, and due to the financial repercussions of the COVID-19 pandemic, food insecurity rates increased. Charitable and federal food assistance programs grew considerably in...
response to increased economic needs from the pandemic. The Greater Boston Food Bank (GBFB) reported that the number of people receiving food assistance through its food pantry doubled between May 2019 and May 2020, and GBFB reported a 58% increase in total pounds of food distributed to local food pantries May-December 2020, highlighting an increased demand for charitable food assistance due to the pandemic. The present study sought to understand racial and ethnic disparities in food security/prevalence and barriers/experiences with food pantry use in Massachusetts to improve equitable access to food pantries. Researchers hypothesized that racial and ethnic minorities had a higher prevalence of food insecurity and faced more barriers to food pantry use. The present, cross-sectional study surveyed adults living in Massachusetts in 2020. Surveys were sent via Qualtrics to English or Spanish speaking adults ≥18 years. Low-income adults were oversampled to obtain adequate sampling of those most likely in need of food assistance. The survey included demographics, food insecurity level, food assistance use, and facilitators and barriers to federal/charitable food assistance use. The survey referred to periods “before the pandemic” and “since the pandemic”. Results from the study noted that food insecurity increased from 19% to 30% during the pandemic with ethnic groups experiencing a significantly higher prevalence. Adults with children in the household were noted to have higher rates of food insecurity. Food pantry use increased from 9% to 12% during the pandemic, with higher rates of use among ethnic groups. However, most food insecure adults did not utilize food pantries during the pandemic. Barriers to food pantry use included not knowing when food pantries open (59%), feeling of embarrassment (56%), inconvenient hours/location (55%), difficulties traveling to the location (53%), etc. Researchers of the current study found an increase in food insecurity prevalence during the pandemic and raised concerns regarding food insecurity among ethnic groups.

RENSAL NUTRITION

New Directions in Phosphorous Management in Dialysis.

Management of hyperphosphatemia in End Stage Renal Disease (ESRD) has centered around dietary restriction, removal of phosphorous via dialysis, and binding phosphorous to prevent absorption in the digestive tract. However, dietary restriction is difficult given “hidden phosphates” in food, which can contribute over 1,000mg added phosphorous daily, and the maximum amount of phosphate that can be removed by dialysis is limited. The recent development of phosphate blocking compounds allows health professionals to rethink approached to phosphorous management given mechanistic understanding of phosphate absorption. Therapies used to directly target the absorption of phosphorous rather than binding it can then be developed. In this review, researchers review the limitations of current phosphate management approaches and describe new, targeted nonbinder therapies that have been developed. Mechanisms of phosphate absorption and the role of the paracellular pathway, novel molecules in development target paracellular uptake of phosphate in the gastrointestinal tract, previous clinical trials for other phosphate-lowering therapies, how dietary phosphorous content overwhelms typical options for phosphate control, and limitations to the current approaches to phosphorous control in ESRD are discussed. The researchers of the current review note that novel therapies targeting the gastrointestinal tract and phosphate absorption pathways present an opportunity to rethink management of hyperphosphatemia, and that clinicians may consider using phosphate absorption inhibitors as a first line
treatment with phosphate binders in adjunction.

RESEARCH

Mendelian randomization study of maternal coffee consumption and its influence on birthweight, stillbirth, miscarriage, gestational age and pre-term birth.

Coffee is one of the most consumed beverages worldwide, with an average daily intake of >400mg per day, approximately four cups. An estimated 70% of pregnant women drink caffeine with coffee being the main source, and the World Health Organization recommends pregnant women consume <300mg caffeine daily. Research has noted that caffeine can accumulate in the body while pregnant and expose the fetus to harmful effects and outcomes. The current study utilizes Mendelian Randomization (MR) to investigate whether the observational relationships between coffee consumption and adverse pregnancy outcomes (i.e., stillbirths, miscarriages, pre-term birth, gestational age, and birth weight). The current study utilizes the UK Biobank and the Avon Longitudinal Study of Parents and Children (ALSPAC) for participant data. Researchers reported that a higher self-reported rate of coffee consumption among pregnant women was associated with lower offspring birthweight, higher risk of pre-term birth, and reduced gestational age, all with or without adjusting for smoking and alcohol consumption. However, no reported relationships were statistically significant. Despite the lack of strong evidence for a causal effect of maternal coffee consumption on poor birth outcomes, researchers did note that their results could be due to a lack of power and the study could yield better results in a larger study population.

EDITORIALS

BEHAVIORAL HEALTH

Behaviour change techniques in cardiovascular disease smartphone apps to improve physical activity and sedentary behaviour: Systematic review and meta-regression.

Family-Empowered Treatment in Higher Levels of Care for Adolescent Eating Disorders: The Role of the Registered Dietitian Nutritionist.

Orthorexia nervosa and eating disorder behaviors: A systematic review of the literature.

Physical and mental health outcomes of an integrated cognitive behavioural and weight management therapy for people with an eating disorder characterized by binge eating and a high body mass index: a randomized controlled trial.
**BUSINESS & INDUSTRY**

Patient-Reported Outcome Measures in Clinical Research.

Systematic literature review of instruments that measure the healthfulness of food and beverages sold in the informal food outlets.

**CLINICAL NUTRITION**

Adding salt to foods and hazard of premature mortality.

Associations of Dietary Cholesterol, Serum Cholesterol, and Egg Consumption with Overall and Cause-Specific Mortality: Systematic Review and Updated Meta-Analysis.


Effectiveness of medical nutrition therapy in the management of adult dyslipidemia: A systematic review and meta-analysis.

Efficacy of a Mediterranean diet for the secondary prevention of cardiovascular disease.

Is Personalized Dietary Therapy Effective for Individuals with Irritable Bowel Syndrome?

Mediterranean Diet vs Low-fat Diet for Patients with Heart Disease.

Nutrition as a risk for mortality and functionality in critically ill adults.

Nutritional status and out-of-hospital mortality in vascular surgery patients.

Possible Non-neurological Health Benefits of the Ketogenic Diet: Review of Scientific Reports over the Past Decade.

Primary Contributors to Dietary Acid Load in Patients with Urolithiasis.
Betz MV, Penniston KL. *J Renal Nutr*. 2022; https://doi.org/10.1053/j.jrn.2022.05.005.

A questionnaire for physical findings of malnutrition when physical exams are not possible.

A randomised controlled trial of a Mediterranean Dietary Intervention for Adults with Rheumatoid Arthritis (MEDRA): Study protocol.

Relationship between Emotional Eating, Consumption of Hyperpalatable Energy-Dense Foods, and Indicators of Nutritional Status: A Systematic Review.

Technology-supported models of nutrition care: perspectives of health service providers.

**COMMUNITY NUTRITION**

Adult Obesity Prevalence Increased During the First Year of the COVID-19 Pandemic.

Current WHO recommendations to reduce free sugar intake from all sources to below 10% of daily energy intake for supporting overall health is not well supported by evidence.

Life’s Essential 8: Updating and Enhancing the American Heart Association’s Construct of Cardiovascular Health: A presidential Advisory From the American Heart Association.

Notes from the Field: Outbreak of Salmonella Enteritidis at a Correctional Facility Using Mechanically Separated Chicken — Nebraska, 2022.

A Qualitative Examination of California WIC Participants’ and Local Agency Directors’ Experiences during the COVID-19 Pandemic.


State SNAP Policies Unlikely to Close Participation Gap Between Seniors and Non-Seniors, Study Show.

CULINARY
Edible Flowers as a Source of Dietary Fibre (Total Insoluble and Soluble) as a Potential Athlete’s Dietary Supplement.

Fish and human health: an umbrella review of observational studies.

Mercury bioaccessibility in fish and seafood: Effect of method, cooking, and trophic level on consumption risk assessment.

Natural Bioactive Compounds in Organic and Conventional Fermented Food.

The nutritional quality of whole grain and multi-grain bread is not necessarily better than white breads: the case of gluten-free and gluten-containing breads.

DIABETES CARE
Dose-dependent effect of carbohydrate restriction for type 2 diabetes management: a systematic review and dose-response meta-analysis of randomized controlled trials.

Increasing Annual Dietitian Visits or Patients with Diabetes.

EDUCATION
Dietetics Students’ Perceptions of Academic and Health Impacts of the COVID-19 Pandemic.

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Eligibility information, examination resources, and more can be found at cdrnet.org/CSP.
GERONTOLOGY

Long Term Physical Activity Improves Quality of Life Perception, Healthy Nutrition, and Daily Life Management in Elderly: A Randomized Controlled Trial.

NUTRITION SUPPORT

An analysis of nonnutritive calories from propofol, dextrose, and citrate among patients who are critically ill that are receiving continuous renal replacement therapy.

Patterns of lipid-injectable emulsion in neonatal intensive care units across the United States: A multi-institution survey.

ONCOLOGY


PEDIATRIC

Association of snacking frequency, size, and energy density with weight status among US preschool children.

Can children report on their own picky eating? Similarities and differences with parent report.

Complementary food introduction practices in infants with intestinal failure.

Health outcomes associated with micronutrient-fortified complementary foods in infants and young children aged 6-23 months: a systematic review and meta-analysis.

A Narrative Review of Toxic Heavy Metal Content of Infant and Toddler Foods Evaluation of United States Policy.

PUBLIC HEALTH

10-Year Weight Gain in 13,802 US Adults: The Role of Age, Sex, and Race.

Changes in Body Weight, Health Behaviors and Mental Health in Adults with Obesity during the COVID-19 Pandemic.

Consumption of Foods-Away-from-Home is Associated with Lower Diet Quality Among Living in Puerto Rico.


Ensuring Food Safety for Americans: The Role of Local Health Departments.

Facilitators and barriers to the implementation of improved solid fuel cookstoves and clean fuels in low-income and middle-income countries: an umbrella view.

How different COVID-19 recovery paths affect human health, environmental sustainability, and food affordability: a modelling study.

Is altering the availability of healthier vs. less-healthy options effective across socioeconomic groups? A mega-analysis.

Racial/Ethnic Disparities in Food Pantry Use and Barriers in Massachusetts during the First Year of the COVID-19 Pandemic.

Tap water avoidance is associated with lower food security in the US: Evidence from NHANES 2005-2018.
Rosinger AY, Bethancourt HJ, Young SL. J Renal Nutr. 2022; https://doi.org/10.1053/j.jrn.2022.06.009.

RENEAL NUTRITION

Case Studies of Intradialytic Total Parenteral Nutrition in Nocturnal Home Hemodialysis.
Designing dietary education materials for people with chronic kidney disease: recommendations for improving the quality of resources.

Diet therapy along with Nutrition Education can improve Renal Function in People with Stages 3-4 chronic kidney disease who do not have diabetes (A randomized controlled trial).

Energy-Adjusted Dietary Inflammatory Index is Associated with 5-Year All Cause and Cardiovascular Mortality Among Chronic Kidney Disease Patients.

New Directions in Phosphorous Management in Dialysis.

Plant or animal based or PLADO diets: Which should chronic kidney disease patients choose?

Sarcopenic Obesity Versus Nonobese Sarcopenia in Hemodialysis Patients: Differences in Nutritional Status, Quality of Life, and Clinical Outcomes.

RESEARCH
Adolescents’ exposure to and evaluation of food promotions on social media: a multi-method approach.

Association between hyperchromocytinemia and the risk of all-cause and cause-specific mortality among adults in the US.

The association of obesity-related traits on COVID-19 severity and hospitalization is affected by socio-economic status: a multivariable Mendelian randomization study.

Association of the “Weekend Warrior” and Other Leisure-Time Physically Activity Patterns with All-Cause and Cause-Specific Mortality: A Nationwide Cohort Study.

Associations between moderate alcohol consumption, brain iron, and cognition in UK Biobank participants: Observational and mendelian randomization analyses.

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Birth length is the strongest predictor of linear growth status and stunting in the first two years of life after a preconception maternal nutrition intervention: the children of the Women First trial.


Brain regulation of hunger and motivation: The case for integrating homoeostasis and hedonic concepts and its implications for obesity and addiction.


Comparison of an Online Dietary Assessment Tool (the “Boden Food Plate”) with 24-Hour Recalls.


Effectiveness of 2, 3, and 4 COVID-19 mRNA Vaccine Doses Among Immunocompetent Adults During Periods when SARS-CoV-2 Omicron BA.1 and BA.2/BA.2.12.1 Sublineages Predominated — VISION Network, 10 States, December 2021-June 2022.


Efficacy of Marine ω-3 Fatty Acid Supplementation vs Placebo in Reducing Incidence of Dry Eye Disease in Healthy US Adults: A Randomized Clinical Trial.


Factors Attributed to Breastfeeding Success in a Tertiary Obstetric Hospital.


I Had to Go in a Bubble: Investigating the Effects of COVID-19 on Fertility Treatments and Nutrition.


Impact of BMI on COVID-19 vaccine effectiveness.

Wilder-Smith A, Frasha A. Lancet Diabetes Endocrinol. 2022; https://doi.org/10.1016/s2213-8587(22)00170-x.

Insulin Resistance and Urolithiasis as a Challenge for a Dietitian.


Low-grade inflammation, COVID-19, and obesity: clinical aspect and molecular insights in childhood and adulthood.


Mendelian randomization study of maternal coffee consumption and its influence on birthweight, stillbirth, miscarriage, gestational age and preterm birth.


Nonpharmacological Interventions for the Management of Testosterone and Sperm Parameters: A Scoping Review.


Pilot Plant-Based Lifestyle Medicine Program in an Urban Public Healthcare System: Evaluating Demand and Implementation.


Pilot study for the development of a screening questionnaire to detect sarcopenic obesity.

Bissonnette DJ, Burk BN, Knobilch P. In J Obes. 2022; https://doi.org/10.1038/s41366-022-01118-y.

Worse sleep health predicts less frequent breakfast consumption among adolescents in a micro-longitudinal analysis.

SPORTS NUTRITION

Carbohydrate fear, skinfold targets and body image issues: a qualitative analysis of player and stakeholder perceptions of the nutrition culture within elite female soccer.

Edible Flowers as a Source of Dietary Fibre (Total Insoluble and Soluble) as a Potential Athlete’s Dietary Supplement.

WEIGHT MANAGEMENT

Association of Bariatric Surgery with Cancer Risk and Mortality in Adults with Obesity.

The consequences of a weight-centric approach to healthcare: A case for a paradigm shift in how clinicians address body weight.

Global variations in preoperative practices concerning patients seeking primary bariatric and metabolic surgery (PACT Study): A survey of 634 bariatric healthcare professionals.

The Impact of Health Coaching on Weight and Physical Activity in Obese Adults: A Randomized Control Trial.

Obesity and Weight Management for Prevention and Treatment of Type 2 Diabetes.

SlimMe, a Chatbot with Artificial Empathy for Personal Weight Management: System Design and Finding.

Understanding weight regain after a nutritional weight loss intervention: Systematic review and meta-analysis.

Validation of Tools to Assess Predictors of Successful Weight Loss Outcome in Individuals with Overweight and Obesity.

Weight Management Interventions Provided by a Dietitian for Adults with Overweight or Obesity: An Evidence Analysis Center Systematic Review and Meta-Analysis.

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The FDA has the power to take action against any adulterated or mislabeled dietary supplement. This means that businesses that manufacture dietary supplements and dietary ingredients are responsible for assessing the safety and labeling of their products before sale to ensure that they meet all the requirements of the Federal Food, Drug and Cosmetic Act, as amended by DSHEA and FDA regulations.

The FDA's Dietary Supplements website offers a plethora of resources for healthcare professionals, industry, teachers, and consumers. Healthcare professionals may find Dietary Supplements Products & Ingredients of interest. This resource defines dietary supplements and dietary ingredients, reviews claims that dietary supplements cannot make, and outlines what criteria must be met before the FDA can take action to remove a dietary supplement from the market. The resource includes links to detailed information for a select list of dietary supplement products, ingredients, and other substances such as Cesium Chloride, DMAA (1,3-dimethylamylamine), Phenibut, and Vinpocetine. The resource also includes a link to the FDA Dietary Supplement Ingredient Advisory List that aims to alert individuals when the FDA identifies ingredients that do not seem to be lawfully included in products sold as dietary supplements.

For industry, the website organizes information under four headings: 1) Applications & Submissions includes instructions and links for industry to submit specific notifications and applications for dietary supplements; 2) Guidance & Regulatory Information is comprised of policies, resources, and links to offer guidance pertaining to dietary supplements; 3) Warning Letters consists of a searchable database of warning letters sent by the FDA to manufacturers; and 4) Related Resources provides miscellaneous resources for industries. A resource highlighted for teachers is the FDA's Science and our Food Supply: Examining Dietary Supplements high school science class curriculum. This interactive supplementary curriculum aims to foster curiosity and empower students to assess the accuracy and credibility of information they encounter about dietary supplements. For consumers, the website offers a variety of fact sheets available in English and in Spanish. Fact sheet titles include Understanding Dietary Supplements, Talking to Healthcare Professionals About Dietary Supplements, Dietary Supplements: Report Adverse Events to FDA, and Dietary Supplements: How FDA Helps Keep You Safe. The FDA website also features several short videos designed for consumers including Dietary Supplements Overview, Dietary Supplements and Medications, and Dietary Supplements and Adverse Events. In addition, the website provides a variety of consumer updates, consumer alerts, and information regarding health fraud scams.

Operation Supplement Safety (OPSS) was developed in response to a January 2012 request from the Assistant Secretary for Health Affairs for a U.S. Department of Defense (DoD)-wide educational campaign on dietary supplements. On March 9, 2022, the DoD issued the Department of Defense Instruction (DoDI) 6130.06, Use of Dietary Supplements in the DoD, which identified OPSS as the go-to program for dietary supplements. OPSS's mission is to offer evidence-based information regarding dietary supplements to Service Members, their families, healthcare providers, and leaders to promote optimal human performance. It aims to provide tools and resources to support users in making informed decisions about dietary supplements to optimize their health, performance, and careers.

In addition to delineating DoD-wide and branch-specific military policy regarding dietary supplement usage, OPSS's website provides the most up-to-date information available on a variety of dietary supplement topics. Site users can use its interactive A-Z Index, to find information regarding a specific ingredient or type of supplement. Dietary supplement ingredients prohibited by the DoD can be identified by searching the DoD Prohibited Dietary Supplement Ingredient List. A Check Your Supplement tool assists individuals in screening supplements for safety. The tool directs users to read the label on their supplement and then answer 7 brief questions. A supplement score of 4 or more indicates that the supplement is okay. A score of less than 4 or if the supplement contains any ingredients on the Prohibited Dietary Supplement Ingredient List indicates that the supplement is a “no-go.” The OPSS website also features a confidential Ask the Expert feature that allows individuals to submit and receive answers to specific dietary supplement questions.
Late-Breaking Project Abstracts
The Academy acknowledges the following members who donated their time and expertise in the review and evaluation of abstracts for presentation:

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Angela Ditucci  Michelle Myers  Christopher Taylor
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Late-Breaking Project or Program Report Abstracts
Dietary Diversity, Ultra-Processed Foods, and Risk for Chronic Disease: A Controlled Dietary Intervention Trial

Author(s): M. Baumler, A. Mitra, K. Thames, M. Rosenfield, A. Brown, I. Schuster; St. Catherine University

Learning Outcome: Upon completion, participants will be able to describe an effective approach to improve dietary pattern and reduce risk for chronic disease.

A diet rich in plant foods and lower in ultra-processed foods is associated with reduced risk for chronic diseases. The purpose of this study was to determine whether an intervention promoting increased diversity of plant food varieties and including a grocery stipend was associated with reduced intake of ultra-processed foods and reduced risk for chronic disease. A dietary intervention trial was conducted with 19 college students who completed the 12-week study. Participants underwent a 4-week control period and an 8-week intervention period in which they watched weekly educational modules on dietary diversity and received a weekly grocery stipend. Participants tracked the number of plant foods they consumed on a weekly basis and completed 24-hour recalls using ASA24. Anthropometric data (weight, waist and hip circumference, blood pressure, body composition) and labs (fasting glucose, lipid panel, C-reactive protein) were collected at baseline, and at the start and end of the intervention. There was a significant increase in average weekly number of types of plant foods consumed in the intervention compared to control (34.7 +10.8 vs. 23.1 + 12.1; p< 0.001). There was a significant reduction in average daily number of ultra-processed foods consumed in the intervention compared to the control (5.4 + 1.6 vs 6.5 + 2.0; p= 0.02). There were no statistically significant changes in the anthropometric or lab measures. A dietary intervention to increase the number of plant food varieties was associated with an increase in the types of plant foods consumed each week and a reduction in consumption of ultra-processed foods.

Funding Source: This study was funding by a GHR- Innovative Scholarship grant from St. Catherine University.

Prophylactic Use of Prolact CR in NICU standardized Feeding Protocol

Author(s): A. Salley1, K. Hawthorne2; 1AdventHealth Hinsdale Hospital, 2Dell Medical School, University of Texas at Austin

Learning Outcome: Upon completion, participant will be able to describe supportive evidence for prophylactic use of Prolact CR in a standardized feeding protocol for very low birthweight infants rather than use reactively.

Background: An exclusive human milk diet (EHMD) and standardized feeding protocol are two critical methods for feeding very low birth weight (VLBW) infants safely. Our institution initiated a standardized feeding protocol for all VLBW infants in 2018. Prolact CR (human milk cream) was previously used only reactively when an infant was found to have poor weight, need for fluid restriction and/or hypoglycemia. A chart review of 30 VLBW babies in 2021 showed 77% of babies utilizing Prolact CR and 30% of babies utilizing Prolact +8 human milk fortifier. Following the chart review, we updated the feeding protocol in Sept 2021 to include prophylactic use of Prolact CR for all infants qualifying for EHMD.

Methods: The revised feeding protocol called for Prolact CR to be initiated when total parenteral nutrition and lipids were discontinued when feeds reached 110-120 mL/kg. Data compared use of Prolact CR, use of Prolact +8 fortifier, and overall growth before and after the feeding protocol changes.

Results: With the revised feeding protocol, need for Prolact +8 fortifier decreased from 30% to 19%. Overall growth improved dramatically with severe malnutrition declining from 3% to 0% and moderate malnutrition declining from 39% to 11%.

Conclusion: Improved growth and decreased use of increased caloric fortifiers can be achieved with prophylactic use of Prolact CR in a standardized feeding protocol for VLBW infants. Further evaluation of cost savings by decreased use of Prolact +8 and shorter length of stay is warranted.

Funding Source: None
Late-Breaking Project or Program Report Abstracts
Comparing Outpatient Clinic Outcomes Based on Medical Nutrition Therapy

Modality: In-person vs. Telehealth

Author(s): K. Humbert1, K. Mauldin1, D. Saarony2, N. Chan1; 1San Jose State University; 2Stanford Health Care

Learning Outcome: Upon completion, participant will be able to describe how telehealth medical nutrition therapy has changed outpatient clinic outcomes compared to in-person nutrition visits.

Background: During the start of the global pandemic in March 2020, patient care modalities changed from in-person to telehealth (phone and video) to prevent the spread of COVID-19. The primary aim of this study was to examine outpatient clinic outcomes from an urban teaching hospital comparing in-person (pre-pandemic) and telehealth care modalities (post-pandemic year 1 and year 2).

Methods: We analyzed a total of 49,204 patient encounters in the timeframes March 2019-February 2020, March 2020-February 2021, and March 2021-February 2022, and compared the outcomes using ANOVA.

Results: The patient demographics trends over the three years did not change dramatically, with the majority of the patients being non-White Hispanic, English-speaking females with private insurance (average age ~52 years). There was a significant increase in the number of appointments over the three years (n=13,457 vs. n=14,265 vs. n=19,166, p<0.001). More return visit patients were scheduled for telehealth compared to in-person (61.6% vs. 46.5%, p<0.001). The appointment cancellation rate was less with telehealth compared to in-person (28.7% vs. 39.4%, p<0.001) yet the no-show rate was similar (10.9% vs. 10.4%). The average number of days from scheduled to appointment initially decreased with the switch in care modality (51.1 vs. 35.2 days), but then increased back to “baseline” as telehealth became the norm (51.8 days), likely correlated with an increase in demand for services.

Conclusion: Overall telehealth has helped increase patients’ access to health care and continues to play a role in future medical services.

Funding Source: None
Effects of APOE Genotypes and Resveratrol Supplementation on Gut Microbiota Composition in Mice

Authors: A. Alsayeih1, V. Mulgrave2, A. Jildi1, O. Ntekim3, K. Thompson1, J. Allard1; 1Jazan University, 2Howard University, Nutritional Sciences, 3Howard University/Physiology & Biophysics, 4Howard University/College of Medicine, Microbiology, 4Howard University, College of Medicine, Physiology & Biophysics.

Learning Outcome: We aimed to compare the composition of the gut microbiota from APOE3 and APOE4 mice fed a standard (STD) diet supplemented with or without (RSV).

Background: The gut microbiome is an extensive and diverse ecosystem that has recently been highlighted as an important modulator of metabolic, immune, and neurological function. Changes in gut microbiome species can potentially contribute to various disease states. Apolipoprotein E (ApoE) is a plasma protein involved in cholesterol transport, especially in the brain. The 3 human variants of ApoE have differential associations with disease states. The ε4 variant of the ApoE gene (APOE4) increases risk for Alzheimer's disease, cardiovascular disease, and metabolic syndrome (MetS); these diseases have been associated with imbalances in gut microbiota. Resveratrol is a natural polyphenol with anti-inflammatory effects that may beneficially impact the gut-brain axis.

Methods: A total of sixteen 12-week-old female mice of APOE3 and APOE4 genotypes were used. Mice from each group were randomly assigned into either RSV diet or a STD diet group. DNA extraction and bacteria 16S rRNA gene amplification were conducted from stool-impacted colon tissue.

Results: Both alpha and beta diversity analyses showed no significant differences between genotypes or dietary groups. Moving deeper to the genera level, Akkermansia and Alistipes, which are implicated in lipid metabolism and cardiovascular disease respectively, were found significantly affected by RSV in APOE4 mice. In addition, a cofounding finding showed that Helicobacter at the Genera level was eliminated by RSV in APOE3 group.

Conclusion: RSV may differentially impact gut microbiota and disease risk based on APOE genotype. Further investigation is necessary to determine relevance in humans.

Funding Source: None

Efficacy of Metabolic Surgery During the COVID-19 Pandemic

Authors: C. Anding V. Goya, T. Chung, B. Davis; Texas Tech University Health Sciences Center School of Medicine.

Learning Outcome: Upon completion, participants will better understand and be more equipped to care for bariatric weight-loss patients in an increasingly electronic health care world.

Background: There is an obesity epidemic in the United States and many people have resorted to bariatric surgery. This study sought to determine if patients who received surgery immediately prior to the pandemic were less successful in weight loss and comorbidity resolution.

Methods: Weight loss and comorbidity resolution were recorded through EMRs. The experimental group included patients who received surgery from December 2019-February 2020 (immediately prior to the start of the pandemic). The control group included patients from December 2018-February 2019.

Results: Of the 64 participants who met inclusion criteria (control, N = 34; experimental, N = 30), the average starting BMI - 47 6-month BMI - 35.6, and 12-month BMI - 33.8. Results showed that the experimental group experienced a decrease in BMI of 1.51 points less than the control (p = 0.189) at 6-months. The experimental group experienced a BMI decrease of 2.89 fewer points (p = 0.132) at 12-months. There were no statistically significant differences in weight loss between the two groups. Women experienced a 6-month BMI decrease of 11.0 compared to men at 12.6 (p = 0.011). Women experienced a 12-month BMI decrease of 11.9 compared to men at 16.7 (p = 0.018).

Conclusion: Results indicate similar success of bariatric surgery between experimental and control groups. This could be caused by less strict COVID restrictions in Texas compared to European nations who demonstrated variance in weight loss due to COVID impact. Women lost less weight compared to men which is opposite to most bariatric research conclusions and warrants further long-term study to determine internal validity and potential socioeconomic causes specific to this region.

Funding Source: No funding, student led project.

Improved Methods of Making Standardized “Ready to Eat” Chinese Food: Individual Quick Frozen with 95% Cooked

Author: Y. Tang; Earth Big Data Lab.

Learning Outcome: Participants will learn about a general-purpose improved preparation method for ready-to-eat Chinese meals.

Affected by the COVID-19 epidemic, food is becoming more and more important as the foundation of people’s livelihood. However, Chinese food has been unable to be standardized because of its high complexity and numerous dishes. In 2022, R2E standardized Chinese food market rise rapidly. Liquid nitrogen rapid cooling technology has always been an important means to store food in Japan and South Korea. Its food cells are well preserved, which makes the storage time long and the melted food tastes good. In this study, the improved method “95% cooked” method was adopted in cooking Chinese food with Robot, then liquid nitrogen rapid cooling treatment was carried out, and it was stored at freezing temperature in refrigerator, it was cooked by microwave oven with high heat before eat. Through the comparison of 40 people’s focus group, it is found that: 1. The taste satisfaction of meat products (shredded pork with fish flavor, kung pao chicken, boiled fish, etc.) in R2E food increased by 15% after the “95% cooked” method, but the vegetable products (stir-fried cabbage, etc.) did not significantly improve; 2. The taste is good when the storage period is less than one year; 3. Although the cooking time of the microwave oven with liquid nitrogen quick cooling and 95% ripening is one minute longer than that after 100% ripening, the cell wall of the food is broken after cooking, and the pot smell of the food is better.

Funding Source: None
Involuntary Weight Loss and Dietary Patterns of Migrant Peoples Who Transit Through the Darién Forest in Panama: A Rapid Epidemiological Study

Author(s): J. Katz, M. Jiangmal, A. Yu Pen, J. Erasquin, E. Flores-Millender, M. González, M. Peralta, Y. Peña, G. Cabezas-Talavero, N. Cabezas, O. Pisara, A. Gabi; 1Instituto Conmemorativo Gorgas de Estudios de La Salud, 2University of North Carolina at Greensboro, 3Center of Population Sciences for Health Equity, Florida State University, 2Cruz Roja Panameña, 2Cruz Roja Panameña Comité El Real, 2Special Olympics

Learning Outcome: Upon completion, participants will be able to describe dietary patterns and reported involuntary weight loss among migrant peoples who transit through the DF and to identify interventions to protect this population’s health.

Background: Monthly, thousands of migrant peoples travel by foot through the Darién Forest (DF) en route to North America. This study aimed to describe self-reported weight change and dietary patterns of migrant peoples after they travel through the DF.

Methods: In January 2022, we randomly selected men and women ≥ 18 years at a Migrant Reception Station in Darién to participate in a cross-sectional descriptive study. Participants completed informed consent requirement and later self-administered questionnaires on a Tablet computer. We report here prevalence and 95% confidence intervals (95% CI) for self-reported weight loss, food accessibility, food insecurity, access to clean water to drink and food frequency.

Results: In all 174 participants from 34 countries were included, median age 31y (IQR 27-37.5y). During their DF transit 59.1% (95% CI:49.6-68.0%) reported involuntary weight loss. In all 21.8% (95% CI:15.3-30.3%) reported to not eat at least once daily in the previous two weeks. Of those who reported to not eat daily 53.8% (95% CI:34.2-72.4%), reported eating every other day: 46.2% (95% CI:27.6-65.8%) every 3 weeks. Of those who reported to not eat daily 53.8% (95% CI:34.2-72.4%), reported eating every other day: 46.2% (95% CI:27.6-65.8%) every 3 weeks.

Conclusions: This rapid epidemiological study found migrant peoples who transit through the DF are at extreme vulnerability to involuntary weight-loss. This population reported insufficient food and water security. Interventions should focus on provision of food and supplies before entering and after leaving the DF.

Funding Source: Funding is provided by Instituto Conmemorativo Gorgas de Estudios de la Salud (Panama).

Nurse-Administered Malnutrition Screening Tool Improved Identification of Malnutrition and Access to Nutrition Care at a Veterans Affairs Hospital

Author(s): M. Chew, J. Olsen, J. Fawcett, W. Everett, C. Badaracco; 1Phoenix VA Health Care System, 2Veteran Affairs (VA), 3Avarelhe Health

Learning Outcome: Describe improvements in timing and access to nutrition care for malnourished patients using a validated screening tool.

Nutrition risk screening is imperative for identifying and treating malnutrition, which affects up to 50% of hospitalized patients. In 2019, the Phoenix Veterans Affairs Health Care System (PVAHCS) implemented the Malnutrition Screening Tool (MST) into the nurse admission screen, replacing an unvalidated tool used previously by diet techs. The study's purpose was to determine if an observable change occurred in the time from admission to malnutrition screening, assessment, and diagnosis using the MST.

Retrospective data abstracted from the Veterans Affairs Corporate Data Warehouse reflected 2 cohorts from 10-month periods pre- and post-MST implementation.

The study population covered 6,163 admissions, with average age of 63 ± 15 years. There was a significant reduction in time from admission to malnutrition screening between pre- and post-implementation cohorts [14.6 IQR (9.6 19.0) to 1.0 IQR (0.5 2.4) hours, p < 0.001]. There was a significant increase in time to nutrition assessment [20.6 IQR (3.8 29.5) to 34.1 IQR (16.6 54.7) hours, p < 0.001] but no significant difference in time to malnutrition diagnosis [34.8 IQR (18.2 47.8) vs. 28.1 IQR (17.3 44.6) hours, p = 0.263]. The percentage of patients assessed increased from 48.8% (164/338) to 25.8% (717/2780) (p < 0.001) and the percentage diagnosed with malnutrition increased from 5.3% to 11% (p < 0.001).

MST implementation led to earlier screenings, more referrals for assessments, and more malnutrition diagnoses. Unexpectedly, it led to increased time to assessment, which may be attributed to more at-risk patients requiring nutrition assessment. Further research should assess effects of MST implementation on patient outcomes.

Funding Source: Avarelhe Health

Perceived Barriers of Nutrition Focused Physical Exam by Registered Dietitian Nutritionists Through Qualitative Responses

Author(s): M. McLaughlin, N. Caine-Bish; 1Cleveland Clinic, 2Kent State University

Learning Outcome: Upon completion, participants will be able to define the primary barriers that dietitians describe to conducting NFPE and the top qualitative themes that were drawn from this research.

Background: The purpose of this study is to investigate perceived barriers to performing NFPE described by practicing RDs in the United States, qualitatively.

Methods: All registered dietitians currently practicing in the U.S. and above the ages of 18 years old were asked to respond to a survey. The survey included five open-ended questions that were designed to obtain information regarding RDNs’ top perceived barriers to NFPE. Qualitative responses were grouped according to frequently recurring themes.

Results: The following are the top five barrier themes that were distinguished from a content analysis of survey responses: Lack of time (n = 58); subjectivity of the exam and variability in malnutrition diagnosis (n = 57); lack of confidence in performing the exam (n = 43); lack of training/education (n = 26); and lack of acceptance from the patient (n = 25). Dietitians cited inadequate staffing of their facility as an issue that further limited their time. Dietitians were concerned that malnutrition severity diagnosis varies considerably between clinicians, and a patient’s baseline muscle and fat stores are unknown, which enhances error in malnutrition diagnosis. Respondents reported personal discomfort with touching patients, perceiving the exam as an awkward component of malnutrition assessment, and little confidence in their ability. Dietitians frequently reported a lack of NFPE training and experience, in academic as well as internship environments.

Conclusions: Research can be applied to enable educators and policy makers to implement changes to the NFPE procedure and to provide objective, standardized, and accessible education of the procedure.

Funding Source: None

Pilot Study: Exploring the Relationship Between Site-Specific Bone Mineral Density (BMD) and Whole-Body BMD Using Dual-Energy X-Ray Absorptiometry (DXA) in East Asian Women

Author(s): J. Fong, K. Mauldin, J. Gieng; San Jose State University

Learning Outcome: Upon completion, participant will be able to describe how regional bone mineral density results from whole body dual-energy x-ray absorptiometry scans correlate with site-specific bone mineral density scans.

Background: Osteoporosis rates are highest in East Asian women. Osteoporosis is screened using the World Health Organization’s criteria for site-specific dual energy x-ray absorptiometry (DXA) scans of the spine and hip. It is not known whether whole-body DXA scans can be used in lieu of site-specific scans for osteoporosis screening.

Methods: The aim of this study is to determine how bone mineral density (BMD) from site-specific DXA scans of the hip, spine, and forearm correlate with BMD of the same region from whole-body DXA scans in East Asian women (n=41, mean age 38 ± 14.5 years). Correlations of BMD in the hip, spine, and forearm were assessed separately using Pearson correlation coefficient.

Results: The BMD value from the whole-body scan lumbar region had a strong positive correlation with the BMD value from the lumbar-specific scan (r=0.942, p < 0.001). The BMD value from the whole-body scan pelvis region had a strong positive correlation with the BMD value from the femoral neck-specific scan (r=0.771, p < 0.001). The BMD value from the whole-body scan forearm region had a strong positive correlation with the BMD value from the 1/3 radius-specific scan (r=0.717, p < 0.001).

Conclusion: Considering the whole-body scan lumbar region has the strongest correlation with its corresponding site-specific scan, future studies should explore the potential use of the whole-body scan lumbar region to screen bone health, thus simplifying osteoporosis screening (reducing number of scans and saving time and money).

Funding Source: Private: San Jose State University, Department of Nutrition, Food Science, and Packaging alumni association “Circle of Friends” graduate research assistance award

SUNDAY, OCTOBER 9

Clinical Care; Communications; Critical Thinking and Decision Making; Ethics and Professionalism; Food, Nutrition and Dietetics and Physical Activity; Leadership and Advocacy

JOURNAL OF THE ACADEMY OF NUTRITION AND DIETETICS A-93
Standard Fortification Using Bovine Liquid Human Milk Fortifier and Target Pooled Donor Milk May Not Meet Enteral Protein Requirements of The Very Low Birth Weight Preterm Infant

**Author(s):** K. Beard, C. McLaughlin, W. Cruse; Riley Hospital for Children

**Learning Outcome:** Upon completion, participants will be able to describe protein intakes in VLBW infants receiving fortified donor human milk.

**Background:** The Evidence Analysis Center of the Academy of Nutrition and Dietetics recommends donor milk be provided to very low birth weight (VLBW) preterm infants when maternal milk supply is insufficient. The goal of this study was to analyze macronutrient content of target-pooled pasteurized donor human milk (DHM) sourced from a Midwest milk bank to determine protein delivery of DHM fortified with bovine liquid human milk fortifiers (HMF) commercially available in the United States.

**Methods:** Samples from 99 unique lots of DHM were analyzed using a mid-infrared spectroscopy analyzer (MIRIS AB, Uppsala, Sweden) over the course of one year (May 2021 – May 2022). Average macronutrient content for protein (g/dL), fat (g/dL), carbohydrate (g/dL), and calories (kcal/dL) were obtained with standard deviations using Excel 365. Estimated protein content was calculated for DHM fortified with four unique HMF products prepared according to manufacturer directions to 24 kcal/oz and delivered at a volume of 160 mL/kg.

**Results:** Analyzed protein content of DHM was low (0.81 g/dL ± 0.13), whereas fat content was higher than anticipated (4.26 g/dL ± 0.81), leading to increased caloric density of DHM (76.1 kcal/dL ± 7.73). Standard fortification to 24 kcal/oz met published preterm enteral protein goals of 3.5 - 4.5 g/kg when using 2 of 4 HMF products. No HMF product met published protein calorie goals of 3.2 - 4.1 g protein/100 kcal after accounting for analyzed DHM caloric content.

**Conclusion:** Standard human milk fortification practices may not be adequate to meet estimated protein needs in VLBW infants receiving primarily DHM.

**Funding Source:** None

The Development and Validation of a Tool Measuring Privilege Within the Dietetics Profession

**Author(s):** K. Burt1, M. Fuster1, A. Odoms-Young1, S. Folta1; K. Lau;2 Lehman College, City University of New York,3 Tulane School of Public Health and Tropical Medicine,4 Cornell University, College of Human Ecology,5 Tufts University,6 Joslin Diabetes Center

**Learning Outcome:** (1) describe how privilege manifests in dietetics and is related to cultural humility and (2) utilize the Dietetics Profession Privilege Quiz to understand their own relative advantage in dietetics.

Evidence suggests that privilege, the unearned advantage of persons who identify with dominant group(s), manifests in dietetics training and professional culture; however, research exploring how it manifests are limited. This study’s aim was to develop and assess the validity and reliability of a tool to measure an individual’s privilege in the dietetics profession. An initial set of items was developed by experts in diversity, equity, and inclusion (DEI) in dietetics and followed by three phases: (1) expert review for content and face validity (n=21), (2) cognitive interviews to understand how dietetic practitioners understand the items (n=12), and (3) construct validity and test-retest reliability using dietetics practitioners (n=901, re-test sample n=99).

Data from phases 1 and 2 were compiled, reviewed, and discussed by researchers until consensus was reached. In phase 3, data were analyzed using descriptive statistics and exploratory factor analysis, internal consistency reliability analysis, and chi square analysis. Results indicate a 30-item tool measuring six domains: treatment in training, identity alignment, resource access, cultural access, financial access, and physical access. Intraclass correlation coefficients were, on average .8 above or indicating very good or excellent reliability. Persons with dominant group identity (e.g., privilege) scored higher on the tool than persons in groups that have been historically marginalized/minoritized within the field and broader society (p<0.001).

The Dietetics Profession Privilege Quiz is a valid and reliable tool that can be used to help professionals develop self-awareness about their relative position in the profession, which is critical to developing cultural humility.

**Funding Source:** None

The Effect of a 3-Month Lacto-Ovo Vegetarian Diet Intervention on Diet Quality

**Author(s):** O. Templeton, J. Garay; Syracuse University

**Learning Outcome:** To analyze how diet quality is affected after making the switch to a lacto-ovo vegetarian diet from an omnivore diet.

While vegetarian diets have increased in popularity in scientific literature and recognized as healthful diets, there is a lack of research surrounding the transition from an omnivore to a lacto-ovo vegetarian diet. A lacto-ovo vegetarian is one who consumes eggs and dairy, but not meat, poultry, or fish. This study analyzes how diet quality and body composition are affected for three months following the conversion to a lacto-ovo vegetarian diet. Data was collected during three lab visits each six weeks apart, at Falk College’s ACE Center. Participants must have been between 30 and 60 years of age, following an omnivore diet for at least six months prior to the study, not pregnant, and a non-smoker. The intervention diet began after the first lab visit, so the participants served as their own control. Diet information was collected through three 24-hour recalls using Ask24, and a baseline and final visit frequency questionnaire (FFQ) using DHQII. Overall diet quality was scored using the Healthy Eating Index (HEI) with data from the FFQ. Body composition is measured through height, weight, and body fat measurements using the BodPod.

The results showed no significant changes in overall diet quality (measured by the HEI score) or body composition. This is likely due to a health-conscious participant pool as the average baseline HEI score was already 10 points higher than the national average. Limitations additionally include a small sample size.

**Funding Source:** Syracuse University Undergraduate Research Office and the Renee Crown Honors Program Private
The Effect of a 3-Month Lacto-Ovo Vegetarian Diet on Inflammation

Author(s): S. Jezak1, J. Garay2; 1Tufts University, 2Syracuse University

Learning Outcome: Identify when and which biomarkers are impacted by a 3-month lacto-ovo vegetarian diet intervention on previous omnivores.

Introduction: Previous scientific literature on vegetarian diets is unclear regarding how long someone must be following a vegetarian diet before receiving measurable health benefits. Therefore, the purpose of this study was to understand when and which inflammatory biomarkers are affected after a 12-week lacto-ovo vegetarian diet intervention on those who were previously omnivores. A lacto-ovo vegetarian is one who consumes some animal products, such as eggs and dairy, but does not consume poultry, red meat, or fish.

Research Questions: 1) To what extent will inflammatory biomarkers change over a 12-week lacto-ovo vegetarian diet intervention?

2) Is adherence to a 12-week lacto-ovo vegetarian diet intervention sufficient to reflect the biomarker profile of a long-term vegetarian?

Methods: Sixty-two athletes; mean age 19.5 years old, participated in a randomized cross-over design for two weeks. Participants performed 400-m sprints x 3 with 5-min breaks between each sprint under two conditions, CHO + PRO and CHO-only (control). Week 1 consisted of each subject consuming either a 15 g CHO + 30 g whey PRO beverage or a 15 g CHO-only beverage 20 min prior to sprinting; during week 2 subjects consumed the alternate beverage. The feeling scale was used to determine subjective affect in the subjects after the sprints under both conditions. Paired sample t-tests were used to compare differences in total sprint times and subjective affect.

Results: There was no statistically significant difference in total sprint times between the CHO + PRO and the CHO-only conditions (p=0.874) nor was there a statistically significant difference in subjective affect (p=0.573).

Conclusion: Pre-exercise ingestion of CHO + PRO did not increase performance or improve affect during repeated sprints in this group of athletes. Further testing with other performance events and on other populations is warranted.

Funding Source: None

The Effect of a 3-Month Lacto-Ovo Vegetarian Diet on Inflammation

Author(s): R. Rodriguez1, J. Miller2, T. Miltenberger3, D. Babbitt1; 1Fuel The Fire, 2Student, 3Cedar Crest College

Learning Outcome: Upon completion, participant will be able to evaluate pre-exercise carbohydrate (CHO) and protein (PRO) ingestion on repeated sprint times in female college track athletes.

Background: Ingestion of carbohydrate (CHO) pre-exercise has been demonstrated to have a beneficial effect on exercise performance; however, results have been inconclusive with pre-exercise protein (PRO) and CHO ingestion. The primary goal of this study was to determine the effect of pre-exercise CHO and PRO ingestion on repeated sprint times in a group of female college track athletes. A secondary goal was to evaluate the athletes’ subjective affect.

Methods: Subjects included 8 female college track athletes (18-21 y/o) who participated in a randomized cross-over design for two weeks. Subjects performed 400-m sprints x 3 with 5-min breaks between each sprint under two conditions, CHO + PRO and CHO only (control). Week 1 consisted of each subject consuming either a 15 g CHO + 30 g whey PRO beverage or a 15 g CHO-only beverage 20 min prior to sprinting; during week 2 subjects consumed the alternate beverage. The feeling scale was used to determine subjective affect in the subjects after the sprints under both conditions. Paired sample t-tests were used to compare differences in total sprint times and subjective affect.

Results: There was no statistically significant difference in total sprint times between the CHO + PRO and the CHO-only conditions (p=0.874) nor was there a statistically significant difference in subjective affect (p=0.573).

Conclusion: Pre-exercise ingestion of CHO + PRO did not increase performance or improve affect during repeated sprints in this group of athletes. Further testing with other performance events and on other populations is warranted.

Funding Source: None
The Impact of COVID-19 on Nutrition and Mental Health in Division I Student-Athletes: A Mixed-methods Approach

**Authors:** L. Eckenrode¹, C. Spees¹, J. Jennewine², J. Clutter¹, J. Houle³, K. Welker¹; ¹The Ohio State University, ²Ascension St. Vincent Sports Performance, ³Ohio State University Athletics

**Learning Outcome:** To determine D1 student-athlete perceptions and experiences regarding nutrition and mental health throughout the COVID-19 pandemic.

**Background:** At a global level, the COVID-19 pandemic disrupted dietary patterns, physical activity, and social interactions among adults in the U.S. For Division 1(D1) student-athletes, the adjustments to collegiate training disruptions, cancelled competitions, and ongoing mandates added another level of complexity to their lives.

**Objective:** To determine D1 student-athlete perceptions and experiences regarding nutrition and mental health throughout the COVID-19 pandemic.

**Methods:** A 7-to-8-minute online Qualtrics survey of 29 questions was distributed to D1 student-athletes at The Ohio State University between August 2021 and December 2021 via email. IBM SPSS Statistics 27 was used to calculate response frequencies for closed-ended questions. Qualitative responses were coded and further analyzed for emergent themes.

**Results:** Forty-five percent (n=467) of all D1 student-athletes from 2021-2022 active team rosters completed the survey. Across the 37 teams, there was an average participation rate of 51% from each team. Over 50% of all respondents reported a change in dietary patterns during COVID-19 with 26% reporting eating healthier or more intuitively while 15% reported disordered eating patterns. Of the 52% that reported a change in mood during the pandemic 32% reported a negative mood with 19% self-reporting sadness and 16% reporting depression.

**Conclusions:** Our findings document that the COVID-19 pandemic altered the behaviors and perceptions of Division 1 collegiate athletes in ways that impacted both their nutrition and mental health. It is critical for collegiate sports medicine providers and stakeholders to address these issues to ensure optimal health, safety, and performance of our student-athletes.

**Funding Source:** None

The Impact of the Gx Sweat Patch on the Hydration Status of Division III College Athletes

**Authors:** P. Barney, J. Cominsky, K. Eck; Marywood University

**Learning Outcome:** Understand the impact of the Gx Sweat Patch on the hydration status of Division-III college athletes.

**Background:** Mild dehydration has been shown to impair athletic performance, and college athletes often arrive at practice dehydrated. Personalized fluid intake recommendations, based on individual sweat profiles (sweat rate and electrolyte composition), are known to improve hydration status (HS). Gatorade® developed the Gx Sweat Patch as a practical method for assessing sweat profiles and providing personalized fluid recommendations. The patches are valid and reliable measures of sweat profile, but no research has explored the effects of the patch on an athletes’ HS.

**Methods:** Division-III men’s and women’s basketball, men’s baseball, women’s lacrosse, and track and field athletes (n=51) participated in the study. Urine samples (Pre-practice and recovery [next morning first void]) were collected at baseline, and after wearing the patch. Urine specific gravity (USG) and urine color were assessed as indicators of HS. Paired samples t-tests compared HS at baseline and post-patch.

**Results:** Of the 51 patches used, only 10 provided fluid recommendations. At baseline, athletes were, on average, mildly dehydrated before and after recovering from practice (USG=1.022 and 1.027, respectively). Pre-practice USG and color did not change significantly post-patch (p=0.229 and p=0.673, respectively). Recovery USG and color did not change significantly post-patch (p=0.735 and p=0.342, respectively).

**Conclusion:** The Gx patches had a high failure rate, and did not significantly influence hydration status in Division-III college athletes. Future research should identify factors preventing athletes from effectively utilizing the personalized fluid recommendations provided by the patch.

**Funding Source:** None
Poster Sessions
Late-Breaking Project or Program Report Abstracts
A Take-out Taste Panel is an Effective Means of Obtaining Sensory Evaluation Data for Experimental Foods Projects During the COVID-19 Pandemic

Author: S. DePinto; Cedar Crest College

Learning Outcome: Upon completion, participants will be able to describe three key elements of a take-out taste panel for obtaining sensory evaluation data in an experimental foods course.

Food product development is an essential component of nutrition and dietetics education. However, limited research exists regarding the best practices. Undergraduate dietetics courses that include the controlled experimentation and evaluation of foods often utilize untrained taste panels to assess food products, but COVID-19 pandemic protocols and institutional review board pandemic guidelines have limited in-person taste panels over the past two years. A comprehensive plan for a take-out taste panel was developed to address these challenges in the Cedar Crest College Didactic Program in Dietetics Experimental Foods course. The course project was modified to obtain sensory evaluation data in a structured manner while eliminating the risks associated with an in-person taste panel. Upon institutional review board approval, students, faculty, and staff were invited to participate on March 17, 2022. Upon arrival at the location designated for sample pick-up, 64 taste panel participants selected the specific products they wanted to taste, completed electronic consent forms, received QR codes for electronic scorecards, and collected their product samples with tasting instructions. Participants were instructed to take the food sample packages and complete the sensory evaluation and scorecards later that day in their office, home, or dorm. The taste panel results, student feedback, and learning outcomes showed that the take-out taste panel was an effective means of obtaining sensory evaluation data during pandemic restrictions.

Funding Source: Cedar Crest College

Calorie Count Workflow Quality Improvement

Author: A. Traudt; Children’s Hospital Colorado

Learning Outcome: Upon completion, participants will be able to define a calorie count, understand the changes implemented to improve calorie counts at Children’s Hospital Colorado, and describe areas for future improvement.

Background: The communication of calorie counts (CC), documentation of PO, and calculation varies daily and between different Dietitian Assistants (DAs) at Children’s Colorado (CHCO). There is no standardized workflow or operating procedure for the process effecting communication, productivity, accuracy of calorie counts, and ultimately patient care.

Objective: The goal of this project is to decrease the average number of PO documentation errors, to standardize the workflow, and to increase DA confidence level in knowledge surrounding calorie counts.

Design: A quality improvement initiative to set standard operating procedures and improve DA understanding.

Participants: The intervention targeted DAs at the Anschutz campus of CHCO.

Intervention: An SOP was written including an updated communication procedure, a standard nursing/patient facing calorie count sheet for PO documentation, a standard portion guide and calculation using the USDA database. Two trainings were conducted, and an eight-question survey was administered pre (n=8) and post (n=6) training and SOP implementation.

Results: Documentation errors decreased from an average of 7.87 errors per day to 0.75 average errors per day after implementation. Total process steps decreased from 42 steps to 21 steps. DA confidence level increased from 70% of respondents reporting feeling confident pre-SOP to 92% of feeling confident post-SOP.

Conclusion: A standard operating procedure, concise documentation forms, and education was effective in achieving outcomes and should be considered at other locations in order to improve calorie counts and patient care.

Funding Source: None

Development of an Undergraduate Dietetics and Preceptor Training Program: A Malawi-US partnership

Author(s): G. Mphwanthe 1, R. Tucker 2, L. Weatherspoon 3; 1Lilongwe University of Agriculture and Natural Resources (LUANAR), 2Department of Food Science and Human Nutrition, Michigan State University, 3Michigan State University

Learning Outcome: Participants will be able to describe at least two barriers and opportunities in developing dietitian training infrastructure in an underserved country, like Malawi.

Malawi suffers multiple burdens of malnutrition: chronic undernutrition, obesity, and diet-related diseases. The dietetics training program, established in 2015 at Lilongwe University of Agriculture and Natural Resources (LUANAR) and supported by donor funding, has graduated only 10 dietitians. Limited in-country nutrition expertise and reliance on external funding, which limits training program enrollment, severely compromises the ability to address malnutrition comprehensively. In order to achieve program sustainability and to bolster the expertise of recently-graduated preceptors, faculty at LUANAR and Michigan State University collaborated to adapt the current B.S. Nutrition and Food Science major into a coordinated undergraduate dietetics program that meets ACEND guidelines and can be integrated into Malawi government-funded training programs. Nine new courses were developed: medical nutrition therapy I and II, human nutrition metabolism and biochemistry I and II, professional practice of dietetics, clinical pediatric nutrition, the business of nutrition, foodservice operations, and applied culinary nutrition. Curriculum adoption is pending approval, which will pave the way for government financial support. Preceptor skills development was achieved using the Academy’s Preceptor Training Program, with 10 preceptors completing the course. Feedback was positive, with one preceptor commenting, “I have been looking for well-structured training on how to precept since it will be my first time to supervise interns.” Preceptors also identified knowledge gaps in areas of nutrition focused physical assessment, pediatric nutrition, and resources for staying current. Webinars were delivered to meet these needs. Lessons learned from this project can support work in other countries seeking to formalize dietitian training and development.

Funding Source: Alliance for African Partnership, Michigan State University

Evaluation of Oral Health and Nutrition Education Curriculum Topics: Pre- and Post-Program Implementation

Author(s): A. Marshall 1, B. Jeter 2, N. Cruz 2, Z. Azebe-Osim 1, I. Azebe-Osim 1, M. Melchor 1, M. Djukic 1, J. McWhorter 1, A. Edwards 1, D. Hernez 1; 1University of Texas Health Science Center, 2University of Houston

Learning Outcome: Describe the oral health and nutrition knowledge of low-income, underserved high school students before and after program implementation

Background: Over 26% of low-income black and Hispanic adolescents ages 12-19 have untreated dental caries. The risk factors associated with dental caries also place black and Hispanic children in jeopardy for obesity and diabetes. Despite the direct link between oral care and nutrition, there is a scant curriculum in high schools focused on the relationship between nutrition and dental hygiene. The purpose of this study is to evaluate the oral health and nutrition knowledge of underserved high school students pre- and post-program implementation.

Methods: The 7-week program was implemented in an urban high school March-May 2022. Students who were part of a high school dropout prevention and college readiness program were eligible to participate in the program. Students completed a socio-demographic survey that also included an 8-item questionnaire designed to evaluate the learning objectives of the 7-lessons pre- and post-program implementation. Due to small sample size, statistical significance is unobtainable; instead, findings are qualitatively described.

Results: Fifteen students [16 years old (SD=7.69)] participated in the program with an average attendance of 11 students per lesson. Sixty-seven percent of the students had not visited a dentist in the past year and 100% wanted to have their teeth professionally cleaned by a dentist. Out of the 8-questions, students improved their knowledge on 5-items and maintained their knowledge on 1-item.

Conclusion: The oral health and nutrition knowledge improved among students who participated in the program.

Funding Source: University of Texas Health Science Center — Houston, Gzik School of Nursing and School of Dentistry Joint Seed Grant
Food-Based STEM Education in rural Southern US Promotes Science-learning

Author(s): D. Holben1, M. Duffrin2; 1University of Mississippi, 2Northern Illinois University

Learning Outcome: After participating in this poster session, participants will be able to describe a food-based STEM education program for youth in rural Southern US.

Program Need, Purpose, and Audience: Food-based STEM education increases multidisciplinary science knowledge and likelihood to choose STEM careers, including nutrition and dietetics. A 4-lesson program (Growing Peanuts and Beans; Making Butter; Popping Corn; Sprouting Spuds) was developed and implemented in an informal learning environment (rural community library) for youth in grades K-8 living in rural Southern US. Theory and Previous Research: A constructivist theoretical framework was utilized. One year prior to implementation (2020), lessons were piloted, evaluated, and revised using 2020 youth feedback. Unique Program Characteristics The food-based STEM education program implemented summer 2021 utilized a drive-through distribution due to COVID-19. Science kits included all STEM materials/supplies/books, postage-paid evaluation postcards, and shelf-stable lunches and snacks meeting USDA summer feeding guidelines. Books highlighted diverse food-based scientists to expand diversity, equity, and inclusion in food-based STEM education.

Outcome Evaluation: An 8-item postcard for each lesson and a 7-item pre-post program postcard were utilized for evaluation, with 23/100 youth participants (23% response rate) returning at least 1 evaluation. Participants were female (65%), Non-Hispanic (90%), White (90%), and in 4th grade (32%). The majority of youth “agreed or super-agreed” that they: 1) learned about science from the activities (94.2%); 2) liked doing the science activities (94.3%); reading the related books (90.4%); 3) had fun completing the activities (98.1%); 4) would recommend the activities to others (94.2%); and 5) would do the activities again (93.3%).

Conclusions: Food-based STEM education promotes science-learning, warranting implementation to promote both science-learning and dietetics careers.

Funding Source: National Institute of General Medical Sciences (NIGMS) at the National Institutes of Health (NIH) and UMFoundation Food and Nutrition Security Support Fund.

Interprofessional Education: Experiences of Graduate Dietetic Students

Author(s): J. Andrade, E. Black, C. Rush, A. Blue; University of Florida

Learning Outcome: Upon completion, participants will be able to discuss an innovative interprofessional patient-centered community focused experiential learning activity.

Interprofessional education is an integral component of a dietetic student’s training. At the University of Florida, Putting Families First (PFF), is a longitudinal collaborative experiential community-based learning experience. Master in Dietetic Internship (MS/DI) graduate students work with other interprofessional health students in teams of 4 to 5 to meet with a volunteer family, in a patient-centered, non-clinical setting, four times throughout the year to learn about the family’s health and wellness and ultimately to complete a project that enhances the family’s health. Students are supported in this process by six 90-minute facilitated group meetings that enable students to share and receive feedback about their home visit experiences, and engage introductory material related to interprofessional teamwork, inclusivity within the health professions, roles and responsibilities, social determinants of health and methods to improve healthcare delivery. Sessions are led by faculty members from the professional programs. Seven MS/DI students (100% of cohort) participated in PFF during 2021-2022. We explored the health projects associated with their respective teams. Projects focused on a broad range of health-related topics, including stress-reducing activities and recipe books for dietary preferences/adherence such as plant-based and the paleo diet. Through the team presentation, interprofessional education was recognized as important to provide adequate care to the patient and importance of closed-loop communication. Overall, PFF provides a unique and intensive opportunity for MS/DI students to engage with other healthcare professional students and community members while reinforcing the importance of interprofessional education.

Funding Source: None

Piloting a Student-Led Bingocize® Nutrition Workshop for Marginalized Community-Dwelling Older Adults

Author(s): K. OoNorasak1, R. Corrone1, M. Kinnarney1, M. Oberle1, K. Yokokura1, K. Crandall2, M. Ickes1; 1University of Kentucky, 2Western Kentucky University Center for Applied Science in Health & Aging

Learning Outcome: Upon completion, participant will be able to describe strategies and challenges in implementing and conducting process evaluation of the 10-week Bingocize® Nutrition Workshop for marginalized community-dwelling older adults.

Half of community-dwelling older adults are at risk for malnutrition or social isolation with poor eating habits and physical activity, which can be detrimental to health. Due to growing health concerns for older adults, there is a need for accessible, fun, interactive, age-friendly, and culturally appropriate health promotion programs. Bingocize® Nutrition Workshop is a ten-week, 20-session nutrition education program that combines a bingo-like game with social engagement, physical activity, nutrition education, and healthy snacks freshly prepared by students to improve nutrition education, behaviors, and quality of life among aging adults. A pilot project of this Bingocize® Nutrition Workshop was developed through building partnerships with community and higher education institutions. The program was implemented Summer 2022 in person at two United Way community centers for at least 30 marginalized older adults by a faculty-supervised group of graduate and undergraduate students at a land-grant southeastern 4-year institution. Age-friendly web-based Bingocize® displays physical activity and nutrition education videos between virtual bingo rolls, and nutrition-themed bingo prizes were distributed as curriculum reinforcers. Process evaluation measures, including field notes and pre- and post-surveys, were utilized to identify and assess this community-based program strategies, challenges, areas of improvement, and feasibility. Preliminary findings report most participants enjoyed student led Bingocize® sessions, including physical activity and snacks. Having students engage older adults in a bingo-like game that is often favored by aging population, while incorporating physical activity, healthy snacks, and nutrition information, provides a unique approach to promote health, nutrition knowledge and behaviors among marginalized community-dwelling aging population.

Funding Source: University of Kentucky College of Agriculture, Food and Environment Research Activity Award; University of Kentucky Summer Sustainability Undergraduate Research funding; and Department of Kinesiology and Health Promotion, University of Kentucky

Nutrition Education Teaching Experience for College Students Through a Partnership with Eat Smart Idaho to Reach Hidden Hungry Populations

Author(s): K. Miner, A. Roe; University of Idaho

Learning Outcome: Upon completion, participants will be able to describe positive outcomes, challenges, and recommendations from delivering Eat Smart Idaho nutrition education programs to hidden hungry populations through a college capstone experience.

Students (N=14) in a nutrition education capstone course at the University of Idaho provided nutrition education to hidden hungry populations through a partnership with Eat Smart Idaho. Three groups not typically eligible for Eat Smart Idaho programs were selected: 1) Pre-K class at a children’s center; 2) K-2 students in an afterschool program, and 3) college students. Students received training on the evidence-based curriculums and taught sessions once a week for six weeks. Following the lessons, students were given an anonymous survey to evaluate the teaching experience. No incentives or grade requirements were connected to completion of the survey. Content analysis of responses was conducted to generate themes. Twelve students (86% response rate) completed the survey. Positive aspects of the project included themes of: 1) a great real-life experience 2) opportunity to work with a certain age group, and 3) professional growth. Challenges of the project identified included 1) keeping the audience engaged 2) logistical issues 3) not enough training 4) preparation time required for lessons, and 5) materials not specific to college age population. Recommendations students identified for this project included 1) providing more training sessions 2) improved recipes 3) using a college specific curriculum, and 4) allowing more flexibility for students to adapt materials. This partnership created an opportunity to deliver nutrition education to over fifty individuals from hidden hungry populations and provided a professional teaching experience for food and nutrition students.

Funding Source: University of Idaho Extension, Innovative Project Funds
Safe Recipe Tools for Food Bloggers

**Author(s):** B. Saunier, K. Weston; Partnership for Food Safety Education

**Learning Outcome:** Attendees will learn how to develop recipe blogs that showcase food safety steps to prevent foodborne illnesses using a food safety graphic and video library and learn the formative research.

The Safe Recipe Video Style Guide is a standardized tool that helps recipe writers plug in key food safety steps into recipe instructions. It includes suggested (and tested) food safety text, a "how to use guide", stock images and videos that show safe food handling practices, and more. Research from Dr. Godwin, et al. found that if people receive recipes with food safety steps included they are more likely to adhere to recommended safe food handling practices. Practicing safe food handling is a key step to preventing foodborne illnesses. The image and video library are new additions (March 2022) to the Style Guide and are intended to make it easier for anyone creating interactive recipe content like blogs or hands-and-pans videos to show safe food handling steps. These resources were created with input from health and food safety experts and are available to access free of charge. More and more content is digital. To be able to bring awareness to safe food handling practices, it's important to show up where people are interacting with their food. This includes in recipes, in their social media feed, and online where they are consuming videos. Helping RDNs and nutrition and dietetics professionals develop content and understand how they can leverage these science-based, free, resources in their nutrition conversations with their communities and in their recipe development is important to reducing the risk of foodborne illnesses.

**Funding Source:** The Safe Recipe Style Guide creation was made possible with an initial investment from the FMI Foundation. The Partnership for Food Safety Education is the creator and steward of the guide and sole funder of the digital library.
Late-Breaking Project or Program Report Abstracts
An Evaluation of the Arkansas Foodbank Backpack Program: A Mixed Methods Study

Author(s): A. Landry1, H. Donoway1, R. RolKahr1, V. Valev1, L. Albritton1; 1University of Central Arkansas, 2Arkansas Foodbank

Learning Outcome: Upon completion, participants will be able to describe multiple stakeholders’ perceived effectiveness of the Arkansas Foodbank Backpack Program.

Background: The Arkansas Foodbank (ARFB) Backpack Program (BP) has provided food for students in need since 1995, though to date, no thorough evaluation has been conducted. Students are identified by school staff as potential candidates and then given a prepackaged bag with food items they can take home.

Design: Researchers used a mixed-methods study designed to comprehensively evaluate the perspectives of site coordinators, parents, and community stakeholders regarding the effectiveness of the ARFB BP. Researchers interviewed site coordinators, parents, and stakeholders across 33 counties in Arkansas. The research team developed a survey based on a modified version of the Feeding America Client Survey and used standard interview scripts for qualitative data collection.

Results/Discussion: Participants reported that the BP is making a positive impact on relieving hunger among students in need. Food items contained in the packs are nutritionally acceptable and enjoyed by the majority of students. Areas of improvement included increasing community awareness of food insecurity and other resources such as food pantries, providing additional food items for students, and involving parents/siblings in the distribution process. Potential barriers to food assistance are the lack of program awareness and transportation as well as students’ feelings of shame and embarrassment when receiving backpacks. Many stakeholders mentioned the reasons for hunger in local communities and the impact it has on learning, behavior, and general health.

Conclusion: The majority of participants responded that the BP effectively serves students experiencing hunger. Improvements can be implemented and include the immediate need for nutrition education among parents.

Funding Source: None

Assessing the Nutrition Knowledge, Family Activity-Eating Behaviors, and Food Accessibility of Parents with Children Diagnosed with Spina Bifida

Author(s): J. O’Neill1, J. Whelan1, C. Armstrong2, R. Schroer1; 1Indiana University Health, 2Indiana University - Indianapolis, 3Indiana University Health - Riley Hospital

Learning Outcome: Upon completion, participants will be able to describe levels of nutrition knowledge, family activity-eating behaviors, and food accessibility of parents that care for children with spina bifida.

Background: Childhood overweight and obesity rates have skyrocketed over the past decades in the United States. Children with spina bi (SB) frequently have a higher risk of being overweight/obese due to changes in mobility and eating patterns than typically developing peers.

Objective: To investigate the relationships between body mass index (BMI) levels in children with SB and their parent’s BMI, parental nutrition knowledge (PNK), family activity-eating behaviors (FAEB), and food accessibility (FA).

Methods: One parent (83% female 15% male) of a child with SB (aged 2–18 years) completed demographic questionnaires and PNK, FAEB, and FA surveys between May 2021-March 2022 during a single visit to a Midwest pediatric SB outpatient clinic. Parent-ceived t-tests, regression analysis, and correlational statistics were conducted via SPSS 27 and compared survey data to the child’s BMI.

Results: Completed data from 118 parent-child dyads suggested 60% of parents were overweight/obese (mean BMI 30.53 kg/m²; s.e. 0.45 SD; n = 116). A median PNK score of 18 (range 2-24; maximum 26; n = 104) suggested parents lacked nutrition knowledge (18/26 = 69.2%). As parental BMI increased, FAEB significantly decreased (r = −0.42; p < 0.05; n = 115). Approximately 46% of children were in the overweight/obese range (≥85th percentile; n = 116). A significant negative relationship was identified between the child's maximum BMI level and their FAEB score (β = −0.035; 95% CI -0.062 0.007; p < 0.05; n = 115). Additionally, as FA increased, FAEB also significantly increased (r = 0.16; p < 0.05; n = 115).

Conclusion: These findings suggest a need for parental nutrition education to assist children with SB with meal and activity planning to maintain health.

Funding Source: None

Association Between Skeletal Muscle and Systemic Inflammation in Patients with Newly Diagnosed Prostate Cancer

Author(s): C. Pine, E. Hobbs; Rush University

Learning Outcome: Upon completion, participants will be able to describe the hypothesized association between skeletal muscle and systemic inflammation in patients with newly diagnosed prostate cancer.

Background: Low muscle mass assessed from computed tomography (CT) images is associated with systemic inflammation in lung cancer patients; however, this has not been well-described in prostate cancer (PC).

Methods: This retrospective, cross-sectional study utilized data from the EMR (age, BMI, cancer stage, PSA, neutrophil count, lymphocyte count, and CT image at the L3 within 45 days of diagnosis). CT images were analyzed to determine muscle cross-sectional area (CSA) using SliceOMatic. Low skeletal muscle index (SMI) was set as < 45.4 cm²/m2. Neutrophil-to-lymphocyte ratio (NLR), as a marker of inflammation, was set at > 2.5. Frequency distributions, Chi-square analyses, and Spearman’s Rho correlations were used for statistical analysis.

Results: Subjects were older and overweight (n = 61: 69 ± 10 years 29 ± 5.57 kg/m²). Most were non-Hispanic White (49%) or non-Hispanic Black (44%), and 36.1% presented with low SMI (n = 22). White race (p = 0.001), smoking status (p = 0.015), alcohol users (p = 0.004), and GERD (p = 0.023) were significantly associated with sarcopenia. Mean NLR was higher in those with sarcopenia (4.97) than those without (2.35) (p = 0.004). Mean PSA in the sarcopenic group was higher than in the non-sarcopenic group (209.9 ng/mL and 11.0 ng/mL, respectively) (p = 0.007).

Conclusion: Inverse associations were observed between SMI and NLR in this sample; PC patients with low-muscle CSA may have elevated inflammation at diagnosis. Elevated inflammation is independently associated with sarcopenia and cancer; the compounded effects of these variables may lead to a poorer prognosis.

Funding Source: None

Body Fat Percentage Assessment Using Skinfold Thickness Agrees with Measures Obtained by DXA Scan in African American (AA) and Caucasian American (CA) Females

Author(s): V. Cedillo, R. Knight, B. Darnell, J. Fernandez, D. Moellering; The University of Alabama at Birmingham

Learning Outcome: Upon completion, participants will be able to define the use of skinfolds as an alternative when DXA is not available.

Background: The present study hypothesized that the equations most commonly used for predicting body fat percentage (BF%) using skinfold thickness agree with direct measures of BF% obtained by DXA Scan in African American (AA) and Caucasian American (CA) females.

Methods: Data from 42 females from Alabama 21-45 years of age, who self-identify as AA (n = 20) or CA (n = 22) were included. BF% was estimated using DXA scan and through six different skinfold thickness equations. Agreement between DXA-BF% and BF%- based on the skinfold thickness equations was assessed following the Bland-Altman method (bias and agreement limits).

Results: Agreement analysis showed in both AA and CA females that the BF%-Siri reflects better agreement and lower mean differences (bias) with BFXA than the BF%-Brozek after applying four body density (BD) equations. Limits showed that BF%-Siri and BF%-Brozek predictive equations overestimate BF% compared to DXA-BF% in both AA and CA females.

Conclusions: The results of this study show that BF%-Siri is a more accurate alternative than the BF%-Brozek equation for the calculation of BF%. In the calculation of BD, the Wilmore and Behnke equation in AA females, and Dunnin and Womersley in CA females were those that underestimated BF% to a lesser degree.

Funding Source: Mid-South Transdisciplinary Collaborative Center for Health Disparity Research NIMHD U54 MD008176 & the Social Determinants of Health Measurement Science - NCATS UL1 TR000165; UAB Diabetes Research Center - NIDDK DRC: P30 DK079626 & Andrea Cherrington; UAB BioAnalytical Redox Biology (BARB) Core, Kelley Smith-Johnston, and Brittany Fields-Blackstock.

JOURNAL OF THE ACADEMY OF NUTRITION AND DIETETICS A-103
Cultural Humility: How Foodservice and Management Professors are Preparing Dietetics Students

**Author(s):** K. McBride1, T. Pruitt1, E. Woodbery1, E. Vaterlaus Patten1, N. Stoken1
1 Brigham Young University, 2 Merrimack College and Wellness Workdays Dietetic Internship

**Learning Outcome:** Readers will understand how dietetics foodservice and/or management educators are addressing cultural humility education with students.

**Background:** Dietitians work with a diverse population of patients/clients each with their own unique cultural traditions. Developing cultural humility is important for dietitians to effectively work with patients, clients, and employees from diverse backgrounds. This study explored how cultural humility is being addressed in dietetics foodservice and/or management education.

**Methods:** Foodservice and/or management educators (n=52) from ACEND-accredited education programs were recruited via email to complete a 26-item survey. Prior to recruitment the survey was reviewed by five experts in dietetics education.

**Results:** Most participants were female (82.4%), White (94.1%), >50 years old (56.8%), and from Didactic Programs in Dietetics (75%). Nearly all (98.1%) indicated that cultural humility has a place in foodservice and/or management education and many (72.5%) had participated in formal cultural humility training. Most (69.2%) indicated that utilized specific course content designed to prepare students to provide services and/or manage people from a variety of cultures. Participants strongly agreed that cultural humility is an important part of both general (M=4.79) and foodservice/management (M=4.73) dietetics education. They disagreed (M=2.63) that cultural humility is best learned in a classroom and strongly agreed (M=4.32) that it is best learned through real world work experience.

**Conclusions:** Foodservice and/or management educators believe that cultural humility is important and has a place in foodservice and management education. However, they also believe cultural humility is best gained through real life work experiences rather than in the classroom. Foodservice and management educators should continue to highlight the importance of cultural humility through foodservice and management curriculum.

**Funding Source:** This study was partially funded through a CURA grant from the College of Life Sciences at Brigham Young University

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Depression, Anxiety, Stress, and Loneliness Rates of the Didactic Program in Dietetics (DPD) Students During Spring 2022

**Author(s):** B. Wayne, K. Mueller, S. Bellini, E. Vaterlaus Patten; Brigham Young University

**Learning Outcome:** Describe the prevalence of depression, anxiety, stress, loneliness, and major stressors experienced by DPD students.

**Background:** DPDs are rigorous education programs and qualifying for a dietetic internship program is competitive. Beyond the challenging DPD educational experience, students’ learning experiences have also been impacted by the COVID-19 pandemic. Emerging research indicates college students’ mental health has been negatively influenced by the pandemic. Recognizing DPD students’ experiences with depression, anxiety, stress and loneliness may help dietetics educators better support current and future students.

**Methodology:** An electronic survey instrument was sent through DPD directors (N=215) to students during March-April 2022. The DASS-21, UCLA Loneliness, and stressor scales were included. Descriptive statistics were calculated using SPSS.

**Results:** Of DPD students (n=341) representing 51 DPDs, most were 18-24 years old (74.2%) and female (92.0%). About one-third was classified as having mild or moderate symptoms of depression (32%), anxiety (31.4%), and stress (36.5%). Some students’ symptoms were considered severe or extremely severe (14.6% depression 23.7% anxiety 16.0% stress). Of respondents 50.2% were classified as lonely. Students identified their greatest stressors (5-point scale) to be post-graduate plans (x=3.89), managing their time (x=3.79), self-imposed expectations (x=3.75), dietetics courses (x=3.68), and finances (x=3.54).

**Conclusion:** Consideration of the depression, anxiety, stress, and loneliness among dietetics students warrants a closer look at available student resources. Dietetics educators can connect their students with available mental health resources, foster a learning environment that supports student well-being, and find ways to facilitate meaningful interaction in classes and clubs.

**Funding Source:** None
Effect of a Spice-Blended Muffin on Salivary Inflammation Markers in Adults Who Are Considered Obese

**Author(s):** S. Acevedo, D. Aycart, J. Andrade; University of Florida

**Learning Outcome:** Upon completion, participants will be able to examine the impact consumption of a spiced-muffin for 10-days has on salivary inflammation markers in adults who are considered obese.

**Background:** Obesity is characterized by a persistent state of inflammation that could be modulated by dietary habits. Limited research has been conducted on the effect that spices added to whole foods has on salivary inflammation markers among obese adults.

**Objective:** To examine the impact consumption of a spiced muffin has on salivary inflammation markers, C-reactive protein (CRP) and Interleukin-6 (IL-6) in obese adults.

**Methods:** A 10-day feasibility pre/post-test trial was conducted at a Southwestern University. Participants (n=14) consumed a 60-gram muffin that included turmeric (3g) and cinnamon (1g) for 10 days. Baseline and post-trial salvia samples (2ml) were obtained 2-hours post consumption of food and beverages other than water. At baseline, participants completed a 30-day spice and dietary habits questionnaire. Salivary CRP and IL-6 were measured using the ELISA immunological tests. A one-sample t-test was conducted using SAS® v9.4 with significance determined at p<0.05.

**Results:** Participants were predominately female (71%), were considered Latinx (34%), and had an average BMI of 32.16 kg/m². There was a significant decrease in salivary IL-6 (p<0.03), but no statistical difference in salivary CRP (p=0.46). Even though no analysis was performed on the impact diet/spice consumption had on salivary levels, no changes were observed in these habits with participants consuming limited spices.

**Conclusion:** Consumption of a spiced muffin reduced salivary IL-6 in 10-days. Further larger scale randomized control trial should take place along with analyses of serum and saliva of these inflammation markers prior to recommending spices into dietary patterns.

**Funding Source:** National Kidney Foundation and McNair Scholarship

Examining Division I Athletes’ Sports Nutrition-Related Knowledge

**Author(s):** D. Tavares, K. Pietro; University of New Hampshire

**Learning Outcome:** Upon completion, participants will be able to demonstrate that nutritional knowledge discrepancies are present amongst Division I athletes, and demonstrate why team-specific education is necessary.

Adequate nutritional knowledge is essential for athletes who are faced with increased physical demands, complicated time constraints, and the desire to gain a competitive advantage in order to maintain a scholarship or increase playing time. Possession of a strong nutritional knowledge base may make it easier for an athlete to adapt to a foreign environment when traveling for competition or adjusting to different phases in the season (i.e., off-season). This study examined sports nutrition knowledge of Division I athletes (n=95) from a university in the northeastern part of the US. Student-athletes, representing ten different athletic teams, completed the 35-item Abridged Sports Nutrition Knowledge Questionnaire (ASNKQ), as well as 14 additional nutrition-related questions (i.e., alcohol consumption, supplemental usage, perceived importance of nutrition in athletic performance, previous nutrition courses taken, and source of nutrition-related information). A nutritional knowledge score of 75% was deemed adequate nutritional knowledge. There were no athletes who scored above 75%. The overall mean score was 45.73%, and males (n=54, 42.3%) on average scored significantly lower than females (n=41, 51.4%). The highest scoring team was Women’s Skiing (62.3%) and the lowest scoring team was Men’s Football (41.7%). The most frequently missed questions were regarding hydration and carbohydrate/protein requirements. Further, nutritional knowledge discrepancies between teams were evident, highlighting the need for team-specific nutrition education. Team-tailored education allows for Sports Dietitians to fill the gaps in knowledge that exist between teams, and correct false perceptions that athletes have, in order to improve their nutritional understanding.

**Funding Source:** None

Impact of a Cooperative Extension Curriculum to Improve Sustainable Eating Knowledge and Reduce Perceived Barriers Among Kentuckians

**Author(s):** K. Pickford, H. Norman-Burgdolf, A. Koempel, T. Stephenson, D. Brewer, L. Barker; University of Kentucky

**Learning Outcome:** Understand the effectiveness of a Cooperative Extension curriculum to increase healthy and sustainable eating knowledge among community members.

Consumers play a role in the food system but may not have a strong understanding of how their dietary behaviors impact the environment or their health. Creating and piloting a sustainable eating curriculum through the Cooperative Extension Service may be one way to increase awareness and steer consumers’ dietary behaviors towards healthy and sustainable eating patterns. Our formative work suggests that an Extension curriculum targeting adults has potential to effectively expand community knowledge and perceptions of healthy and sustainable diets. Feedback on lesson outlines were collected from Kentucky Cooperative Extension Agents during structured interviews (n=26) conducted via Zoom during the summer of 2021. Knowledge and attitudes were collected via surveys, which included the Sustainable Eating Barrier and Involvement Questionnaires. Initial coding was conducted using stratified coding by question, then refined and organized thematically. Survey data was analyzed using SPSS. After reviewing the lesson outlines, agents’ overall perception of the barriers associated with healthy and sustainable eating significantly decreased and their attitudes in response to “I care a lot about sustainable eating” significantly increased. These results indicate that providing information about sustainable eating can result in positive changes in the awareness of healthy and sustainable eating while reducing perceived barriers. Agent interviews provided insight into lesson acceptability; interview themes were utilized to revise the curriculum to reflect community concerns and perspectives. Future research will evaluate changes in sustainable eating knowledge and intended behavior change among community members throughout Kentucky following their participation in this Agent-visited, five-lesson sustainable eating Extension curriculum.

**Funding Source:** Kentucky Department of Agriculture- USDA Specialty Crop Grant PON2 035 20000000252 Research reported in this publication was also supported by the National Institute Of Environmental Health Sciences of the National Institutes of Health under Award Number P42ES007380. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.
Improving Self-Management of Diabetes and Hearing Loss Program

Authors: L. Landfried, V. Moran, M. Fischer, M. Espejo Serrano, K. Wan, D. Del Rosario; Saint Louis University

Learning Outcome: Upon completion, participants will be able to identify innovative interdisciplinary treatment modalities for diabetes and hearing loss, 2 well-known factors for late onset dementia and cognitive decline.

Background: Many of the participants in this program live in an area of St. Louis with the lowest household income level and the highest diabetes mortality rate (76.2 per 100,000 population) as well as high rates of unemployment, hospitalizations, ER visits, and overall mortality (DOH, 2016). Poorly controlled diabetes and hearing loss put individuals at risk for development of dementia (Livingston et al, 2020) given the poor health statistics and high rates of poverty in this region, more needs to be done to reach this population.

Methods: Treatment for diabetes and hearing loss are delivered in a multidisciplinary clinic setting. After recruitment, RD/graduate students, Audiologist/CSD student, and RN meet with participants to address diabetes and hearing loss concerns and are trained to manage blood glucose levels using blood glucose meters and dietary records. The RD/grad students use motivational interviewing to motivate participants to make sustainable changes. Participants have individualized follow-up sessions and are evaluated for their individual diabetes and hearing loss management.

Results: As of yet (recruitment is still open), 2 participants were followed and it was determined that they appreciated the individual approach and felt more confident in their ability to manage their own diabetes. One participant went from an average 200 mg/dL blood glucose level to 140 mg/dL because of their ability to see how their food choices affected their blood glucose levels.

Conclusion: An interdisciplinary approach is impactful in addressing diabetes and hearing loss and may be effective in reducing morbidity/mortality rates.

Funding Source: None

Integrating Interactive Digital 2D and 3D Food Models for Virtual Dietary Assessment Training in Dietetic Course

Author: D. Ho; Taipei Medical University

Learning Outcome: Upon completion, participants will be able to develop a novel pedagogical framework which combining interactive 3D-model and 2D into formal dietetic training as a virtual dietary assessment teaching platform.

Rationale: Augmented Reality might have the potential to improve perception and estimation of portion sizes. The aims were: (1) to develop a Virtual Interactive 3D and 2D-Image based Dietary Assessment to formal dietetic training program and (2) to evaluate dietetic students’ performance and receptiveness to the integration

Methods: A total of sixty-five second year dietetic students enrolled in the Nutritional practicum course, School of Nutrition and Health Sciences, Taipei Medical University, Taiwan. Dietetic teaching and evaluation of student’s performance was done by a virtual digital food portion size platform comprised standardized 2D photos and interactive 3D food models covering a wide variety of foods and portion size.

Results: Sixty-five undergraduate dietetic students enrolled in class. Students performed differently between 2D and 3D in certain food in the first semester. The combination of interactive 3D-Model and 2D-Image based Dietetic Assessment platform significantly improved student’s portion size estimation accuracy (qualified correctly in ≥10%) from first semester: 16-18% to second semester: 43% and reduced absolute estimated errors from 29-30% (first semester) to 13% (second semester). The platform greatly improved food quantification of amorphous food, stuffing, and condiments but not vegetables. Seventy-one percentage of students agreed that the combination of 2D and 3D) is helpful to conduct virtual dietary assessment training and 82% agreed that such training should be retained in the classroom

Conclusion: The study developed and proposed a novel pedagogical framework which combining interactive 3D-model and 2D into dietetic course as a virtual dietary assessment training platform

Funding Source: None
Low Use of Prescription Weight Loss Medication and Dietary Supplements for Weight Loss Positively Correlated Among Adults with Overweight And Obesity

**Author(s):** E. Pash1,2, C. Iretan-Jones1,2,3, G. Lesiak, 2Good Nutrition for Good Living

**Learning Outcome:** Demonstrate under prescribing of evidence-based pharmacotherapy for overweight and obesity among healthcare practitioners and consumers opting for self-treatment with weight loss supplements.

**Background:** The 2017–2018 National Health and Nutrition Examination Survey (NHANES) obesity prevalence in U.S. adults was 42.4% and 31.1% for overweight. Use of approved non-surgical, anti-obesity prescription interventions is minimal, yet dietary supplements are a $25.5 billion industry in the U.S. with over 40% marketed as weight loss supplements. This research aimed to identify a relationship between Body Mass Index (BMI), use of a prescription weight loss medication, and dietary supplementation for weight loss.

**Methods:** The 2017-2018 NHANES data from respondents who took prescription weight loss medication and dietary supplements for weight loss were included for correlational analysis. This data included 2338 participants, 18-74 years-old, with BMI 27–40 kg/m².

**Results:** A significant, positive correlation exists between BMI and use of prescription weight loss medication (r = .65, p < .05) and use of supplements for weight loss (r = .65, p < .05). Only 2.1% (n = 49) reported taking prescription weight loss medication, while self-reported supplement use for weight loss was 3.6% (n = 85). The average BMI was 31.81 kg/m².

**Conclusion:** Results reveal low rate of prescription weight loss medication in those with overweight or obesity. This may be indicative of under prescribing evidence-based pharmacotherapy or lack of knowledge. Supplement use for weight loss was greater than prescriptions. Differing from accessibility of recommended and approved prescription treatments, advertised weight loss supplements are readily available without a prescription. These findings can inform clinical practice, and patient-provider communication about weight loss and improve pathways to treatment options.

**Funding Source:** None

Perceptions of Dietetics Majors Regarding Career Choices Including Foodservice Management

**Author:** D. Burnett; Auburn University

**Learning Outcome:** Upon completion, participants will be able to: Understand and list some of the factors that can be used to increase interest in foodservice management career options of dietetics students.

**Background:** The purpose of this research was to evaluate the impact of active learning projects in a foodservice management course sequence on dietetics students’ interest in and confidence to succeed in a foodservice management position upon entering the profession. It is prudent that students can envision themselves in foodservice management roles if preferred positions are anticipated need for foodservice management practitioners.

**Methods:** Participants were students (n=18; female, n=17; white 72.2%; Hispanic/Latino 16.7%; Asian or Pacific Islander 5.6%; Multiracial/Biracial, 5.6%) who completed a foodservice management course sequence at a large southeastern university and who volunteered to complete a Qualtrics survey based on a modified version of the published Career Aspirations and Motivations of Dietetics Students (CAMDS) survey, used with permission.

**Results:** Of the 18 (78% of class) students in the course 44% agreed that their interest in employment in foodservice management increased during their dietetics curriculum 56% agreed interest decreased and 50% said interest remained the same. Active learning projects and positive attributes of the professor were credited to the increased interest and self-confidence by 94% to 100% of participants, respectively.

**Conclusions:** Active learning projects and attributes of the professor were found to be important to increased interest in serving in professional foodservice management roles; however, this pilot project did not have sufficient participants to draw more definitive conclusions. Results are important to continuing active learning projects in the curriculum for further study.

**Funding Source:** Auburn University investigator start-up funds.

Qualitative Evaluation of Cooking and Gardening Sessions with Elementary School Children

**Author(s):** H. Muzaffar, A. Valinskas, A. Werner, N. Collins, M. Regan; Northern Illinois University

**Learning Outcome:** Upon completion, participants will be able to describe qualitative program evaluation strategies to use with children to assess the appeal and acceptability of a health promotion program.

The Federal Task Force on Childhood Obesity calls for programs focusing on nutrition-literacy, gardening, and cooking skills of children and families to heighten enjoyment of preparing and consuming healthy foods. Multicomponent interventions tend to have enhanced outcomes as opposed to interventions that focus on a single component. The objective of this study was to seek qualitative information from 4th and 5th graders by conducting focus groups to assess the appeal and acceptability of a combined pilot cooking and gardening program. A total of 225 elementary school children participated in six cooking sessions and six gardening sessions between September 2021 and May 2022. Each session was 35 minutes long and included nutrition education and either hands-on cooking activities or gardening skills. The programs was delivered by a university researcher and her four students. At the end of the program, focus groups were conducted with nine groups (2 girls and 2 boys) of children, one group from each section of 4th and 5th grades that participated in the program. The focus group script included a total of 14 questions, including opening, introductory, key and closing questions. Each focus group was 25-30 minutes long and all the responses were audiotaped and transcribed verbatim. Grounded theory approach was used to analyze the focus group data. Four major themes emerged: benefits of healthy eating, cooking and tasting fun, joy of growing fruits and vegetables, and ultimate cooking and gardening program. These results will guide adaptations to the program for an effectiveness randomized controlled study.

**Funding Source:** Internal Funding: Research and Artistry Grant from Northern Illinois University.

Results from a Mixed-Methods Survey and Focus Group to Assess Social Media and Technology Use By Older Adults in Northeast Tennessee to Inform Development of a Virtual Social Supper Club Nutrition Education Intervention

**Author(s):** W. Bignell, S. Kelley, A. Cobble; East Tennessee State University

**Learning Outcome:** Upon completion, participant will be able to describe challenges and opportunities in designing virtual nutrition education programs for older adults.

**Background:** During COVID-19, most senior centers closed, decreasing access to interactive nutrition education and increasing risk for loneliness and malnutrition among older adults. Many senior centers in Northeast Tennessee adapted nutrition education to virtual platforms, such as Facebook®. Post-pandemic, several center directors desire to continue virtual programming to serve more older adults in the region. Researchers at two local universities are developing a “virtual social supper club” intervention to address these issues and extend nutrition education “beyond senior center walls.” The purpose of this study was to determine older adults’ use of technology and social media to understand challenges and opportunities in implementing a virtual program in this region.

**Methods:** A focus group was conducted with senior center staff to understand their experiences offering virtual programs, and a cross-sectional survey was distributed through regional senior centers to assess participants’ use of technology and social media.

**Results:** A total of 150 participants completed the survey (89 online; 61 paper-based). Most access the internet at home (n = 137) and use Facebook (n = 100). When asked about preferred class format, many preferred in-person classes (n = 77) or online videos (n = 45). Senior center directors reported more engagement with social media versus live virtual classes. Directors expressed a need for training about new platforms (i.e., Zoom) prior to starting a program.

**Conclusion:** While many older adults in this region have access to the internet and may use social media, additional supports are necessary to increase participation in virtual nutrition education.

**Funding Source:** This project was supported, in part by grant #90INNU0031-01-00 from the U.S. Administration for Community Living, Department of Health and Human Services, Washington, D.C. 20201.
Signals of Environmental Sustainability and Influence On Food Purchasing Decisions By U.S. Consumers

Author(s): N. Wijayatunga1, Y. Chang1, A. Brown2, A. Webster1, K. Sollid1, D. Bailey1, 1University of Mississippi, 2Indiana University School of Public Health-Bloomington, 3International Food Information Council (IFIC), 4Well Done Nutrition, LLC

Learning Outcome: Upon completion, participants will be able to describe signals of environmental sustainability consumers use and demonstrate how different signals are associated with individual characteristics and stated impact on purchasing decisions.

Background: Even though the need for environmentally sustainable diets is increasing, consumer perception regarding food produced in an environmentally sustainable (ES) manner is not clear in the United States (US). We aimed to explore the factors associated with signals of ES in US consumers.

Methods: Repeated cross-sectional data, collected online in 2019 and 2020 by the International Food Information Council (IFIC) in its annual Food and Health Survey, were used. The sample consisted of 1,059 US consumers who said it is somewhat or very important that the food products they purchase or consume are produced in an ES manner. Six dichotomous signals were examined to discern ES products when shopping: recyclable packaging, minimal packaging, organic, locally grown, sustainably sourced, and non-GMO/not bioengineered.

Results: 94% of consumers use at least one of the six signals when shopping for foods and beverages to determine ES. Poisson regression showed that education, race, health status, and the impact of ES on buying decisions were associated with the number of signals used (p<.05). Logistic regressions of each signal revealed that different consumers might look to different aspects of ES (p<.05).

Conclusion: Consumers who think it is important that the food they purchase is produced in an ES manner look for ~ 2-3 signals. As the impact of ES on the decision to buy increases, consumers are more likely to look for more signals. The types and number of signals used vary by demographics, health characteristics, and the stated impact on the decision.

Funding Source: Research support funding from the School of Applied Sciences Dean’s office and startup funds from the University of Mississippi

Spectrum of Collegiate Culinary and Nutrition Instruction (CCNI)

Author(s): H. Barkoukis, s. Harris, S. Nori, C. McManus; School of Medicine, Case Western Reserve University

Learning Outcome: Define the scope of opportunity for RDN leadership in US collegiate culinary and nutrition instruction.

Increasingly research is demonstrating the importance of developing food preparation skills concurrent with nutrition education as an enabler for healthy dietary behaviors. Our objective was to assess the status of collegiate culinary and nutrition instruction (CCNI), (excluding food service or food hospitality courses), from fall 2019 through June 2021 at the top 50 US colleges based on published rankings from the US News and World Report website. Both credit and non-credit offerings were determined by conducting systematic keyword searches, (food preparation, culinary nutrition, culinary immersion, etc), from publicly accessible online resources from these university websites, course catalogs, and course/program descriptors. Structured course programs that transitioned into virtual demos due to the pandemic were included. 52% of these universities offer at least one CCNI course for academic credit and 32% offered at least one non-credit option every academic year. The credit courses were taught by an RDN (13%), non-RDN (80%), undetermined (7%).Non-credit offerings were taught by an RDN (28%), non-RDN (32%), undetermined (40%). All credit courses were categorized into one of the following focus areas: 31% cultural immersion, 29% food science, 16% culinary/food literacy, 2% introductory culinary nutrition, and collectively 8% from farm to table, environmental nutrition and healthy lifestyles. On campus teaching kitchens were used for credit classes at 22% of universities. Overall, CCNI credit and non-credit classes are popular, but predominantly not being taught by RDNs. This illustrates another venue for further expansion of the RDN leadership role.

Funding Source: Case Western Reserve Wharton Endowment Scholarship funding for undergraduate research

Student Perceptions of their Student-Operated Restaurant Experience and Confidence with Foodservice Management Competencies

Author(s): S. Owen1, T. Pruit2, E. Woodbery2, E. Vaterlaus Patten2, N. Stokel2, 1Brigham Young University, 2Mercerack College and Wellness Workdays Dietetic Internship

Learning Outcome: Upon completion, participants will be able to describe student perceptions of their student-operated restaurant experience.

Background: Student-operated restaurants (SORs) are used by dietetics and hospitality programs to meet curriculum standards. However, research regarding students’ perceptions of their SOR experience is lacking. The purpose of this study was to explore student perceptions of their SOR experience.

Methods: Students were recruited via email to complete an electronic survey with questions regarding student perceptions of SORs including interactions with students and professors, foodservice and management skills, leadership experiences, future implications of their SOR experience, and the application of nutrition principles within SORs.

Results: Of 107 usable responses, 66 had participated, 35 were currently participating, and 6 were planning to participate in an SOR. Sixty-five were from dietetics programs and 30 were from hospitality programs. Students reported the skills they learned in the SOR would help them in their future careers (M=4.18), they learned leadership skills from their SOR experience (M=4.31), engaged in interactive learning in the SOR (M=4.56), and disagreed with the statement that their SOR experience was negative (M=1.86). Regarding the integration of nutrition education with the SOR experience, students were neutral (M=3.09) and felt there was a greater focus on foodservice management than nutrition in the SOR (M=4.16). Students agreed that incorporating more nutrition information into the SOR curriculum would be beneficial (M=3.85).

Conclusions: Students appreciated their SOR experience and learned valuable skills that they believed will help them in their future careers. Students do not feel SORs are nutrition-focused. There remains an opportunity for nutrition principles to be integrated into the SOR experience.

Funding Source: Allene Vaden Memorial Grant from the Academy of Nutrition and Diethetics Foundation

Students’ Interest in Pursuing a Food Systems Career after Completion of a 1-year Agriscience or Culinary Arts Program

Author(s): A. Ha, M. Badolato, K. Shelnutt, L. House, A. Mathews; University of Florida

Learning Outcome: describe students’ interest in food system careers and satisfaction of course material after a year of an agriscience or culinary arts program.

Background: As the average age of US farmers is 57.5, programs should encourage students to consider a food systems career.

Objective: To examine students’ interest in food systems careers after completing one year of an agriscience or culinary arts program.

Method: At the beginning and end of the academic year, high school students (n=186) enrolled in a culinary (46.2%) or agriscience (52.7%) program completed a survey. It looked at their interest in the program, demographic characteristics, post-high school and career intentions.

Results: Majority of students were female (55.9%), white (52.2%), in 11th grade (30.1%), and a 3.18-3.45 (31.2%) grade point average. Students’ reasons for taking the course: material interest (62.5%), learn new skills (60.2%), expand knowledge (50.0%), and education requirements (29.6%). At program completion, 89.3% were applying skills beyond the classroom and 59.7% spent the time satisfied. The Kappa coefficient showed the inter-rater reliability from the beginning to the end of the academic year, a future STEM career had a fair agreement in the direction of students answering ‘no’ to ‘yes’. Students’ post-high school plans had a fair agreement going in the direction of continuing their education. Agriscience students had a fair and culinary students had a moderate agreement, with both students moving in the same direction.

Conclusion: Students one-year immersion in the program allowed for students to have an increased interest in the food systems field.

Funding Source: Walmart Foundation
Significantly, the weight loss was doubled using Telehealth. We also saw a statistically significant decrease in A1C of 0.57% (p=0.05), with the maximum A1C decrease of 7.1% in 2020 to 2022 using Telehealth.

Telehealth outcomes yielded greater improvements in A1C and Obesity indicating that it may be a more effective method of delivering MNT.

**Funding Source:** Private KaiZenRD EMR

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The average weight loss for patients seen using Telehealth was 4.45 pounds (p=1.2 E-10), with the maximum weight loss of 91 pounds in the two-year period 2020-2022. The average weight loss for patients seen with In-Person visits was 2.1 pounds (p=0.001), with the maximum weight loss of 41.8 pounds in the two-year period 2018-2022. Both the number of patients seen and the weight loss was doubled using Telehealth.

Telehealth outcomes yielded greater improvements in A1C and Obesity indicating that it may be a more effective method of delivering MNT.

**Funding Source:** Private KaiZenRD EMR

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**The Effect of the 6-Month Diet-Induced Weight Loss Intervention on Calcium and Vitamin D Intakes in Older Adults with Overweight or Obesity**

**Author(s):** I. Puthoff, M. Miller, K. Timmerman; Miami University

**Learning Outcome:** Upon completion, participant will be able to describe how the types of claims (i.e., health, nutrient) may enable healthier food choice.

Healthy eating habits can combat the risks of chronic diseases. Messages on food packages convey healthfulness of food and are important in consumers' food choices. This study examined the interaction effects of psychological social distance (thinking of self versus children) in a consumption context with food packaging claims (health versus nutrient claims) on healthy food choices. Rooted in construal level theory, proximal thinking (self) was expected to exhibit greater response to health claims (high-level value) on packaging. In a between-subjects experimental design, a total of 171 U.S. adults from low-to-mid socio-economic household, having children living at home, participated in an online experiment employing a 2 (Social Distance: Children vs. Self) x 3 (Message Claim: Health vs. Nutrient vs. No Claim) full-factorial design. Participants were randomly assigned to view and evaluate food products that bore the different claims across breakfast cereal, pasta, milk, and yogurt categories. Significant main effect of message value on social distance (F=3.42, p=0.035) was observed. As hypothesized, consumers choosing products for their children had more positive evaluations of food packaging with a health claim (M=5.58, SE=.22) compared to a nutrient claim (M=5.39, SE=.19) or no claim (M=5.39, SE=.19). The findings revealed how the types of messaging on food packaging may enable healthier food choices. Specifically, the dietary choices that parents make for children maybe improved via the use of health rather than nutrient/no claims.

**Funding Source:** None
TikTok Offers an Opportunity for Nutrition-Professionals to Impact Celiac Patients Active on Social Media

**Author(s):** L. Samuel1, C. Jaime1, J. Fera1, C. Basch1; 1Lehman College, CUNY, 2William Paterson University, 3Lehman College

**Learning Outcome:** Upon completion, participants will be able to describe predominant themes across trending Celiac Disease (CD)-related TikTok videos and explore possible role of nutrition-professionals in impacting online community of celiac patients.

**Background:** Celiac patients access social media to share emotional and practical support through personal narratives. Despite being a positive influence on the celiac community, the predominantly consumer-initiated uploads present challenges in terms of professional accuracy. The overall goal of this study was a content analysis of trending TikTok videos pertaining to CD.

**Methods:** One hundred videos that used the hashtag #celiac disease were analyzed for viewership, comments, likes and inclusion of specific content (personal narrative, hardships associated with gluten-free diet, disease management, pictures of foods). One-tailed t-tests (α = .05) were conducted to determine if content categories had a statistical effect on the number of likes received.

**Results:** Only one video was created by a health profession. Personal narratives had the highest representation (47%), followed by videos that contained pictures of foods (33%), hardships of a gluten-free diet (32%), and CD management (30%). Videos that shared personal narrative or disease management significantly affected the number of likes (p< 0.005).

**Conclusions:** Goals of the online celiac community are for patients to share their lived experiences, practical challenges in managing the disease and adherence to a gluten-free diet. Our results indicate a missed opportunity by nutrition-professionals to effectively use wide-ranging, low-cost online social media platforms such as TikTok to complement traditional patient education without the constraints of time, physical location and cost.

**Funding Source:** None

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Using Photovoice with Middle and High School Students to Capture Youth Voices on Food Environments and the impact of COVID-19

**Author(s):** P. Sandha1, J. Higgins1, K. LeCros Strickler1, M. Weitzner1; 1Metropolitan State University of Denver, 2Dietetic Intern, 3Lululemon Athletica

**Learning Outcome:** Upon completion, participants will be able to define the importance of youth participation in school meal programs and the need for youth feedback to modify existing and creating new policies.

**Background:** Past research suggests participation in school meal programs improves youth academic and health outcomes. Incorporating youth feedback into school meal programs may increase participation.

**Methods:** A qualitative study using the photovoice methodology was organized. Participants attended workshop covering photography basics and project goals, took pictures during the week post workshop of their food-environment, and then attended a focus group (FG). Students discussed meaning of their pictures during FG. FGs were recorded, transcribed, and coded using grounded theory. An iterative process was used to categorize individual pantry staff/volunteer responses into themes ranked by the number of responses for supports and barriers.

**Results:** Thirty-one students, ages 12-18 (16.25 ± 1.8) participated in the study. Five major themes were identified: 1)Lack of time and resources to provide nutritious meals; 2)Accessibility, availability, and finances; 3)Safety; 4)Lack of coordination between food service and classroom; 5)Sharing meals with friends and family was considered to be important for social health.

**Conclusions:** Allowing more time to enjoy meals to meet students’ social needs, greater flexibility in when and where students can eat, extending the COVID-19 free lunch policy, and incorporating student feedback could increase participation in school meal programs. The COVID-19 pandemic led to increased snacking, desire to eat out, and increased perceptions of health and body image. Future research is needed to examine impacts of COVID-19 and strategies to make the school lunch program students’ preferred choice.

**Funding Source:** Master’s Program at [Name of University. blind for review] Internal Funds

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Virtual Journal Club to Enhance Preceptor Development in Support of Student Learning

**Author(s):** H. Roberts, J. Gnau, S. Murray; Missouri State University

**Learning Outcome:** Describe three benefits of hosting a virtual journal club to provide training for nutrition and dietetic preceptors.

Literature on the effectiveness of journal clubs (JC) as a teaching modality focuses on student learning, but there is limited literature on how JCs could be effective in enhancing preceptors’ confidence to serve the profession in a teaching capacity. The purpose of this study was to assess how dietetic preceptors’ confidence in precepting changed after attending virtual JCs, in addition to assessing how attending affected the preceptors’ desire to implement something they learned in future interactions with dietetic interns. The researchers designed four, one-hour virtual JCs based on results of a learning needs assessment provided to preceptors. Preceptors were recruited using convenience sampling via e-mail. After each JC, preceptors were invited to give informed consent prior to participating in an online survey. Descriptive statistics and frequencies were used to analyze Likert scale questions. Thematic analysis was used to analyze open-ended questions. The research team independently coded and then convened to discuss and establish themes. Themes identified in the effectiveness of providing JC virtually were fostering a greater diversity of participants resulting in rich discussion and brainstorming opportunities. As a result of attending virtual JC, 100% of preceptors reported gains in confidence in their precepting abilities and indicated a likelihood to implement something they learned in future interactions with interns. Additionally, from thematic analysis, preceptors indicated they would implement new skills related to giving feedback, fostering connection with interns as well as self-directed learning in future interactions with interns. In conclusion, virtual JCs provide an effective training modality for dietetic preceptors.

**Funding Source:** This study was supported by an internal grant from the Office of Assessment at Missouri State University.

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Volunteer/Staff Perceptions of Supports and Barriers Towards Adopting the “MyChoice” Food Pantry Model

**Author(s):** D. Remley1, L. Franzen-Castile2, L. McCormack1, H. Eicher-Miller4, D. Mehrle Elliott3, B. Henne3, S. Stluka1; 1Ohio State University Extension, 2University of Nebraska-Lincoln, 3University of South Dakota School of Medicine, 4Purdue University, 5University of Missouri, 6Michigan State University, 7USDA National Institute of Food Safety and Nutrition

**Learning Outcome:** Upon completion, participants will be able to describe the MyChoice Food Pantry Model, and identify strategies to help non or limited-choice food pantries transition to MyChoice.

**Background:** MyChoice food pantries allow patrons to choose food based on the USDA MyPlate food groups and promote nutrition through signage, nudges, and volunteer engagement with clients. Previous studies suggest that pantries allowing choice are preferred by volunteers and patrons but little is known about staff/volunteer perceptions of the supports and barriers related to the transition from no choice to MyChoice.

**Methods:** This study uses data from staff/volunteer surveys (n=283) from 24 food pantries within 6 midwestern states enrolled in the Voices for Food project. Open-ended questions related to staff/volunteer perceptions of supports and barriers during the transition from little or no choice to MyChoice were analyzed by 2 researchers and directed by grounded theory. An iterative process was used to categorize individual pantry staff/volunteer responses into themes ranked by the number of responses for supports and barriers.

**Results:** Top themes for supporting MyChoice were staff/volunteer teamwork, improvements to facilities (i.e. getting more space or equipment), staff/volunteer involvement in decision making, and support from Extension. Lack of funding, lack of facilities such as space and equipment, volunteer administration issues (number, skills, physical capacity, turnover, recruitment of volunteers) and negative volunteer/staff attitudes were seen as barriers.

**Conclusion:** For food pantry administrators, successful transition from little or no choice to MyChoice includes partnering with Extension, working to secure necessary facilities and funding, promoting staff/volunteer teamwork (including addressing negative attitudes), and including staff/volunteers in decision making.

**Funding Source:** Voices for Food is supported by the Agriculture and Food Research Initiative Competitive Grant no. 2012–01623 from the USDA’s National Institute of Food and Agriculture, Sustainable Food Systems Program. Any opinions, findings, or recommendations expressed in this publication are those of the author (s) and do not necessarily reflect the view of the USDA.
Incorporating a Virtual Interprofessional Case Study into Medical Nutrition Therapy Curriculum to Create Collaborative-Ready Health Professionals

Author(s): N. Allen, T. Garrison, N. Curry, A. Hunter; Missouri State University

Learning Outcome: Incorporate virtual interprofessional case study into dietetics curriculum encouraging collaboration with students from various health disciplines.

Background: The ACEND requirement of KRDN 2.5 and the change driver “Creating Collaborative-Ready Health Professionals” are guides to developing interprofessional education (IPE) opportunities and breaking down professional “silos.” As courses move to virtual formats, dietetics educators need sustainable, interactive and researched options to enhance online curriculum.

Methods: A pre/post-test addressed criteria of collaboration with an interdisciplinary group. A virtual case study (CS) was administered in a senior-level Medical Nutrition Therapy (MNT) course at a public university focusing on a fictional patient who suffered an ischemic stroke. Students from Dietetics and Nutrition, Occupational Therapy, Speech Language Pathology, and Social Work participated. Via discussion boards, dietetics students conducted a nutrition assessment, and all disciplines developed an IPE care plan.

Results: Student test questions centered around involvement within a healthcare team and included topics such as: understanding diversity within a team, clinical roles, problem-solving measures, patient-centered care, and respecting culture and values. Quantitative data analyzed on 220 participants showed statistically significant improvement on pre/post-test scores measuring independent and identical (IID) data (pre=28.92, post=32.97). Summary scores were significantly higher on post-tests, which suggests competency increased (pre=41.21, post=43.59). Both sets of data had a 95% CI (confidence interval).

Conclusion: Increases on test scores demonstrated a virtual CS improved students’ knowledge in all subject areas, increased communication via a simulated healthcare team and enhanced understanding of clinical roles. The online CS is scalable to class size and is adaptable to include varied allied health students.

Funding Source: None
Tuesday, October 11

Poster Sessions
Late-Breaking Project or Program Report Abstracts
Community-based Fruit and Vegetable Prescription Programs: A Scoping Review

Author(s): E. Creatorex-Books, M. McInerney; Rush University

Learning Outcome: Discuss the different methodologies and effectiveness of community-based fruit and vegetable prescription programs.

Background: Americans do not consume an adequate amount of fruits and vegetables. Consumption rates are even lower among low-income individuals, with cost often cited as a barrier. Incentivizing fruit and vegetable consumption through community-based prescription programs has shown promising results improving health outcomes, dietary intake, and food security.

Research objective: Identify and categorize different models of community-based fruit and vegetable prescription programs, to determine variation in terms of methodology, target population characteristics, and outcomes measured.

Methods: Applying scoping review methodology, ten electronic databases were utilized to identify community-based fruit and vegetable incentive programs. Results were evaluated by two independent reviewers, using Covidence software. All full-text reviews were completed and documented using the PRISMA-ScR guidelines.

Results: Final review consisted of 30 full-text articles. Target populations were predominantly female, non-white and low-income. Considerable heterogeneity was found in both study design and quality. Fruit and vegetable vouchers were utilized in 63% of the studies. Prescriptions were primarily provided by health centers (44%) or NGOs (27%) and could be redeemed at community markets (40%) or grocery stores (27%). When measured, diet quality significantly improved in 94%, health outcomes significantly improved in 83%, and food security status improved in 82% of studies.

Conclusions: The Majority of studies showed significant improvements in at least one outcome, demonstrating the effectiveness of community-based fruit and vegetable prescription programs. However, diversity of measurement techniques and heterogeneity of design, dosage, and duration impeded meaningful comparisons. Further well-designed studies are warranted to compare the magnitude of effects among different program methodologies.

Funding Source: None

Hospital Food Donation Program Addresses Food Insecurity

Author: T. Kinn; Loyola Medical Center

Learning Outcome: Be familiar with a hospital-based food donation program to utilize excess food and reduce food waste while addressing food insecurity.

Food insecurity affects more than 35 million Americans. At the same time, over one-third of the food produced in the United States is never eaten, wasting the resources used to produce it and creating significant environmental impacts. In 2015, the United States announced a goal to halve U.S. food loss and waste by 2030. Solutions include efforts to redistribute surplus food where possible. In 2021, Loyola Medical Center began participation in the Food Surplus program to donate excess hospital food to those in need. The goal of this program which began at another local hospital and now includes multiple hospitals in the Chicago area, is to eliminate food waste by creating collaborative relationships between hospitals and identified community needs. Volunteers certified in Food Safety Handling package surplus foods into recyclable containers. In the last six months, Loyola has donated approximately 2400 meals to veterans at a nearby hospital. Trinity Health recently provided a $50,000 grant to continue to expand the program and provide resources to donation sites. This effort to donate surplus food to those in need is an environmentally sensitive, socially responsible alternative to wasting food.

Funding Source: None
Community, Population and Global Health

The Development of Nutritional Literacy Curriculum with Practical Application on Middle School Students

Authors: A. Redmond, G. Bullough, A. Gray, T. Bruen, M. van der Merwe, S. Foley, M. Schallert, K. Cook, M. Petersen, Y. Fleshkin, M. Gill; University of Memphis

Learning Outcome: Identify the impact of a nutrition literacy education program on middle school aged children through hands-on experience and practical nutrition literacy lessons.

Background: Nutrition and food literacy powerfully impacts the eating habits and overall health of an individual. In our nation, adolescents are lacking proper nourishment due to poor food decisions. By targeting the nutrition literacy of students, we can impact the health of a nation through this pivotal age group.

Objective: To determine if a nutrition literacy program tailored to adolescents is positively received and results in a desire to make food choices that include more fruits and vegetables.

Design: A three-week diagnostic validity pilot study gauging the impact of curriculum lessons, recipes, and activities on middle school receptivity and desire to increase fruit and vegetable intake through culinary and nutrition education.

Participants/Setting: Middle and high school students (n=20-55 years, mean age 14) from a diverse urban community participated in the pilot program at the University of Memphis Student Wellness Center. Outcomes: Qualitative measures included student receptivity to programming and receptivity to including more fruits, vegetables, and previously unfamiliar whole foods into their diet. Receptivity was assessed through small group conversational questions and observation.

Results: One hundred percent (100%) of students found the program to be engaging and stated a desire to continue to participate. Themes included, “great class,” “learned a lot,” and “said that it’s over.”

Conclusion: Nutrition literacy is important for the rising generation in improving their future health. This nutrition literacy curriculum design is projected to work successfully in future larger scale community education programs with adolescents due to the success seen in this smaller pilot project.

Funding Source: Funding was sponsored in part by the Campus Community Fund to bring students to the facility by bus and to provide ingredients and utensils for the students for all recipes taught in the Wellness Center and virtually.

The FoodMASTER Initiative Deep South Network: Impacting STEM Education Learning Environments with Food-Based Activities

Authors: M. Duffrin1, D. Holben2, R. Evans1, c. Wang3, D. Burnett3, S. Hines3, A. Baum3, J. De Chabert-Roh3, S. Diaz2, 7Northern Illinois University, University of Mississippi, 7University of Alabama at Birmingham, 7Auburn University, 7University of Georgia, 7University of South Carolina, 7East Carolina University, 7Northeast Ohio Medical University

Learning Outcome: Upon completion, participants will be able to describe a Registered Dietitian Nutritionist-led food-based education network targeting STEM and nutrition education disparities among underserved youth across the Southern United States.

Theory and Previous Research: Food engages learners, improves mathematics and science attitudes, and is conducive to collaborative learning. Research evidence from The Food, Math, and Science, Teaching Enhancement, Resource (FoodMASTER) initiative (FMI) supports the use of food as a teaching tool for STEM.

Program Need, Purpose, and Audience: Underserved youth across the Southern United States lack access to food and STEM education. The purpose of this project was to establish a Deep South Network (DSN) to address gaps in access.

Program Characteristics: The FMI DSN established and maintained a six-university partnership over a period of five years. Each member in the network was charged with creating robust partnerships with existing STEM education infrastructure in their communities and implementing existing FMI curriculum or modifying FMI approaches.

Outcome Evaluation: The network resulted in six new food-based STEM education programs in five States. Each program integrated practice opportunities for university students interested in food-based STEM education, including dietetics interns. Major organizations accessed by the DSN included libraries, art clubs, centers for community outreach, childcare centers, Girl Scouts 4-H, and Boys and Girls Clubs. Each program site collected data on participant satisfaction, attitudes towards science, confidence, and program-specific measures, yielding positive outcomes.

Conclusions: The FMI DSN is a successful model for continuing to impact STEM education learning environments with food-based activities and has served as a useful resource for real-time collaborative approaches led by RDs, educators, and health educators. Implication for Practice: Registered Dietitian Nutritionists (RDNs) can effectively lead collaborative food-based STEM education teams.

Funding Source: National Institute of General Medical Sciences (NIGMS) Science Education Partnership Award (SEPA) at the National Institutes of Health (NIH).

The Middle East Dietetics Needs Assessment: Using Data to Drive Change in Policy, Systems and Environment for Impactful Dietetics Practice

Author: T. El-Kour; Independent Practice

Learning Outcome: Explain how a regional-level dietetics needs assessment serves as a comprehensive tool for evidence-based policymaking in governing the practice of nutrition and dietetics in the Middle East and North Africa.

Creating needs assessment that is useful for policymakers on the practice of nutrition and dietetics in the Middle East and North Africa (MENA) is critical to ensuring that practice decisions are based on workforce and market needs and priorities. Limited understanding of the potential for nutrition and dietetics profession exists with inequitable offering of academic education, training, and support within and across countries in the region. Data on the number of degrees and training in nutrition are old—with some dating back to early 1990. Nutrition is not integrated in the medical curricula. Large variability exists in number of trained nutrition professionals per 100,000 populations with very few countries regularly monitoring the nutrition and dietetic workforce. No database is available to explain the status of nutrition and dietetic registration, regulation, and lifelong learning warranting the need to assess the regional situation, develop a database, and build the advocacy capacity of nutrition and dietetic professionals. The project aims to: 1) identify practice needs and priorities to develop database on status of nutrition and dietetic registration, regulation, and lifelong learning in 17 countries in MENA, 2) design engagement modalities for nutrition and dietetics professionals to advocate for advancing dietetics practice, and 3) address interlinkages between education, training, credentialing (registration, regulation, and legislation), recognition, and policy in support of advancing advocacy outcomes. The project administered semi-structured surveys targeting 34 professionals in 17 countries adapted from the European Federation of the Associations of Dietitians coupled with assessments of peer-reviewed and grey literature.

Funding Source: The project is funded by the Academy of Nutrition and Dietetics Foundation through The Middle East Needs Assessment Policy Grant.

The Role of Session Zero in High School Students Sense of Belonging, Attendance and Learning Outcomes with the Nourishing Smiles Program

Authors: A. Marshall1, B. Jeter2, N. Cruz1, Z. Azebe-Osime1, L. Azebe-Osime1, M. Melchor1, M. Djakic1, J. McWhorter1, A. Edwards1, D. Hernez1; University of Texas Health Science Center, 2University of Houston

Learning Outcome: Describe the association between an informative and motivational session on sense of belonging, attendance and learning outcomes of an oral health and nutrition literacy program.

Background: The Nourishing Smiles program is a skill-based oral health and nutrition literacy program for under-resourced high school students. Peer acceptance and low attendance are barriers to learning and compromise the health benefits of such programs. An informative and motivational session (i.e. session zero) prior to the implementation of the first lesson could be an effective strategy to retain students and consequently enhance learning. The purpose of this study is to examine the association between session zero, sense of belonging, attendance and learning outcomes.

Methods: The 7-week program was implemented in an urban high school March-May 2022. Students who were part of a high school dropout prevention program were eligible to participate in the program. Prior to program implementation, students were invited to a 45-minute informative and motivational session to learn about the program. Students completed a socio-demographic survey that included a sense of belonging scale (Yorke, 2016) and an 8-item questionnaire designed to evaluate the learning objectives pre- and post-programming. Due to small sample size, statistical significance is unobtainable; instead, findings are qualitatively described.

Results: Fifteen students (16 years old (SD=.76), 53% female; 67% Black; 40% food insecure) participated in the program, with 5 students attending session zero. Session zero participants had a greater sense of belonging, attended more of the lessons, and answered more of the pre- and post-programming learning objective questions accurately.

Conclusion: While a session zero may attract more students who feel more supported, session zero is correlated with frequent attendance and facilitates learning.

Funding Source: University of Texas Health Science Center – Houston, Cizik School of Nursing and School of Dentistry Joint Seed Grant

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Video Pals: Community-Engaged Learning Goes Virtual

Author: L. Dinour; Montclair State University

Learning Outcome: Upon completion, participants will be able to describe the purpose, characteristics, and evaluation of a virtual community-engaged learning project implemented in a dietetics course.

The necessary transition from in-person to virtual modalities due to COVID-19 required many faculty to rethink course design to enhance student engagement, learning, and connection. For some, there was an added challenge: how to provide community-engaged learning experiences that are safe, feasible, meaningful, and relevant to course objectives and community-identified opportunities. Given the unpredictability of COVID-19, the Video Pals (VP) intergenerational project was developed at one New Jersey university and implemented in the Applied Community Nutrition course. VP paired a resident of an assisted living facility with 2-3 students for nine weekly Zoom conversations. Discussion topics focused on the social determinants of food behavior over the life course, a primary course concept. Nineteen students and eight residents participated in the program during Spring 2021, and a mixed-methods approach (via pre-post surveys and reflections) was used to evaluate VP. Quantitative survey findings indicate a reduction in student loneliness ($t_{16} = 2.43, p = 0.028$), but no significant change in social connectedness or allophilia (i.e., having positive attitudes toward members of an outgroup; in this case, older adults). Qualitative findings from project evaluations and reflections suggest that students felt more socially connected and became aware of residents’ social isolation, loneliness, and lack of social interaction during VP. Students were also able to apply the social ecological model to their VP to better understand another’s food choices and behaviors. Given that trends like aging, diversity, and technology are driving the dietetics profession, VP offers dietetic students an experiential opportunity to develop appropriate skills for each change driver.

Funding Source: None
A Qualitative Exploration of Programs to Address Food Insecurity During the COVID Pandemic in Detroit, MI

**Author(s):** M. Litton, A. Koosis, A. Hill, A. Beavers; Wayne State University

**Learning Outcome:** Upon completion, participant will be able to describe how food insecurity program operations changed during the COVID-19 pandemic, and to describe facilitators/successes and barriers/challenges to operations of these programs.

**Background:** The COVID-19 pandemic increased the need for food assistance due to surging unemployment, the closure of in-person schooling, and other factors, compounding the pre-existing elevated rates of financial hardship in the city of Detroit, Michigan. This posed a historic challenge to organizations that address food insecurity in Detroit: meeting the surging need for food while minimizing the risk of COVID-19 transmission.

**Methods:** This study aimed to identify how food insecurity program operations changed during the pandemic, and to examine facilitators/successes and barriers/challenges to program operations. Semi-structured interviews were conducted with staff at 13 organizations involved in addressing food insecurity in Detroit during the pandemic. Interviews were coded by two coders who discussed differences and reached coding consensus. Coded data were summarized, then used to create matrices and concept map displays for each organization.

**Results:** Nearly all programs changed to a contactless food distribution format, and most programs also experienced an increase in demand for food. Common successes/facilitators included being able to keep clients and staff safe from COVID-19 and waivers that eased program rules. Common challenges/barriers included the increased need for labor and food. Lack of funding was a barrier for some organizations, while others who experienced an increase in funding reported that it facilitated their work.

**Conclusions:** This research identified needs in programs addressing food insecurity during the COVID-19 pandemic, which can inform future disaster planning. Preparation for times of elevated food insecurity, such as public health or economic emergencies, should include plans regarding labor and food needs.

**Funding Source:** United Way of Southeastern Michigan

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An Evaluation of the Suitability of Food Provided through the Arkansas Foodbank Backpack Program

**Author(s):** A. Landry1, J. Setser1, A. Montgomery1, L. Albritton2; 1University of Central Arkansas, 2Arkansas Foodbank

**Learning Outcome:** Upon completion, participant will be able to describe the perceptions of food suitability from parents of children receiving food from the Backpack Program.

**Background:** The Arkansas Foodbank (ARFB) Backpack Program provides food for children in 33 counties throughout the state whose families are food insecure. Foods include nutritious, cost-effective, easy-to-prepare items though few cultural foods are available and the suitability of the food provisions in Arkansas communities has not previously been described.

**Methods:** The purpose of this study was to determine if the food items offered are suitable and it was part of a larger mixed-methods study designed to comprehensively evaluate the perspectives of site coordinators, parents, and community stakeholders regarding the effectiveness of the ARFB Backpack Program. Links to a validated 35-item electronic survey were provided in each backpack and through a monthly newsletter.

**Results:** Of the surveys completed, 67.4% (n = 29) of the participants felt the foods provided met their child’s food needs at home. More than half reported their child was satisfied with the offerings and that the food provided was enough to last over the weekend. Parents reported worrying less about meeting their child’s food needs (62.8%, n = 27). No cultural barriers were noted by parents.

**Conclusions:** The Backpack Program allows children to have breakfast and lunch on the weekends without parents worrying about providing food. The ARFB must consider cost and availability of items when purchasing food, and adding more cultural items may not fit within cost constraints. Though participants were generally positive about the Program, more could be done to make it accessible to a more diverse population.

**Funding Source:** None

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Assessment of Nutrition Literacy and Knowledge Among Rural Midwestern Schoolteachers

**Author(s):** J. Hagen1, M. Chrisman1, N. Marchello1, A. Skarbek1, M. Haster1, P. Endsley1; 1University of Missouri-Kansas City, 2University of Central Missouri, 3University of Kansas Medical Center, 4Wells High School

**Learning Outcome:** Upon completion, participant will be able to describe the level of nutrition literacy and knowledge among rural Midwestern schoolteachers and potential associations between them.

**Background:** Rural communities have fewer supports for nutrition education which could affect diet quality of students and families. It is unknown the degree of nutrition literacy and knowledge that rural teachers possess to deliver information to their vulnerable students.

**Methods:** Cross-sectional online survey administered in March-April 2022 to teachers from seven rural Midwest school districts. The survey includes the validated 64-item Nutrition Literacy Assessment Instrument and 20 nutrition knowledge questions from the US Department of Agriculture’s MyPlate website. Descriptive statistics, bivariate correlations, and Mann-Whitney U tests were conducted to examine nutritional literacy and knowledge and their associations with significance set at P < .05.

**Results:** A total of 135 schoolteachers participated. The majority were female, white, taught at the elementary level, and averaged 10.7 (SD 8.3) years teaching experience. 57.5% never had nutrition education/training and only 37.8% included nutrition content in lesson plans. Average nutrition literacy scores were 45.8 (out of 64; SD = 7.2); average nutrition knowledge scores were 14.25 (out of 20; SD = 2.9). Nutrition literacy and knowledge were significantly correlated (Spearman’s r = .52, p < .001). Having some nutrition training compared to none was not associated with literacy or knowledge.

**Conclusion:** Nutrition literacy scores of ≥ 44 are associated with poor diet quality; sampled teacher scores here bordered that cutoff. These generally low nutrition literacy and knowledge scores are concerning given that schools are required to provide nutrition education as part of national school meal programs. Dietetic professionals could contribute to enhancing nutrition literacy and knowledge among Midwestern rural schoolteachers.

**Funding Source:** University of Missouri-Kansas City Funding for Excellence program

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Assessing Body Measurements, Nutritional Behaviors, And Sleep Behaviors Following Implementation of mHealth in Appalachian State University College Students

**Author(s):** J. Griffin1, A. Lockard1, M. Gutchall1, B. Belcher1; 1Appalachian State University, 2Atrium Health, 3Beaver College of Health Sciences, Appalachian State University

**Learning Outcome:** Upon completion, participants will be able to assess the potential impact of a mHealth-based health behavior and weight management intervention on college students. Chronic diseases such as obesity are common in college students. College students struggle to develop strategies to maintain healthy weight and lifestyle behaviors. mHealth programs are accessible to college students’ schedules. My Quest in the High Country collaborated with Appalachian State University (ASU) Student Health Services and the Blue Cross Institute for Health and Human Services Interprofessional Clinic to create a 24-week mHealth intervention to improve weight status, health behaviors and biometrics in ASU students. Recruitment of ASU students occurred through flyers, social media, and email. During pre-assessment, participant eligibility, informed consent, biometrics and health behaviors were collected. From weeks 1-12, participants received text messages (n = 2/day), eNewsletters (n = 1/week), and physical activity feedback. At midpoint, Fitbits were returned and biometrics were taken. From weeks 13-24, text messages and eNewsletters continued. At post-assessment, biometrics and post-assessment surveys were collected. Statistical analyses included Wilcoxon Signed Rank, McNemar, paired t-test, and descriptives. Significance was set at P < .05. Participants (n = 11) were female (72.7%), non-Hispanic (82%), and Caucasian (64%), with a mean age of 23.4. Significant (p < .05) improvements were observed in body weight, BMI, diastolic blood pressure, fruit and vegetable intake, and sedentary time. No significant changes occurred in systolic blood pressure, step count, physical activity minutes, or sleep score. mHealth interventions in college students may positively impact health and behavior change. Progress dropped after returning the Fitbit at week 12. In future studies, a larger student email list may increase sample size and participant diversity. Wearing the Fitbit for 24 weeks is preferable.

**Funding Source:** Appalachian State University Chancellor’s Innovation Scholar’s Program award
Association between Food Insecurity and Perceived Stress in College Students: A Prospective Study

Author(s): A. El Zein1, S. Colby2, W. Zhou1, K. Shelnut3, G. Greene4, A. Mathews5
1University of Alabama at Birmingham, 2University of Tennessee, 3University of Florida, 4University of Rhode Island

Learning Outcome: Upon completion, participants will be able to describe perceived stress among U.S. college students with varying food insecurity exposures over four academic years.

Background: Food insecurity (FI) is a public health problem among college students with prevalence estimates ranging from 14 to 65%. Despite a growing body of literature indicating an association between FI and poor mental health, no studies to date have examined the association between repeated exposures to FI and perceived stress in college students.

Objective: To determine the association between multiple reports of food insecurity and perceived stress.

Methods: A prospective study was conducted between April 2016 and April 2019 among students across eight U.S. universities. Participants (n = 228) completed the USDA Adult Food Security Survey at the end of every academic year (1-4), and Cohen’s Perceived Stress at the end of their senior year. One-way ANOVA with Tukey post-hoc test examined differences in perceived stress by FI exposures (never food insecure, once, twice, thrice, and four times).

Results: There were statistically significant differences between group means (F(4,219) = 5.498, p < 0.001). Compared to students never experiencing FI, mean perceived stress was significantly higher among students reporting FI four times (32.25 ± 7.7, p < 0.001), thrice (28.27 ± 5.81, p = 0.03), twice (28.26 ± 8.8, p < 0.01) but not for once (26.82 ± 5.77, p = 0.05). Students who never reported FI had the lowest perceived stress score (24.08 ± 7.44).

Conclusions: Repeated exposure to FI during the college years is associated with increased perceived stress. School initiatives and policy measures are needed to mitigate FI and its potential impact on mental health.

Funding Source: This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2014-67001-21851. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.

Baseline Diet Quality Using the Healthy Eating Index-2015 for African American Girls in an Online Obesity Prevention Program

Author(s): C. Callender1, B. Johnson1, S. Musaad1, D. Thompson2, 1Baylor College of Medicine, 2USDA/ARS Children’s Nutrition Research Center, Baylor College of Medicine

Learning Outcome: Upon completion, participant will be able to learn about diet quality in pre-adolescent African American girls and understand what factors may influence diet quality.

Background: Diet-related disparities exist, and diet quality is lower for African American girls compared to their white peers. These disparities increase obesity and chronic disease risk for African American girls. The purpose of this research was to report baseline diet quality using Health Eating Index (HEI)-2015 among 8-10-year-old African American girls in an online obesity prevention program.

Methods: Cross-sectional analysis of baseline data collected on 342 African American girls and their parent were used. Two 24-hour dietary recalls were used to assess dietary intake for the girls. Descriptive statistics were computed and ANOVA was used to compare differences in HEI-2015 and its 13 components with the demographic characteristics.

Results: The mean HEI-2015 total score was 53.58. The mean scores for total vegetables (1.21±0.76), total fruit (1.51±1.12), whole fruit (1.39±1.21), and whole grains (1.96±1.8) were low. The mean scores for refined grains (8.85±1.37), sodium (8.83±1.42), added sugars (9.07±1.17), and saturated fats (7.39±2.16) were high. Significant differences were found in the total HEI-2015 score (p=0.0239) and saturated fats (p=0.0165) for highest household education level, and significant differences were found in fatty acids (p=0.0391) and added sugars (p=0.0083) for marital status.

Conclusion: Understanding diet quality for 8-10 year old African American girls can provide insight on how to reduce disparities in diet quality and how to move forward in the development of nutrition education programs and resources for African American families.

Funding Source: National Institute on Minority Health and Health Disparities Grant [#MD005814]

Association Between Socio Demographic Characteristics, Renal and Liver Function Parameters Among Non-Pregnant, Non-Lactating Women in Selected Areas of Bangladesh

Author(s): A. Shamim1, M. Akhtaruzzaman2, S. Sarwar2; 1BRAC James P Grant School of Public Health, BRAC University, 2Institute of Nutrition and Food Science, University of Dhaka

Learning Outcome: Upon completion, the participants will be able to recognize the status of renal and liver function parameters of Bangladeshi women

Background: The goal of this study was to determine the level of markers of kidney function (serum creatinine, urea, uric acid) and liver function (alanine aminotransferase (ALT) and aspartate aminotransferase (AST) in non-pregnant, non-lactating women (NPWL) in selected areas of Bangladesh. Studies were excluded if data contained only to specific foods (e.g., sweets). We conducted thematic synthesis of study findings, involving line-by-line coding and development of descriptive and analytical themes.

Methods: Participants were selected from (c)ite number and rural/urban districts from the participants of a Nutrition, Health and Demographic Survey of Bangladesh 2011. Socio-demographic data were collected using a structured questionnaire. Serum samples were analyzed using a semi-auto biochemistry analyzer.

Results: We enrolled 100 NPWLs ranging in age from 14 to 49 years old. The median (IQR) of serum urea (mg/dL), creatinine (mg/dL), uric acid (mg/dL), ALT (U/L), AST (U/L) were 16.78(11.81,27.31) 0.84(0.67,1.02) 5.57(4.47,7.13) 31.76(26.13,39.22) 27.72(20.63,37.94). High serum urea, creatinine, and uric acid levels were observed among 11% 14% and 37% of the participants. High levels of ALT and AST were observed among 3% and 26% of the women. According to Spearman’s correlation serum urea, ALT, AST, and uric acid levels were significantly (p<0.05) correlated with family income. In a model adjusted for age, BMI, marital status, monthly income of the family, the odds of having high uric acid, urea, AST were significantly (p<0.05) 7.64 times 14.12 and 6.21 times higher in families with highest income than low-income families.

Conclusion: High-income families had an elevated propensity of having increased Urea, Uric acid, ALT, AST levels which should be monitored properly.

Funding Source: None

Association Between Small, Snacks and Their Definition: A Thematic Synthesis of Qualitative Studies

Author(s): A. El Zein 1, S. Colby 2, W. Zhou1, K. Shelnut3, G. Greene4, A. Mathews5; 1BRAC James P Grant School of Public Health, BRAC University, 2Institute of Nutrition and Food Science, University of Dhaka

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Background: The goal of this study was to determine the level of markers of kidney function (serum creatinine, urea, uric acid) and liver function (alanine aminotransferase (ALT) and aspartate aminotransferase (AST) in non-pregnant, non-lactating women (NPWL) in selected areas of Bangladesh. Studies were excluded if data contained only to specific foods (e.g., sweets). We conducted thematic synthesis of study findings, involving line-by-line coding and development of descriptive and analytical themes.

Methods: We searched four databases for peer-reviewed qualitative studies including caregiver definitions of “snacks” for children ≤5 years. Studies were excluded if data pertained only to specific foods (e.g., sweets). We conducted thematic synthesis of study findings, involving line-by-line coding and development of descriptive and analytical themes.

Results: Our search yielded 651 articles (duplicates removed). Eight met inclusion criteria. Most caregivers were from racial/ethnic minority groups (67%). Most US families were WIC- and/or SNAP-eligible (≥80%). Data synthesis revealed five interrelated domains (food type, portion size, time, purpose, hedonic value) and four themes. Caregivers described snacks as unhealthy foods that their children highly liked and that should be restricted. Caregivers used snacks to manage behavior and curb hunger. Snack portions were described as “small,” with the caregiver or child determining appropriate portions.

Conclusion: Caregiver definitions of snacks appear misaligned with child nutrition and feeding recommendations, including those related to healthy diets and responsive feeding. Interventions, especially for at-risk groups, should align caregiver definitions of snacks to those for healthy eating. There is opportunity to reframe “snack” in future research, nutrition guidelines, and communications.

Funding Source: None
Changes in Diet Quality and the Home Food Environment: A Food Skills Intervention

Author(s): A. Fultz, K. Burns, A. Verdezoto Alvarado, S. Robson; 1University of Pennsylvania, 2University at Buffalo, 3University of Delaware

Learning Outcome: Upon completion, participant will be able to recognize the importance of food skills in relation to diet quality and the home food environment.

Background: Adults and children in the U.S. are not meeting dietary recommendations. Diet quality is poor and characterized by the under-consumption of nutrient-dense food and the over-consumption of energy-dense food. Innovative interventions targeting all members of the household are needed to improve diet quality. Food skills, defined as meal planning, meal preparation, food shopping, budgeting, resourcefulness, and label reading/consumer awareness, are behaviors identified by parents to aid in the creation of healthy family meals and have been associated with diet quality.

Methods: An eight-week food skills intervention was conducted to evaluate impact on diet quality and the home food environment (HFE). The food skills intervention was centered on behavior modification strategies, based upon the Social Cognitive Theory, as utilized in behavioral lifestyle interventions.

Results: A total of thirty parents (37.3 ± 8.6 years; 93.3% female; 56.7% White) participated. Diet quality, as measured by HEI-2015 total score, did not significantly change over time (Baseline: 61.1 ± 13.0; Final: 57.7 ± 11.0, p = 0.16). Within the HFE, one aspect of the social HFE, family meals, significantly increased over time (Baseline: 5.2 ± 1.9; Final: 5.8 ± 1.5, p = 0.03).

Conclusion: The food skills intervention increased family meals, however, there was no change in diet quality or the physical HFE. Given the interconnections between food skills and family meals, future research should include a meal quality component within an intervention to examine impact on diet quality.

Funding Source: This research was funded by the Summer Doctoral Fellowship Award from the University of Delaware Graduate College.

Changes in Physical Activity Levels and Sitting Time Among Predominately Hispanic/Latino University Students Before and One Year Into the COVID-19 Pandemic

Author(s): K. Gottesman, S. Garcia, Y. Jia, B. Robles, T. Kuo, K. Hillstrom; 1California State University, Los Angeles, 2Rutgers University, 3Research Group on Statistics, Econometrics and Health (GRECS), University of Girona, 4UCCLA and Public Health

Learning Outcome: Identify the changes in physical activity levels and sitting time among a predominately Hispanic/Latino student population at a large U.S. public university before and one year into the COVID-19 pandemic.

Background: Physical activity (PA) guidelines encourage adults to be physically active and to reduce the amount of time they spend sitting. Yet, among university students, emerging evidence suggests that the COVID-19 pandemic has adversely impacted PA and sitting time (ST). To better understand this issue and help inform future campus programming, we collected information about these two health behaviors.

Methods: A cross-sectional online survey was distributed to students at a large public university in the United States from April-May 2021. Participants were recruited via email: 1229 students responded to a Survey Monkey questionnaire. The comprehensive survey instrument captured health behaviors before the pandemic and about one year into the pandemic. Specific questions related to PA (walking, moderate and vigorous activities) and ST were self-reported using the International Physical Activity Questionnaire-short form. Other participant characteristics were also captured (e.g., sociodemographics). Descriptive statistics were analyzed using paired t-tests and one-way ANOVA.

Results: Most survey participants were female (75.6%), Hispanic/Latino (60.2%), and about 25 years old. Before the pandemic, mean PA was 153.3 minutes/week and mean ST was 1429.1 minutes/week. About one year into the pandemic, mean PA was 261.6 minutes/week and mean ST was 1805.2 minutes/week (p < 0.001). PA levels were significantly higher for males than females at both time points. Significant racial/ethnic differences in ST were also observed prior to the pandemic (p < 0.005).

Conclusion: The negative trends in PA and ST during the COVID-19 pandemic suggests a need to encourage these students to sit less and adhere to recommended PA guidelines.

Funding Source: None

Consumption of an Ultra-Processed Diet Negatively Alters Biomarkers of Metabolic Health Compared to An Unprocessed Diet: A 4-Week Randomized Controlled Diet

Author(s): J. Cloward, S. van vliet; Utah State University

Learning Outcome: Upon completion, participants will be able to list health markers (metabolite profiles, inflammatory biomarkers, anthropometrics) that improved following an intervention diet consuming whole foods.

The American Diet is characterized by high amounts of ultra-processed foods. Ultra-processed foods are industrial formulations that are typically high in refined grains, added sugars, fats, and sodium while being low in fiber, vitamins, minerals, and phytochemicals. Previous work found that consumption of ultra-processed diets worsened biomarkers of metabolic health; however, it is currently unknown whether this due to excessive caloric intake or is the result of the diet being ultra-processed. The goal of this study was to determine the effects of a 28-day energy-controlled unprocessed vs. ultra-processed diet on biomarkers of metabolic health in middle-aged adults (35-60 y old; n = 13) who are overweight or obese (BMI: 25-35 kg/m²) using a randomized cross-over design with a 14-day washout in between. All meals/snacks were provided to participants using 4-day rotating menus; no other foods were allowed. Triglyceride concentrations decreased from basal (24.7 mg/dl, p < 0.05) in the unprocessed group, but not in the processed food group (0.5 mg/dl, p > 0.05). Significant reductions in cholesterol was only found in the unprocessed group (-12.5 mg/dl, p < 0.05). Interleukin-6 (IL-6), a marker of inflammation, decreased in the unprocessed group (-34 ng/ml, p < 0.001), but not in the processed group (-16 ng/ml, p > 0.05). The consumption of an unprocessed American diet as compared to an ultra-processed diet, matched closely for food groups, improves various biomarkers of metabolic health when compared to basal. This suggests that the consumption of ultra-processed foods is contributing to metabolic health issues independent of energy control.

Funding Source: North Dakota Beef Commission

COVID-19 Taste/Smell Changes: Impact on Dietary Intake & Potential Coping Strategies

Author(s): C. Cobabe, A. Weeden; Idaho State University

Learning Outcome: Upon completion, participants will be able to recognize the need for individualized nutrition interventions and implementing coping strategies for patients and clients suffering with taste and smell alteration from COVID-19.

Background: Smell/taste changes have been a common side effect with COVID-19 infection. As aroma and flavor of food are key contributors to food preferences, and play a role in food choices it is likely changes will impact dietary intake. Both quality and quantity of food may be impacted as preferences and appetite are affected. The purpose of this study was to identify dietary changes resulting from smell/taste alteration due to COVID-19 infection and explore potential coping strategies for those suffering with taste/smell changes.

Methods: Data was collected through two focus group sessions. Participants (n = 13) answered questions regarding their experience with taste and/or smell changes. The focus groups were recorded and transcribed. The transcriptions were used to identify and code themes.

Results: Participants in this study reported alterations to food preferences and/or intake as a result of smell/taste changes related to COVID-19. Common themes noted by participants included reduced appetite, decreased desire to eat, and lack of pleasure in eating. Other identified themes included weight changes, new textural sensitivities, and the avoidance of previously enjoyed foods. Several participants also expressed changes to their mental health, especially when smell/taste alterations lingered for months.

Conclusion: Smell/taste changes associated with COVID-19 can negatively affect dietary intake and mental health. While common themes emerged from the focus groups, each participant had their own experience with smell/taste changes. To help preserve nutritional status and assist in recovering some enjoyment of eating, an individualized approach should be taken to address the taste and smell changes experienced.

Funding Source: Private: Two $25 participation incentives provided by the principal investigator.
Detroiters' Food Needs and Perceptions of Food Assistance Programs During the COVID-19 Pandemic

Author(s): A. Koosis, M. Litton, A. Hill, A. Beavers; Wayne State University

Learning Outcome: Upon completion, participant will be able to identify perceptions of food assistance programs and how to better meet food needs in Detroit during the COVID-19 pandemic.

Background: The COVID-19 pandemic has caused a rise in food prices and unemployment, making it more challenging to meet basic food needs. This is particularly concerning because not only has COVID-19 affected Detroit more than any other area of the state of Michigan, but 39% of Detroit households reported experiencing food insecurity before the pandemic. This study aims to examine Detroiters’ perceptions of food assistance programs, and what would help them better meet food needs.

Methods: An online survey was completed by 654 Detroit residents in 2022. Respondents were asked an open-ended question about what would help to meet food needs. Those who indicated using food pantries or SNAP in the last year were asked open-ended questions about their experiences using each program. Responses were coded by two coders, who discussed coding differences and reached consensus.

Results: To better meet food needs, Detroiters reported needing more food stores, lower food prices, food delivery, greater availability of healthy food options, and more resources to cover the cost of food. Although many Detroiters felt that both SNAP and food pantries were helpful, some SNAP recipients reported that the benefits were not enough or that they had stopped or decreased. Some food pantry users reported being given expired food or not having transportation to food pantries.

Conclusion: These findings indicate that despite current efforts to ensure adequate food assistance during the COVID-19 pandemic, there are still gaps in meeting Detroiters' food needs that need to be addressed.

Funding Source: United Way of Southeastern Michigan

Dietary Diversity in Infancy Is Associated with Linear Growth in The Second Year of Life

Author(s): S. Foster, R. Rickman, A. Nichols, S. Collins, J. Miller, M. Onono, P. Wekesa, S. Young, E. Widen; The University of Texas at Austin, Tulane University, University of North Carolina at Chapel Hill, Kenya Medical Research Institute, Northwestern University

Learning Outcome: Upon completion, participant will be able to describe how dietary diversity contributes to growth in low- and middle-income settings. Despite the high prevalence of undernutrition among young children in low- and middle-income settings, few studies have examined how dietary diversity and adequacy during the complementary feeding period impacts subsequent growth and body composition. We therefore examined associations between dietary diversity (DD, range 0-7) and minimum DD (MDD, DD >4) at 9 months of age with subsequent growth trajectories (up to 23 months of age) among a cohort of infants in Nyanza, Kenya. Infants (n=212) are from the Piti Moromo study, a prospective maternal-infant cohort in Kenya. Repeated measures of infant DD and growth were obtained at 9, 12, 15, and 23 months. Multiple linear regression models were used to examine the relationship between DD (continuous and dichotomous) and weight-for-age (WAZ), length-for-age (LAZ) and weight-for-length (WLZ) scores from 9 to 23 months, adjusting for infant age, breastfeeding, food insecurity, maternal HIV status, and other covariates. At 9 months, mean DDS was 3.38 ± 1.81 (SD) met MDD, and mean LAZ, WAZ, and WLZ were -0.63 ± 1.27, -0.10 ± 1.22, and 0.38 ± 1.29, respectively. In adjusted models, meeting MDD compared to DD <4, was associated with higher LAZ across time (β=0.34, CI:0.05-0.64), but MDD was not associated with WAZ or WLZ. Similar patterns were found with continuous DDS. While minimum dietary diversity was positively associated with linear growth from 9 to 23 months, it was not associated with weight or relative size. Future studies should evaluate how to increase the dietary diversity of infants at risk for stunting.

Funding Source: NIH/NIMH K01MH098902; NIH/NICHD K00/R00 HD086304; NIH/NIDDK T32DK091227; T32DK07559; PepsiCo Global R + D unrestricted grant to support maternal and child health research.

Examination of the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) use and infant feeding choices

Author(s): I. Ramos-Castillo, M. Hernandez, C. Frazier Chapman, A. Raynor, J. Dharod; The University of North Carolina at Greensboro

Learning Outcome: Upon completion, participant will be able to describe how food access affects infant feeding practices in the household at the beginning versus the end of the monthly WIC benefit cycle.

Background: More than half of the infants in the United States benefit from food assistance provided through WIC. The study objective was to understand the utilization of WIC-approved items and the association with infant feeding choices at a monthly level.

Methods: Mothers of 7-12-month-old infants were interviewed to collect information on the use of WIC-approved food items for infants. Along with the interview 24-hour recalls were conducted at the beginning and end of the WIC benefit cycle using the NDSR program (n = 50). Analyses were conducted to estimate overall feeding choices and any differences in feeding patterns and choices between the beginning and end of the benefit cycle.

Results: At 7-months and onwards 90% of the infants were receiving formula-fed WIC packages. Participants reported purchasing 7 cans of 12.4 ounces powdered formula 24 ounces of infant cereal, and 129 ounces of jars of fruits/vegetables. About half of the participants (59%) reported shopping for WIC food all at once. Intake of jars and fruits and vegetables was more common at the beginning of the WIC benefit cycle compared to the end of the month.

Conclusion: WIC plays a critical role in ensuring formula affordability for low-income households. Cyclical pattern in feeding choices is likely to occur between the beginning and end of the WIC benefit cycle. An in-depth investigation of monthly changes in the supply of infant formula and related foods is critical in understanding if inconsistent access to food or food insecurity occurs for infants at a monthly level.

Funding Source: 1R15HD095261-01A1 (NH-NICHD)
Exploring Differences in Diet Quality, Traditional Foods Consumed, and Acculturation among Mexican and Cuban Immigrants

Author(s): A. Erickson, N. Omran, S. Meister, S. Udarbe, H. Hinton, L. Lightner, D. Breuer, H. Norman-Burgdoff, J. Plascencia; 1Veterans Affairs - Milwaukee, WI, 2University of Kentucky, 3Commonwealth of Kentucky

Learning Outcome: Upon completion, participants will be able to describe differences in diet patterns of two Latinx ethnic groups.

Background: The diet of Latinx immigrants varies based on country of origin, cultural food practices, and food access. Limited dietary data exists on Latinx living in new settlement areas. The purpose of this study is to describe the differences in diet quality, foods, and acculturation among Mexican and Cuban immigrants in a new settlement area.

Methods: Participants were recruited for a cross-sectional study from three community clinics that serve large numbers of Latinx immigrants in a Southern U.S. state. One 24-hour dietary recall, level of acculturation, and demographics were collected. Content analysis of 24-hour recalls was completed to categorize foods into traditional cultural, universal, and convenience foods. NDSR was used to compute the 2015 Healthy Eating Index (HEI).

Results: Of the 102 participants, 66 were Mexican immigrants and 36 were Cuban immigrants. Mexican immigrants had higher acculturation scores and had lived longer in the U.S. Cuban immigrants were more likely to have a higher education. Mexican immigrants had a significantly higher total HEI, 59.5 vs. 53.4 for Cuban immigrants (p < 0.003); Mexican immigrants reported consuming 37.7% of traditional cultural foods compared to Cuban immigrants, 14.2% (p < 0.001). Acculturation correlated with the consumption of convenience foods among Mexican immigrants but was not correlated with the food categories for Cuban immigrants.

Conclusion: Findings suggest the relationship between acculturation and the diet of Latinx ethnic groups varies. Further research should consider how access to traditional cultural foods and convenience foods impact diet quality of Latinx immigrants in new settlement areas in the U.S.

Funding Source: None

Feasibility of Online Tailored Messaging and Goal Setting on Short-Term Dietary and Oral Health Behavior Change in Young Children

Author(s): J. Lerner, V. Duffy; 1University of Connecticut, Department of Allied Health Sciences, 2UCONN/CAINR/Allied Health Sciences

Learning Outcome: Describe how an online tailored messaging and goal setting program is feasible for short-term dietary and oral health behavior change in young children.

Background: Caregiver-guided healthy behaviors support optimal growth and oral health in children. We tested the feasibility of an online intervention following the information-motivation-behavior (IMB) framework to promote healthier diet and dental behaviors in preschoolers.

Methods: Low-income caregivers were recruited through agency partnerships into an IMB-focused online survey and tailored message program and then virtual goal setting session with 5 weekly follow-up messages and surveys to encourage improvements in their child's diet and dental behaviors. Feasibility, the primary outcome, was assessed by practicality (attrition), acceptability (satisfaction), and limited efficacy (improved knowledge, motivation, and behavioral skills to promote behavior change). Pre-post changes in survey-reported knowledge and health behaviors were analyzed, including frequency of child's intake scored into a diet quality index.

Results: The online survey and message program was completed by 133 caregivers; 84 online-reported interest in goal setting with 47 completed. Final follow-up was completed by 41. Most caregivers (37 of 41) enjoyed the weekly messages. Although pre-post improvements missed significance (p < 0.091), results of the weekly messages were helpful for goal completion. Caregivers reported a significantly higher total HEI, 59.5 vs. 53.4 for Cuban immigrants (p < 0.003); Mexican immigrants reported consuming 37.7% of traditional cultural foods compared to Cuban immigrants, 14.2% (p < 0.001). Acceptance correlated with the consumption of convenience foods among Mexican immigrants but was not correlated with the food categories for Cuban immigrants.

Conclusion: Findings suggest the relationship between acculturation and the diet of Latinx ethnic groups varies. Further research should consider how access to traditional cultural foods and convenience foods impact diet quality of Latinx immigrants in new settlement areas in the U.S.

Funding Source: None

Food Security and SNAP Awareness in Missouri College Students

Author(s): A. Cullers, M. Chrisman, C. Rodman, A. Gremaud; 1Missouri Southern State University, 2University of Missouri, Kansas City, 3University of Missouri Extension, 4Independent Contractor

Learning Outcome: Upon completion, participants will be able to describe the relationship between food insecurity in college students, list primary barriers to and facilitators for SNAP access.

Background: Food insecurity in college students has been reported to be 20-50%, yet few college students participate in federal programs like the Supplemental Nutrition Assistance Program (SNAP). The objectives of this project were to: 1) assess food insecurity in college students among multiple types of higher education institutions in Missouri; 2) assess students’ knowledge of SNAP; and 3) identify students’ perceived barriers to and facilitators for SNAP access.

Methods: These objectives were assessed via online survey disseminated to 9 higher education institutions across Missouri, which included public universities, private and community colleges, and tech schools.

Results: A total of 844 students completed it. 44.5% reported low or very low food security, and 46.2% reported their food access had been reduced since COVID-19 began. Food insecurity was most prevalent in public universities (57.8%) compared to Black (40%), private (22%), community (29.9%), and tech schools (38%) which significantly differed (p < 0.001). 32.1% did not know what SNAP is, 58.3% did know if they were eligible for SNAP, and 54.6% did not know how to enroll in SNAP. Top barriers to enrolling in SNAP were lack of knowledge, not eligible, and negative stigma associated with enrolling in SNAP. Top facilitators for enrolling in SNAP included university assistance, available campus resources, and easy ability to determine eligibility.

Conclusion: Findings demonstrate wide prevalence of food insecurity in Missouri college students and reveal barriers to overcome along with potential facilitating factors that colleges and SNAP outreach programs could target to improve food security among students.

Funding Source: Falls-Beck Foundation of the New York Community Trust

Food Pantry Program Evaluation: What Barriers Do Students Face to Access On-Campus Food Pantries?

Author(s): F. Brito Silva, W. Wang, C. Moore, C. Warren, PhD, D. Miketinas, W. Tucker, K. Davis; Texas Woman’s University

Learning Outcome: Upon completion, participants will be able to list the barriers college students face accessing the on-campus food pantries.

Background: Little was known about food pantry use and barriers in higher education.

Purpose: The purpose of this study was to explore barriers Texas Woman’s University (TWU) Denton students faced to utilizing the on-campus food pantries.

Methods: This cross-sectional, survey-based study was conducted in Fall 2021. TWU students use of on-campus food pantries and barriers to utilization, including qualitative questions, were evaluated using descriptive statistics and thematic analyses.

Results: Undergraduate and graduate students (n = 529) completed the survey. Despite a high prevalence of food insecurity (49.2%), most students reported never using the on-campus food pantries (89.8%), and almost half of students were unaware that the food pantries existed on campus (47.8%). More than one in four students believed that there were barriers to accessing on-campus food pantries. They listed time issues, lack of transportation, limited food pantry hours of operation, and social stigma as major barriers.

Conclusion: Reducing food insecurity among college students requires more than providing food assistance. Social stigma must be addressed to improve pantry use. This study identified several barriers to accessing on-campus food pantries that can be generalized to other institutions and used as a reference for change. At TWU, the pantries can use these findings to address major barriers, for example by offering after-hours access through the libraries or campus police, partnering on public transportation, and normalizing accessing food assistance.

Funding Source: TWU Health and Wellbeing Initiative, TWU Research Enhancement Program
How Does Nutritional Knowledge of Postpartum Women Participants of the Special Supplemental Nutrition Program for Women Infants and Children (WIC) Program Relate to BMI?

**Author(s):** J. Leon, S. Mata-Ruiz, P. Sha; 2Viebrock University, 2Center of Excellence for Eating Disorders at Denver Health, 2Metropolitan State University of Denver

**Learning Outcome:** Upon completion, participants will be able to understand the relationship between nutrition knowledge of WIC-participants and Body Mass Index (BMI) in women postpartum in a nationally represented secondary data set.

**Background:** Higher BMI in pregnancy has been associated with gestational diabetes, childhood obesity, and complications during labor. From 2011 to 2015, 50% of pregnant women had an above normal-range BMI, leading to difficulties with postpartum weight retention. Nutritional knowledge provided to pregnant and postpartum women has shown to have positive effects on their health.

**Methods:** Nutritional knowledge and WIC-participation data were gathered through the 2013-14 National Health and Nutrition Examination Survey (NHANES). The variables chosen were non-pregnant postpartum women, enrolled in WIC, aged 18-40. Nutritional knowledge was quantified using three NHANES variables (1)knowledge of MyPlate, (2)how healthy they believe their diet was, and (3)how many meals ate outside home. Correlational analysis was conducted using STATA.

**Results:** The women (N=45) were found to be 27.5±5.38 years old, majority were high school graduates or equivalent (n=14/45 31.1%), married (n=21/45 46.7%), and had been pregnant more than 3 times (n=24/45 53.32%). Average BMI was 30.9±8.99kg/m², and only 14 individuals (31.1%) had heard of MyPlate. Bivariate analysis showed that knowledge of MyPlate negatively correlated to BMI (r=0.214), how healthy diet belief vs. BMI (r=0.0381), and meals ate away to BMI (r=0.0034), none with statistical significance.

**Conclusion:** Pregnancy and postpartum are important times, so providing proper nutritional education is crucial. Although findings are inconclusive, the low rates of knowledge of MyPlate and high average BMI is concerning, warranting the need for providing robust nutrition education. Future experimental studies should be organized to investigate if nutrition education provided under WIC affects postpartum mother’s BMI/weight status positively.

**Funding Source:** Masters Program at [Name of University, blinded for review] Internal Funds

Identifying Uses of Social Media Among Nutrition Professionals

**Author(s):** C. Woolley, K. Eck, A. Carignan, G. Lippincott; Marywood University

**Learning Outcome:** Upon completion, participant will be able to describe how Registered Dietitians (RDs) and nutrition professionals utilize social media (SM) in professional and personal capacities.

**Background:** SM platforms have nearly tripled their user base in the past decade. Nutrition topics are frequently discussed on SM by both nutrition professionals and individuals lacking formal nutrition education. Little information is available regarding how nutrition professionals as a whole are using SM platforms. This study explores how RDs utilize social media professionally and personally.

**Methods:** In total 27 interviews were conducted with nutrition professionals (93% RDNs 89% female). Interviewees were asked a series of questions created de novo including questions on social media use. Interviews were recorded and transcribed verbatim. The data were coded individually by 2 researchers to identify the most frequent themes, and a third researcher reviewed the themes and addressed any discrepancies.

**Results:** Of the 27 RDs interviewed 52% (n=14) used SM and 48% (n=13) reported no use of SM. RDs reported using SM to stay up to date with research in their respective fields (37%), personal use (e.g., leisure, non-professional use) (37%), use of employer accounts with and without personal involvement (22%), and sharing educational content (e.g., infographics, recipes) (18.5%), and advertising and promoting services (7%).

**Conclusion:** Overall, RDs are more likely to use SM to obtain information than provide information. With the prevalence of misinformation from individuals without formal education, the general public may benefit from more nutrition professionals providing reliable information.

**Funding Source:** None

Later Sleep Onset Associated with Added Sugar and Saturated Fat Intake Among Preschool-aged children

**Author(s):** A. Abdollahi, E. Roos, I. Merikanto, X. Li, H. Vepsäläinen, R. Lehto, M. Erkkola, L. Korkalo; 1University of Helsinki, 2Folkhälsan Research Center, 6City University of Hong Kong

**Learning Outcome:** Upon completion, participant will be able to describe associations between sleep measures and diet among young children.

**Background:** Sleep and diet are cornerstones in childhood health. To better understand the relationship between the two, this study investigated associations between sleep measures and diet composition among preschool-aged children.

**Methods:** This cross-sectional study included 714 (83% of total) 3-6-year-olds with sleep data (≥2 weekdays and ≥1 weekend) from the Increased Health and Wellbeing in Preschools (DAGIS) study in Finland. Sleep was measured with hip-worn actigraphy. Nighttime sleep measures were dichotomized at 10h for sleep duration, 9pm for sleep onset, and 85% for sleep efficiency (percentage of time asleep during sleep duration).

**Results:** Intake of carbohydrate, fat, protein, added sugar, saturated fat (SFA), polyunsaturated fat (PUFA), and monounsaturated fat (MUFA) as percentage of energy intake were measured via 3-5-day food records. Linear regression models were adjusted for age, sex, and parental education level.

**Conclusions:** Of the preschoolers (48% girls) aged 4.7±0.9 years 63% had < 10h sleep duration 28% sleep efficiency < 85%, and 66% sleep onset >9pm. Intakes (mean±SD) were 49±4.9% for carbohydrates 16±2.4% for protein 32±4.5% for fat 94±4.3% for added sugar 12±2.5% for SFA 4.9±1.2 for PUFA, and 11±1.8 for MUFA. Neither sleep efficiency nor duration were associated with any dietary components. Multivariable-adjusted β-estimates regarding later sleep onset were 0.76 for added sugar (95%C.I: 0.09 1.43,P=0.03) and 0.40 for SFA (95%CI: 0.02 0.79,P=0.04).

**Funding Source:** Primary author received grant funding for PhD studies from the Juho Vainio Foundation.
Mindless Eating Is Related to Very Low Food Security Status Among College Students

Author(s): C. Brantley, L. Knol, M. Boudreaux; The University of Alabama

Learning Outcome: Upon completion, participants will be able to explain the relationship between mindful eating and food security status among college students.

Background: Food insecurity does not only affect college student’s academic performance, but also their mental and physical health. Mindful eating practices may be used as a coping effort to manage performance, but also their mental and physical health. Mindful eating food insecurity does not only affect college student

Methods: FITS is the largest national cross-sectional dietary survey of infants and young children assessing food/beverage intake via 24-hr dietary recalls. Rice-containing infant cereals were identified in the dietary recalls of infants 0–11.9 months of age (n = 1502) and a percent rice was assigned to each type of infant cereal. Varieties of rice-containing infant cereals included plain rice, rice with fruits and rice with other grains.

Results: Mean per capita consumption of rice from infant cereal was 3.3g/day for infants 0–11.9 months in 2016.

Conclusions: Per capita consumption of rice from infant rice cereal has declined between the NHANES–WWEIA 2003–2010 cycles and the FITS 2016. This is important information for the continuous evaluation of exposure to toxic elements from foods, such as inorganic arsenic from rice, in the diets of infants as called for by the FDA Closer to Zero Action Plan.

Funding Source: The Feeding Infants and Toddlers Study 2016 was funded by Nestlé Research, Lausanne, Switzerland and the analysis described in this abstract was funded by Gerber Products Co, Nestlé Nutrition, Arlington, VA. Authors Callen and Pac are employees of Gerber Products Co.

Mind Per Capita Intake of Rice from Infant Cereal Declined from 2003-2010 to 2016

Author(s): C. Callen1, J. Hampton1, S. Pac3, 1Nestle Nutrition Gerber Products Company, 2RTI

Learning Outcome: Upon completion, participants will be able to describe that per capita consumption of rice from infant cereal is less than previously reported

Background: In 2016 the US Food and Drug Administration (FDA) completed an Assessment in Rice and Rice Products Risk Assessment. FDA determined mean per capita consumption of rice from infant cereal to be 4.8g/day for infants 0–12 months from multiple cycles of the NHANES What We Eat in America (WWEIA) survey (2003–2010). This study reports mean per capita consumption of rice from infant cereal from the Feeding Infants and Toddlers Study (FITS).

Methods: FITS is the largest national cross-sectional dietary survey of infants and young children assessing food/beverage intake via 24-hr dietary recalls. Rice-containing infant cereals were identified in the dietary recalls of infants 0–11.9 months of age (n = 1502) and a percent rice was assigned to each type of infant cereal. Varieties of rice-containing infant cereals included plain rice, rice with fruits and rice with other grains.

Results: Mean per capita consumption of rice from infant cereal was 3.3g/day for infants 0–11.9 months in 2016.

Conclusions: Per capita consumption of rice from infant rice cereal has declined between the NHANES–WWEIA 2003–2010 cycles and the FITS 2016. This is important information for the continuous evaluation of exposure to toxic elements from foods, such as inorganic arsenic from rice, in the diets of infants as called for by the FDA Closer to Zero Action Plan.

Funding Source: The Feeding Infants and Toddlers Study 2016 was funded by Nestlé Research, Lausanne, Switzerland and the analysis described in this abstract was funded by Gerber Products Co, Nestlé Nutrition, Arlington, VA. Authors Callen and Pac are employees of Gerber Products Co.

Rice Intake Among Infants 6-11.9 Months: Data from The Feeding Infants and Toddlers Study 2016

Author(s): S. Pac1, J. Hampton1, C. Callen1; 1Nestle Nutrition Gerber Products Company, 2RTI

Learning Outcome: Upon completion, participants will be able to identify sources of dietary rice among infants 6–12 months of age and understand the amount of rice these foods provide to infants.

Background: The Feeding Infants and Toddlers Study 2016 was funded by Nestlé Research, Lausanne, Switzerland and the analyses described in this abstract were funded by Gerber Products Co, Nestlé Nutrition, Arlington, VA. Authors Callen and Pac are employees of Gerber Products Co.

Methods: FITS is the largest national cross-sectional dietary survey of children under age four years. Food/beverage intake is assessed via 24-hr dietary recalls. Sources of rice were identified and a percent of rice grain in the food was assigned to each rice food category. Rice grain consumption among consumers and distribution of grams of rice grain consumed was determined for each rice containing food group using one day intakes for infants 6–12 months (n = 902).

Results: Fifty eight percent of infants 6–11.9 months consuming rice-containing foods and amounts of rice consumed from these foods in the Feeding Infants and Toddlers Study (FITS).

Methods: FITS is the largest national cross-sectional dietary survey of children under age four years. Food/beverage intake is assessed via 24-hr dietary recalls. Sources of rice were identified and a percent of rice grain in the food was assigned to each rice food category. Rice grain consumption among consumers and distribution of grams of rice grain consumed was determined for each rice containing food group using one day intakes for infants 6–12 months (n = 902).

Results: Fifty eight percent of infants 6–11.9 months consuming rice-containing foods, including rice containing snacks (32.13%), rice infant cereal (27.9%), baby food purees containing rice (11.1%) and cooked rice (7.7%). Their mean intake of rice from all sources was 11.9 grams/day. While most frequently reported as consumed, snacks provided the least rice (mean intake 2 grams/day).

Conclusions: Older infants consume rice from a variety of foods. Rice-containing snacks do not provide a high level of rice to the diet. To reduce exposure to inorganic arsenic, infants should be offered foods made from a variety grains.

Funding Source: The Feeding Infants and Toddlers Study 2016 was funded by Nestlé Research, Lausanne, Switzerland and the analyses described in this abstract were funded by Gerber Products Co, Nestlé Nutrition, Arlington, VA. Authors Callen and Pac are employees of Gerber Products Co.

Qualitative Evaluation of CalFresh Healthy Living (SNAP-Ed) Implementation Across Eight Universities

Author(s): E. Grijalva Martinez, C. Zuniga, V. Gray; California State University, Long Beach

Learning Outcome: To identify key findings of a process evaluation focused on a novel application of the Supplemental Nutrition Assistance Program-Education (SNAP-Ed): CalFresh Healthy Living (CFHL) on College Campuses.

Research outcome: To explore key aspects of program content, recruitment, and implementation in a novel application of the Supplemental Nutrition Assistance Program-Education (SNAP-Ed): CalFresh Healthy Living (CFHL) on College Campuses.

Methods: Qualitative research methods were used to elicit experiences of program implementers in this first application of SNAP-Ed to college students. A case study design was employed, using focus groups, to address research questions developed in alignment with a process evaluation framework. A survey captured participant demographics and role on the grant.

Analysis: Focus groups were recorded, transcribed, and coded by two independent researchers following the six steps of thematic analysis, while using NVivo version 12.

Results: Focus groups (n = 8) were conducted across eight campuses participating in CFHL. Participants (n=26) included students, staff, and faculty involved in implementing the grant. Themes emerging from the focus groups emphasize: 1) need for this work as an extension of basic needs services on college campuses; 2) importance of aligning programming with context, needs, and interests of college students; 3) use of incentives and engagement strategies to attract and retain students; 4) working with partners to extend reach; and 5) challenges of remote delivery. Findings suggest a need for adapting existing lessons to emphasize topics of interest and to build cooking skills.

Conclusions: Findings of this study support a need for nutrition education interventions targeting college students and suggest key strategies to improve alignment between college student needs and programming. Additional study is needed to explore SNAP-Ed implementation across other higher education settings.

Funding Source: CSULB Faculty RSCA Award

Rice Intake Among Infants 6-11.9 Months: Data from The Feeding Infants and Toddlers Study 2016

Author(s): S. Pac1, J. Hampton1, C. Callen1; 1Nestle Nutrition Gerber Products Company, 2RTI

Learning Outcome: Upon completion, participants will be able to identify sources of dietary rice among infants 6–12 months of age and understand the amount of rice these foods provide to infants.

Background: The Feeding Infants and Toddlers Study 2016 was funded by Nestlé Research, Lausanne, Switzerland and the analyses described in this abstract were funded by Gerber Products Co, Nestlé Nutrition, Arlington, VA. Authors Callen and Pac are employees of Gerber Products Co.

Methods: FITS is the largest national cross-sectional dietary survey of children under age four years. Food/beverage intake is assessed via 24-hr dietary recalls. Sources of rice were identified and a percent of rice grain in the food was assigned to each rice food category. Rice grain consumption among consumers and distribution of grams of rice grain consumed was determined for each rice containing food group using one day intakes for infants 6–12 months (n = 902).

Results: Fifty eight percent of infants 6–11.9 months consuming rice-containing foods and amounts of rice consumed from these foods in the Feeding Infants and Toddlers Study (FITS).

Methods: FITS is the largest national cross-sectional dietary survey of children under age four years. Food/beverage intake is assessed via 24-hr dietary recalls. Sources of rice were identified and a percent of rice grain in the food was assigned to each rice food category. Rice grain consumption among consumers and distribution of grams of rice grain consumed was determined for each rice containing food group using one day intakes for infants 6–12 months (n = 902).

Results: Fifty eight percent of infants 6–11.9 months consuming rice-containing foods, including rice containing snacks (32.13%), rice infant cereal (27.9%), baby food purees containing rice (11.1%) and cooked rice (7.7%). Their mean intake of rice from all sources was 11.9 grams/day. While most frequently reported as consumed, snacks provided the least rice (mean intake 2 grams/day).

Conclusions: Older infants consume rice from a variety of foods. Rice-containing snacks do not provide a high level of rice to the diet. To reduce exposure to inorganic arsenic, infants should be offered foods made from a variety grains.

Funding Source: The Feeding Infants and Toddlers Study 2016 was funded by Nestlé Research, Lausanne, Switzerland and the analyses described in this abstract were funded by Gerber Products Co, Nestlé Nutrition, Arlington, VA. Authors Callen and Pac are employees of Gerber Products Co.
Sports Nutrition Knowledge and Disordered Eating Attitudes of College Coaches and Athletic Trainers

Author(s): C. Laudisio, K. Eck, A. Levine, L. Howard; Marywood University

Learning Outcome: Participants will be able to understand the relationship between the sports nutrition knowledge and attitudes towards disordered eating in athletes for coaches and athletic trainers at Division III universities.

Disordered eating/eating disorders are prevalent in college athletes, making it essential to determine possible causes, including the knowledge and influence of athletics staff. This study explored the relationship between coaches’ and athletic trainers’ sports nutrition knowledge and attitudes concerning disordered eating. Division III head coaches (n=20), assistant coaches (n=7), and athletic trainers (n=2) completed a survey including the 49-item Sports Nutrition Knowledge Instrument, the 13-item Disordered Eating Attitude Scale 13 items assessingpressuring athletes regarding body weight/shape, and 12 items assessing ability to identify disordered eating behaviors. Participants had low sports nutrition knowledge (37.2% correct response rate on average) and low disordered eating attitudes (23.14±2.53, score range 13 to 65). Participants rarely pressured athletes regarding body weight/shape (2.07±0.87, score range 1 to 6), and were often/usually able to identify disordered eating behaviors (4.16±0.83, score range 1 to 6). Disordered eating attitudes were significantly greater in non-lean sports vs. lean sports (p=0.010), body pressure was significantly greater for male vs. female participants (p=0.017), and disordered eating identification was significantly greater in women’s vs. men’s staff (p=0.008). Sports nutrition knowledge did not differ significantly between participants. Higher protein knowledge was significantly positively correlated with disordered eating attitudes. Limited sports nutrition knowledge and high disordered eating attitudes and body pressure from coaches and athletic trainers suggests the addition of a Dietitian to athletics staff may improve coaches’ and athletic trainers’ sports nutrition knowledge; in turn improving prevention and identification of disordered eating/eating disorders.

Funding Source: None

Trends in Dietary Fiber Intake among the US pregnant and non-pregnant population: from NHANES 1999-2018

Author(s): D. Mikelisnās, H. Lux2, J. Firth3, T. Bender4, A. Bailey4, C. McMillin4, L. Brink5; 1Texas Woman’s University, 2Hubert Department of Global Health, Rollins School of Public Health, Emory University, 3Medical and Scientific Affairs, Reckitt/Mead Johnson Nutrition Institute, Slough, UK, 4Medical and Scientific Affairs, Reckitt/Mead Johnson Nutrition Institute, Evansville, USA

Learning Outcome: Upon completion, participants will be able to describe how dietary fiber intake has changed in pregnant and non-pregnant women in the past two decades.

Background: The study aimed to examine trends in dietary fiber intake from foods alone among women of reproductive age using data from the National Health and Nutrition Examination Survey (NHANES).

Methods: Usual dietary fiber intake from foods and prevalence of adequate intake (AI) were estimated among pregnant (n=1,392) and non-pregnant (9,737) women 20-44y who participated in NHANES 1999-2018 (n=11,129), using the National Cancer Institute method. Dietary fiber intake was adequate if consumption exceeded the Adequate Intake (AI) for pregnant and non-pregnant women. Trends in dietary fiber intake and adequacy were tested using regression models.

Results: Dietary fiber intake for pregnant and non-pregnant women was suboptimal across all survey cycles. Dietary fiber intake in pregnant women changed significantly over time (p<0.0121), increasing from 17.0±7.0 to 19.2±1.0 g/d in 1999-2000 to 19.2±1.0 g/d in 2011-2012 and subsequently decreased to 17.9±0.6 g/d in 2017-2018. Adequate fiber intake increased from 4.9±1.3% in 1999-2000 to 10.3±2.0% in 2011-2012 and decreased to 7.2±1.6% in 2017-2018 (p<0.0353). Non-pregnant women consumed ~3 g/d fewer compared to pregnant women; however, their fiber intake followed the same trends, which increased from 13.5±0.5 g/d in 1999-2000 to 15.7±0.3 g/d in 2011-2012 followed by a decrease to 14.9±0.4 g/d in 2017-2018 (p<0.0405). Adequate fiber intake increased from 3.1±0.8% in 1999-2000 to 6.9±0.9% in 2011-2012 and decreased to 5.2±0.9% in 2017-2018 (p<0.036).

Conclusion: Although dietary fiber intake among women has increased over the past two decades, most (>85%) do not meet recommendations. Moreover, differences in dietary fiber intake between pregnant and non-pregnant women were minimal.

Funding Source: Funded by the Reckitt/Mead Johnson Nutrition

Very Low Food Security Status Is Related to Greater Perceived Stress but Less Stress-Related Eating Among College Students

Author(s): L. Knol, C. Brantley, M. Boudreaux; University of Alabama

Learning Outcome: Upon conclusion of the presentation, the participant will be able to explain the potential determinants of stress-related eating among college students.

Background: Food insecurity and perceived stress are common problems among college students. Students who are food insecure may have higher levels of stress, which may lead to maladaptive coping strategies such as stress-related eating. The purpose of this study was to explore the relationships between food security status, perceived stress, and stress-related eating among college students.

Methods: Undergraduate students

Results: Among the 1310 participants, the average score on the SSES was 2.79 +/- 0.87 (range=1-5) and PSS was 19.48 +/- 0.69 (range=0-40), where higher scores represent eating higher quantities of food when stressed and greater perceived stress, respectively. Students with high food security status (62.7%) reported significantly higher SSES and lower PSS scores than students with very low food security status (16.9%) (2.86 +/- 0.85 versus 2.50 +/- 0.94, p=0.001; 19.47 +/- 6.69 versus 24.17 +/- 5.96, p<0.0001, respectively). Overall, higher PSS scores were negatively related to lower SSES scores (beta=-0.009, p=0.002).

Conclusion: College students with very low food security status have greater levels of perceived stress but reported consuming less than usual when under stress. More research is needed to understand what strategies college students with very low food security use to cope.

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