

# Position of the Academy of Nutrition and Dietetics: Interventions for the Treatment of Overweight and Obesity in Adults



## ABSTRACT

It is the position of the Academy of Nutrition and Dietetics that successful treatment of overweight and obesity in adults requires adoption and maintenance of lifestyle behaviors contributing to both dietary intake and physical activity. These behaviors are influenced by many factors; therefore, interventions incorporating more than one level of the socioecological model and addressing several key factors in each level may be more successful than interventions targeting any one level and factor alone. Registered dietitian nutritionists, as part of a multidisciplinary team, need to be current and skilled in weight management to effectively assist and lead efforts that can reduce the obesity epidemic. Using the Academy of Nutrition and Dietetics' Evidence Analysis Process and Evidence Analysis Library, this position paper presents the current data and recommendations for the treatment of overweight and obesity in adults. Evidence on intrapersonal influences, such as dietary approaches, lifestyle intervention, pharmacotherapy, and surgery, is provided. Factors related to treatment, such as intensity of treatment and technology, are reviewed. Community-level interventions that strengthen existing community assets and capacity and public policy to create environments that support healthy energy balance behaviors are also discussed.

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## POSITION STATEMENT

It is the position of the Academy of Nutrition and Dietetics that successful treatment of overweight and obesity in adults requires adoption and maintenance of lifestyle behaviors contributing to both dietary intake and physical activity. These behaviors are influenced by many factors; therefore, interventions incorporating more than one level of the socioecological model and addressing several key factors in each level may be more successful than interventions targeting any one level and factor alone.

**T**HE PURPOSE OF THIS ARTICLE is to provide an update to the 2009 position paper on adult weight management and incorporate the revised Academy's evidence-based adult weight-management guidelines from the Evidence Analysis Library (EAL) and the 2013 American Heart Association, American College of Cardiology, and The Obesity Society (AHA/ACC/TOS) Guideline for the Management of Overweight and Obesity in Adults.<sup>1</sup> The scope of the paper has been expanded to include a socioecological approach and provide evidence regarding community-based and policy-level interventions designed to reduce the prevalence of overweight and obesity in communities in the United States. Within those areas in which various interventions are described, included

evidence focuses as much as possible on systematic reviews and/or meta-analyses, randomized controlled trials (RCTs), and other evidence-based guidelines.

In 2012, 34.9% of adults in the United States were obese and another 33.6% were overweight.<sup>2</sup> The high prevalence of overweight and obesity in the United States negatively affects the health of the population, as obese individuals are at increased risk for developing several chronic diseases, such as type 2 diabetes, cardiovascular disease (CVD), and certain forms of cancer.<sup>1,3</sup> Because of its impact on health, medical costs, and longevity, reducing obesity is considered to be a public health priority.<sup>4</sup>

Weight loss of only 3% to 5% that is maintained has the ability to produce clinically relevant health improvements (eg, reductions in triglycerides, blood glucose, and risk of developing type 2 diabetes).<sup>1</sup> Larger weight loss reduces additional risk factors of CVD (eg, low-density and high-density

This Academy position paper includes the authors' independent review of the literature in addition to systematic review conducted using the Academy's Evidence Analysis Process and information from the Academy's Evidence Analysis Library (EAL). Topics from the EAL are clearly delineated. For a detailed description of the methods used in the Evidence Analysis Process, go to [www.andevidencelibrary.com/eaproces](http://www.andevidencelibrary.com/eaproces).

Recommendations are assigned a rating by an expert work group based on the grade of the supporting evidence and the balance of benefit vs harm. Recommendation ratings are Strong, Fair, Weak, Consensus, or Insufficient Evidence.

Recommendations can be worded as conditional or imperative statements. Conditional statements clearly define a specific situation and most often are stated as an "if, then" statement, while imperative statements are broadly applicable to the target population without restraints on their pertinence.

Evidence-based information for this and other topics can be found at [www.andevidencelibrary.com](http://www.andevidencelibrary.com) and subscriptions for nonmembers can be purchased at [www.andevidencelibrary.com/store.cfm](http://www.andevidencelibrary.com/store.cfm).

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lipoprotein cholesterol and blood pressure) and decreases the need for medication to control CVD and type 2 diabetes. Thus, a goal of weight loss of 5% to 10% within 6 months is recommended.<sup>1</sup>

**EAL Recommendation:** “The registered dietitian nutritionist (RDN) should collaborate with the individual regarding a realistic weight-loss goal such as one of the following: up to 2 lb per week, up to 10% of baseline body weight, or a total of 3% to 5% of baseline weight if cardiovascular risk factors (hypertension, hyperlipidemia, and hyperglycemia) are present.” (Rating: **Strong, Imperative**)

### GOALS OF ADULT OBESITY TREATMENT

While intentional weight loss of at least 3% to 5% improves some clinical parameters,<sup>1</sup> to sustain these improvements, this degree of weight loss needs to be maintained. While there is no standard definition for length of time for maintenance of weight loss for it to be considered successful, duration of 1 year is often used.<sup>5</sup> While long-term weight-loss maintenance is one of the challenges in obesity treatment, it is possible. For example, the Look AHEAD (Action for Health in Diabetes) trial, an RCT with >5,000 adults with type 2 diabetes, reported that 39.3% of the 825 participants who received a lifestyle intervention (consisting of a reduced-energy dietary and physical activity prescription, and a cognitive behavioral intervention) who lost at least 10% of their body weight at year 1 maintained at least a 10% weight loss at year 8, and another 25.8% maintained a 5% to <10% weight loss at year 8.<sup>6</sup>

To achieve a reduction in weight that can be sustained over time and improve cardiometabolic health, obesity treatment ideally produces changes in lifestyle behaviors that contribute to both sides of energy balance in adults. Thus, the diet should be altered so that reductions in excessive energy intake and enhancements in dietary quality occur, so that the likelihood of achieving recommendations provided in the 2010 Dietary Guidelines for Americans (DGA)<sup>7</sup> is increased. Along with changes in dietary intake, obesity treatment should encourage increases in physical activity in order to increase energy

expenditure, in the minimum to meet the 2008 Physical Activity Guidelines for Americans (150 minutes per week of moderate-intensity, or 75 minutes per week of vigorous-intensity physical activity)<sup>8</sup> and ideally to meet the American College of Sports Medicine’s Position Stand for weight-loss maintenance (>250 minutes/wk of moderate-intensity physical activity),<sup>9</sup> and enhance cardiovascular fitness. Preservation of changes in lifestyle behaviors is required to achieve successful weight-loss maintenance.<sup>10</sup>

### FACTORS INFLUENCING FOOD INTAKE

Eating behavior is generally believed to be influenced by both internal and external cues.<sup>11,12</sup> Internally, two systems have been identified that assist with regulating intake.<sup>11</sup> The first system is the homeostatic system, in which neural, nutrient, and hormonal signals allow communication between the gut, pancreas, liver, adipose tissue, brainstem, and hypothalamus. The arcuate nucleus of the hypothalamus integrates these signals and regulates hunger, satiation, and satiety in response to the signals via higher cortical centers that influence the sympathetic and parasympathetic nervous system, gastric motility and hormone secretion, and other processes relevant to energy homeostasis. The second internal system is the hedonic system, which is influenced by the hedonic (“liking”) and rewarding (“wanting”) qualities of food and is regulated by the corticolimbic system.<sup>11,12</sup> It is through the hedonic system that environmental cues influence consumption.<sup>11,12</sup> The hedonic system does have a strong impact on intake, as is demonstrated in situations when eating occurs after reports of satiation and when there is no nutrition need (eg, the dessert effect).<sup>12</sup> It is believed that cross talk does occur between these two internal systems; however, little is known about this process.<sup>11</sup>

Many external factors influence consumption, but environmental variables that appear to greatly influence intake are food availability and variety and energy density and portion size of food.<sup>12</sup> Research has found that when availability, variety, energy density, and portion size increase, intake is heightened.<sup>12</sup> The increased intake appears to

be outside of awareness, is not associated with enhanced satiation, and compensation does not appear to occur over time.

### FACTORS INFLUENCING ENGAGING IN MODERATE- TO VIGOROUS-INTENSITY PHYSICAL ACTIVITY

As with food intake, there are internal and external factors that influence how much moderate- to vigorous-intensity physical activity (MVPA) one engages in. Internally, physical limitations and discomfort and beliefs about how MVPA influences health have been related to amount of MVPA achieved.<sup>13</sup> Mood and, specifically, core affective valence (eg, good/bad feelings) in response to engaging in MVPA are related to future physical activity.<sup>14</sup> Also as engaging in regular MVPA involves consistently making decisions to engage in a behavior that requires costs to achieve the long-term cumulative health benefits, it is theorized that strong executive control and optimized brain structures supporting executive functioning (ie, dorsolateral prefrontal cortex) is an important internal factor.<sup>15</sup>

The social and physical environments are also believed to be factors that influence engaging in MVPA. How supportive other individuals are to MVPA efforts and the potential interaction with others who are active are external factors that can promote physical activity.<sup>13</sup> Different physical environmental dimensions, such as walkability, land use, public transportation availability, safety, and aesthetics, in residential and/or work neighborhoods have also been shown to influence physical activity.<sup>16</sup> Finally, within a home or work setting, the option of engaging in sedentary behaviors, especially those that are screen-based, can also influence MVPA.<sup>17</sup>

### SOCIOECOLOGICAL MODEL OF OBESITY INTERVENTION

The socioecological model provides a framework that proposes that multiple levels of influence can impact energy-balance behaviors and weight outcomes. Levels of influence include intrapersonal factors, community and organizational factors, and government and public policies.<sup>18</sup>

## Intrapersonal-Level Obesity Intervention

The vast majority of research forming an evidence-based approach to obesity treatment has focused on intervention at the individual level, in which treatment targets intrapersonal-level factors that assist with changing energy balance behaviors. The nutrition care process, which includes nutrition assessment, diagnosis, intervention, monitoring, and evaluation, represents an intrapersonal-level of focus. The Academy's evidence-based adult weight-management guidelines from the EAL focus on obesity treatment at the intrapersonal level, incorporating the nutrition care process within its recommendations.

**Assessment.** As with any nutrition assessment, applicable information that can assist in the development of a nutrition diagnosis and intervention for obesity is essential (see [Figure 1](#) for suggested data to collect for assessment). Determining body mass index (BMI; calculated as  $\text{kg}/\text{m}^2$ ) is often the first step of obesity treatment, as it identifies whether a client is overweight or obese. Using the current criterion for overweight and obesity, individuals with a BMI  $\geq 25.0$ - $29.9$  (overweight) or  $\geq 30$  (obese) should be identified and provided with obesity treatment.<sup>1</sup> Other anthropometric and medical measures, such as waist circumference, blood pressure, lipids, and glucose, should be taken to assess for cardiovascular risk.<sup>1</sup> This will assist with matching obesity treatment benefits with risk profiles and making appropriate referrals.<sup>1</sup>

**EAL Recommendation:** "The RDN, in collaboration with other health care professionals, administrators, and/or public policy decision-makers, should ensure that all adult patients have the following measurements at least annually: height and weight to calculate BMI; and waist circumference to determine risk of CVD, type 2 diabetes, and all-cause mortality." (Rating: **Fair, Imperative**)

**EAL Recommendation:** "The RDN, in collaboration with other health care professionals, administrators, and public policy decision makers, should ensure that overweight or obese adults are referred to an RDN for medical

nutrition therapy (MNT)." (Rating: **Fair, Imperative**)

Once an RDN initiates the nutrition care process, data about the client (see [Figure 1](#)) should be collected to assist in individualizing MNT. An assessment can include, but is not limited to, dietary intake; social history, including living or housing situation and socioeconomic status; and motivation for weight management. Resting metabolic rate should be determined, and that, combined with activity level and calculation of usual dietary intake in terms of energy and nutrient content, can assist with developing dietary parameters that may be appropriate to target during intervention. In the EAL, physical activity is listed with food- and nutrition-related history, and level of physical activity is required to estimate energy needs. To assist with assessing physical activity, "A Physical Activity Toolkit for Registered Dietitians: Utilizing Resources of Exercise is Medicine," was developed by the Weight Management and Sports, Cardiovascular, and Wellness Nutrition dietetic practice groups, in collaboration with the American College of Sports Medicine.

**EAL Recommendation:** "The RDN should assess the following data in order to individualize the comprehensive weight-management program for overweight and obese adults: food- and nutrition-related history; anthropometric measures; biochemical data, medical tests and procedures; nutrition-focused physical findings; and client history." (Rating: **Strong, Imperative**)

**EAL Recommendation:** "The RDN should assess the energy intake and nutrient content of the diet." (Rating: **Strong, Imperative**)

**EAL Recommendation:** "If indirect calorimetry is available, the RDN should use a measured resting metabolic rate (RMR) to determine energy needs in overweight or obese adults." (Rating: **Consensus, Conditional**)

**EAL Recommendation:** "If indirect calorimetry is not available, the RDN should use the Mifflin-St. Jeor equation using actual weight to estimate RMR in overweight or obese adults." (Rating: **Strong, Conditional**)

**EAL Recommendation:** "The RDN should multiply the RMR by one of the following physical activity factors to estimate total energy needs: sedentary

(1.0 or more to less than 1.4); low active (1.4 or more to less than 1.6); active (1.6 or more to less than 1.9); and very active (1.9 or more to less than 2.5)." (Rating: **Consensus, Imperative**)

**EAL Recommendation:** "The RDN should assess motivation, readiness and self-efficacy for weight management based on behavior change theories and models (such as cognitive-behavioral therapy, transtheoretical model, and social cognitive theory/social learning theory)." (Rating: **Fair, Imperative**)

**Dietary Intervention.** As treating obesity requires achieving a state of negative energy balance, all efficacious dietary interventions for obesity treatment must decrease consumption of energy. There are many dietary approaches that can reduce energy intake, with some approaches more greatly reducing intake than others. However, the degree of weight loss generally reflects the size of the decrease in energy intake achieved. Thus, the reduction in energy intake is the primary factor to address in a dietary intervention for obesity treatment.<sup>1</sup> As many dietary approaches reduce energy intake, a client's preference and health and nutrient status should be taken into consideration when a dietary intervention for obesity treatment is prescribed.<sup>1</sup> See [Figure 2](#) for dietary interventions and a summary of the evidence-base regarding ability to produce weight loss or not, or whether evidence is lacking for conclusions to be drawn.

**EAL Recommendation:** "During weight loss, the RDN should prescribe an individualized diet, including patient preferences and health status, to achieve and maintain nutrient adequacy and reduce caloric intake, based on one of the following caloric reduction strategies: 1,200 kcal to 1,500 kcal/day for women and 1,500 to 1,800 kcal/day for men; energy deficit of approximately 500 kcal/day or 750 kcal/day; one of the evidence-based diets that restricts certain food types (such as high-carbohydrate foods, low-fiber foods, or high-fat foods) in order to create an energy deficit by reduced food intake." (Rating: **Strong, Imperative**)

**EAL Recommendation:** "For weight loss, the RDN should advise overweight

Assess	Monitor and Evaluate
<b>Food- and nutrition-related history</b> <ul style="list-style-type: none"> <li>• Beliefs and attitudes, including food preferences and motivation</li> <li>• Food environment, including access to fruits and vegetables</li> <li>• Dietary behaviors, including eating out and screen time</li> <li>• Diet experience, including food allergies and dieting history</li> <li>• Medications and supplements</li> <li>• Physical activity</li> </ul>	<ul style="list-style-type: none"> <li>• Beliefs and attitudes, including motivation</li> <li>• Food environment, including access to fruits and vegetables</li> <li>• Dietary behaviors, including eating out and screen time</li> <li>• Medications and supplements</li> <li>• Physical activity</li> </ul>
<b>Anthropometric measurements</b> <ul style="list-style-type: none"> <li>• Height, weight, body mass index</li> <li>• Waist circumference</li> <li>• Weight history</li> <li>• Body composition</li> </ul>	<ul style="list-style-type: none"> <li>• Weight, body mass index</li> <li>• Waist circumference</li> <li>• Weight history</li> <li>• Body composition</li> </ul>
<b>Biochemical data, medical tests, and procedures</b> <ul style="list-style-type: none"> <li>• Glucose and endocrine profile</li> <li>• Lipid profile</li> </ul>	<ul style="list-style-type: none"> <li>• Glucose and endocrine profile</li> <li>• Lipid profile</li> </ul>
<b>Nutrition-focused physical findings</b> <ul style="list-style-type: none"> <li>• Ability to communicate</li> <li>• Affect</li> <li>• Amputations</li> <li>• Appetite</li> <li>• Blood pressure</li> <li>• Body language</li> <li>• Heart rate</li> </ul>	<ul style="list-style-type: none"> <li>• Affect</li> <li>• Appetite</li> <li>• Blood pressure</li> <li>• Body language</li> <li>• Heart rate</li> </ul>
<b>Client history</b> <ul style="list-style-type: none"> <li>• Appropriateness of weight management in certain populations (such as eating disorders, pregnancy, receiving chemotherapy)</li> <li>• Client and family medical and health history</li> <li>• Social history, including living or housing situation and socioeconomic status</li> </ul>	

**Figure 1.** Data needed to assess, monitor, and evaluate a comprehensive weight-management program from the Academy of Nutrition and Dietetics' Evidence Analysis Library.

Diet	Investigated using RCTs <sup>a</sup> with evidence considered supportive for weight loss	Investigated using RCTs with evidence considered non-supportive for weight loss	Lacking investigation for weight loss using RCTs
<b>Small, food-based</b>			
Increasing fruits and vegetables		X	
Decreasing sugar-sweetened beverages	X		
Decreasing fast food			X
<b>Portion control</b>	X		
<b>Larger-, energy-, macronutrient- and/or dietary pattern-based</b>			
Energy-focused			
Low-calorie diet	X		
Meal replacement/structured meal plans	X		
Very-low-calorie diet	X		
Macronutrient-focused			
Low-carbohydrate	X		
Low glycemic index/load without energy restriction		X	
High protein with energy restriction	X		
Dietary-pattern focused			
Energy density			X
DASH <sup>b</sup> with energy restriction	X		
Mediterranean with energy restriction	X		
Dietary-timing focused			
Eating frequency			X
Timing of eating			X
Breakfast consumption			X

**Figure 2.** Evidence-base for dietary interventions for weight loss in adults. Sources include 2013 American Heart Association, American College of Cardiology, and the Obesity Society Guideline for the Management of Overweight and Obesity in Adults and the Academy of Nutrition and Dietetics' Evidence Analysis Library. <sup>a</sup>RCTs=randomized controlled trials; <sup>b</sup>DASH=Dietary Approaches to Stop Hypertension.

or obese adults that as long as the target reduction in calorie level is achieved, many different dietary approaches are effective.” (Rating: **Strong, Imperative**)

**EAL Recommendation:** “During weight maintenance, the RDN should prescribe an individualized diet (including patient preference and health status) to maintain nutrient adequacy and reduce caloric intake for maintaining a lower body weight.” (Rating: **Strong, Imperative**)

**EAL Recommendation:** “For weight maintenance, the RDN should advise overweight and obese adults that as long as the target reduction in calorie level is achieved, many different dietary approaches are effective.” (Rating: **Strong, Imperative**)

**Small, food-based changes.** It has been proposed that small behavior changes, those that shift energy balance by 100 to 200 kcal/day, may be helpful for weight management.<sup>19</sup> It is important to recognize that this degree of energy deficit is much smaller than what is currently recommended to produce clinically relevant weight loss.<sup>1</sup> It is hypothesized that small behavior changes, such as reducing intake of sugar-sweetened beverages (SSB), may be more feasible and sustainable than larger behavior changes, such as changing macronutrient composition of the diet.

**Fruits and vegetables.** Within the context of promoting healthy diets, the increased consumption of fruits and vegetables has gained recognition, in large part due to the findings of the DASH (Dietary Approaches to Stop Hypertension) and DASH-Sodium RCTs.<sup>20,21</sup> Increasing fruits and vegetables is a dietary change that can reduce dietary energy density, enhance satiation, and assist with decreasing overall energy intake, particularly if fruits and vegetables are consumed instead of other foods higher in energy density.<sup>22</sup> Those RCTs that have examined the influence of solely increasing fruits and vegetables with no other dietary changes on weight management have generally not produced weight loss.<sup>23</sup>

**SSB.** Reducing SSB should be helpful for weight management if compensation to the reduction in energy consumed from SSB does not occur and

if energy-containing beverages are not consumed in place of SSB when SSB are reduced. While few studies have examined the effect of solely reducing SSB on weight loss, an RCT conducted by Tate and colleagues<sup>24</sup> found that replacing caloric beverages with water or diet beverages resulted in weight losses of 2% to 2.5% during a 6-month period. While concerns have been raised about increases in hunger, which may increase overall energy intake when non-nutritive sweetened foods and beverages are consumed, a recent RCT found that consumption of at least 24 oz of non-nutritive sweetened beverages during a 12-week behavioral weight-loss intervention reduced subjective feelings of hunger as compared with a 24-oz water consumption comparison.<sup>25</sup>

**Fast food.** Food prepared away from home, in particular fast food, comprises an increasing amount of the American diet and contributes to the epidemic of obesity.<sup>26</sup> Fast food is generally high in energy density and commonly purchased in large portion sizes, thereby contributing to excessive energy intake.<sup>26</sup> Due to the relationship between fast food and increased energy intake, in the context of a weight-loss dietary regimen, avoidance or reduction of the frequency of consumption of foods away from home is typically recommended. However, no RCT has been conducted to examine whether reducing fast food alone, with no other changes in the diet, produces weight loss.

At this time, research conducted in the area of small, food-based changes indicates that only changes in SSB, and no other small food-based change, can assist with weight management. It is important to note that the weight loss found with reducing SSB alone, while statistically significant, is below the amount of weight loss that is recommended to improve cardiometabolic health.<sup>1</sup>

**Portion-control changes.** RDNs have long endorsed skills that include portion control for lifelong weight management.<sup>27</sup> Portion control can be accomplished in a variety of different ways, including using packages containing a defined amount of energy (eg, complete meals, individual food

items); portion-controlled utensils where food is delivered in specific serving sizes; or communication strategies such as MyPlate, developed as an adjunct to the DGA,<sup>7</sup> to assist with consuming appropriate serving sizes of specific foods. The EAL’s Relationship of Single Serving Portion Size Meals and Weight Management Project states that single-serving portion-sized meals are a tool that can be used as a part of a weight-management program. This project’s key findings were that eating one or more single-serving portion-sized meals per day as part of a weight-management program resulted in a reduction of energy intake and weight loss in adults.

**Larger, energy, macronutrient, and/or dietary pattern-based changes.** Dietary approaches that target larger nutrient (eg, energy and/or macronutrient) and or dietary pattern-based changes (eg, Mediterranean diet) are predominantly considered efficacious for weight loss and produce the recommended amount of weight loss,<sup>1</sup> as many RCTs investigating these diets have shown that they reduce energy intake enough (500 kcal/day to 750 kcal/day) so that the degree of negative energy balance achieved produces at least a 3% reduction in percent body weight.<sup>1</sup> These dietary interventions have either an explicit energy goal per day or provide an ad libitum approach without a formal energy goal that still produces a reduction in energy intake, usually by restriction or elimination of specific foods and/or food groups, or provision of prescribed foods (eg, meal replacement).<sup>1</sup> Outcomes indicate that all of the larger, energy, macronutrient, and/or dietary pattern-based approaches produce a weight loss of about –4 to –12 kg at 6-month follow-up.<sup>1</sup> After 6 months, slow weight regain occurs, and at 1 year, total weight loss is –4 to –10 kg, and at 2 years, total weight loss is at –3 to –4 kg.<sup>1</sup> As this is the pooled effect of the weight loss achieved with the energy, macronutrient and/or dietary pattern-based change diets, the individual weight-loss outcomes for each diet described in this paper are not reported (except for the very-low-calorie diet [VLCD] as this diet has a lower energy prescription than all other diets; meal replacements, as they are a specific form

of the low-calorie diet [LCD] and their weight loss is included to allow comparison with the LCD; and timing of eating, as this diet was not included in the AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults).<sup>1</sup>

Although no one diet approach that targets larger nutrients or dietary patterns is considered to be more efficacious than another diet approach, some of the diets have differential effects on cardiometabolic outcomes and dietary quality. While research in these differential effects is limited, available research on cardiometabolic outcomes specific to a diet intervention, after controlling for effects attributable to weight loss, and diet quality are described here for the corresponding diet. If measures of cardiometabolic outcomes and diet quality are not reported on in a section, this indicates that there is very little evidence available to report about the influence of the diet alone on these parameters.

**Energy focused.** Two of the most widely investigated dietary prescriptions for weight loss are the LCD and the VLCD. Along with varying in energy goals, these two diets differ in the amount of structure they provide.

**LCD.** An LCD is usually >800 kcal/day, and typically ranges from 1,200 to 1,600 kcal/day.<sup>28</sup> Structure can be increased in the LCD with the use of a meal plan, in which all food choices and portion sizes for these choices for all meals and snacks are provided. Use of meal replacements, usually liquid shakes and bars, containing a known amount of energy and macronutrient content also increase structure in the LCD diet. These methods of increasing structure in the diet are believed to be helpful for adherence to an LCD because they reduce problematic food choices, and decrease challenges with making decisions about what to consume. In addition, meal replacements can enhance dietary adherence via portion control, limiting dietary variety, and convenience.<sup>28-30</sup> Meal plans and the partial meal-replacement plan, which prescribes two portioned-controlled, vitamin/mineral-fortified meal replacements per day, with a reduced energy meal and snack composed of

conventional foods, may produce greater short-term weight loss as compared with an LCD composed of traditional foods.<sup>28,31</sup> For example, a meta-analysis of six studies comparing an LCD composed of conventional foods or meal replacements found a 2.54 kg and 2.43 kg greater weight loss in the meal-replacement group for the 3-month and 1-year follow-ups, respectively.<sup>28</sup>

**EAL Recommendation:** “For weight loss and weight maintenance, the RDN should recommend portion control and meal replacements or structured meal plans as part of a comprehensive weight-management program.” (**Rating: Strong, Imperative**)

**VLCD.** A VLCD provides ≤800 kcal/day and provide a high degree of dietary structure (VLCDs are commonly consumed as liquid shakes).<sup>32,33</sup> The VLCD is designed to preserve lean body mass; usually 70 to 100 g/day of protein or 0.8 to 1.5 g protein/kg of ideal body weight are prescribed.<sup>32</sup> VLCDs are considered to be appropriate only for those with a BMI ≥30, and are increasingly used with individuals before having bariatric surgery to reduce overall surgical risks in those with severe obesity.<sup>32</sup> A meta-analysis of six RCTs comparing weight-loss outcomes of VLCDs to LCDs found that although VLCDs produce significantly greater weight loss in the short-term (4 months),  $-16.1\% \pm 1.6\%$  vs  $-9.7\% \pm 2.4\%$  of initial weight, there was no difference in weight loss between the diets in long-term follow-up (>1 year), VLCD =  $-6.3\% \pm 3.2\%$ ; LCD =  $-5.0\% \pm 4.0\%$ .<sup>32</sup>

**Macronutrient focused.** Many RCTs have been conducted to help determine which mix of macronutrients best promotes weight loss, while including other positive metabolic benefits. What is important to recognize about macronutrient-focused diet prescriptions is that when one macronutrient is altered, there will be a change in the other macronutrients. Thus, prescriptions for macronutrient-focused diets have often targeted changing one macronutrient, allowing the other two macronutrients to change as different food choices are made. The name of the macronutrient-focused diet is usually based on the one macronutrient that is targeted for change.

**Low carbohydrate.** A low-carbohydrate diet is commonly defined as consuming no more than 20 g of carbohydrate per day.<sup>34,35</sup> Energy and other macronutrients are not restricted in low-carbohydrate diets. Once a desired weight is achieved, carbohydrate intake can increase to 50 g per day.<sup>36</sup>

While amount of weight loss achieved is not considered to be different between a low-carbohydrate and low-fat, LCD especially over 12 months or longer, research does suggest that these diets may produce differences in cardiometabolic outcomes during weight loss.<sup>1</sup> For example, a low-fat, LCD produces a greater reduction in low-density lipoprotein cholesterol than a low-carbohydrate diet, while a low-carbohydrate diet produces a greater reduction in triglycerides and a larger increase in high-density lipoprotein cholesterol than a low-fat, LCD.<sup>1</sup>

• **Low-glycemic index/glycemic load.** There is currently no standard definition of a low-glycemic index or low-glycemic load diet. The effectiveness of a low-glycemic index diet without restriction of energy intake on weight loss is fairly poor.<sup>37</sup> With regard to cardiometabolic outcomes, a recent RCT found that when coupled with energy restriction, a low-glycemic index diet controlled glucose and insulin metabolism more effectively than a high-glycemic index, low-fat diet.<sup>38</sup>

**High protein.** A high-protein diet is commonly defined as consuming at least 20% energy from protein, with no standard amount defined for fat or carbohydrate.<sup>39</sup> For weight loss, high-protein diets also include an energy restriction. A high-protein diet is often achieved through consumption of conventional foods, but high-protein, portion-controlled liquid and solid meal-replacement products can also be used on a high-protein diet.

**Dietary pattern focused.** Dietary pattern-focused prescriptions emphasize the importance of the overall diet by providing recommendations about types of foods to consume, rather than providing recommendations about amount of energy or macronutrients, to consume.<sup>7,40</sup> The DGA promotes adopting an eating pattern to assist with weight management and reduce

disease risk.<sup>7</sup> As these diets focus on types of foods to consume and may not produce greater weight loss than other types of diets, they enhance consumption of foods that are generally considered beneficial in the diet and enhance overall dietary quality.<sup>41,42</sup>

**Energy density.** Energy density is the ratio of energy of a food to the weight of a food (kcal/g). Energy density is largely determined by the water content (higher water content lowers energy density), but is also affected by the fiber and fat content (more fiber lowers energy density and less fat lowers energy density) of foods and beverages consumed. As low-energy density foods have fewer kilocalories per gram weight, low-energy density foods allow consumption of a greater weight of food relative to energy consumed, which may assist with appetite control and reducing energy intake.<sup>22,43</sup>

Basic eating research has found that serving meals with foods low in energy density results in decreased meal energy intake.<sup>22</sup> For example, one study reduced energy density by 20% for entrées served at breakfast, lunch, and dinner, on three different days, using three different methods (reducing fat, increasing fruits and vegetables, or adding water to entrées), with a different method used to reduce energy density each day. With the reduction in energy density, energy intake per day decreased, ranging from  $-396 \pm 44$  kcal/day to  $-230 \pm 35$  kcal/day, with the largest decrease occurring when fat was reduced in entrées.<sup>44</sup>

Few RCTs have been conducted to examine the effect of a low-energy density diet on weight loss and currently there is no standard method known to best reduce energy density in the diet.<sup>45</sup> Results from these trials about weight loss are mixed, and this may be a consequence of the methods used to reduce dietary energy density, the degree of reduction in energy density achieved, and whether or not energy restriction was included. To better understand how recommendations to reduce energy density can be implemented, guidelines need to be developed regarding what is considered to be low-energy density and high-energy density (currently no definition exists), how best to lower energy density of the

diet, and how dietary energy density should be calculated (ie, as energy density is greatly influenced by water, dietary energy density varies greatly depending on whether and how beverages are included in calculations and no standard calculation has been determined).<sup>46</sup>

**DASH.** DASH is a dietary pattern that was developed to reduce hypertension in individuals with moderate to high blood pressure. DASH encourages the consumption of fruits, vegetables, whole grains, nuts, legumes, seeds, low-fat dairy products, and lean meats and limits consumption of sodium, in addition to caffeinated and alcoholic beverages.<sup>47</sup> A daily energy limit is not a component of the original DASH diet, but when one is provided with the DASH diet, weight loss occurs.<sup>48,49</sup> The DASH diet combined with weight loss significantly enhances reductions in blood pressure above that achieved by weight loss alone.<sup>49</sup>

**Mediterranean.** There is not a standard definition for the Mediterranean diet, but generally the Mediterranean diet reflects the dietary patterns of Crete, Greece and southern Italy in the early 1960s.<sup>50</sup> The traditional Mediterranean diet was focused on plant-based foods (eg, fruits, vegetables, grains, nuts, seeds), minimally processed foods, olive oil as the primary source of fat, dairy products, fish, and poultry consumed in low to moderate amounts, and minimal amount of red meat.<sup>51</sup> As with the DASH diet, the Mediterranean diet can be prescribed with or without an energy restriction, but if weight loss is desired, it does appear that an energy-restriction component is needed.<sup>52</sup> In addition, the Mediterranean diet may improve cardiovascular risk factors, such as blood pressure, blood glucose, and lipids, more so than a low-fat diet,<sup>53,54</sup> but more research is needed in this area.

In summary, there are several dietary approaches that target larger nutrient (eg, energy and/or macronutrient) and or dietary pattern–based changes (eg, Mediterranean diet) that can produce the recommended amount of weight loss.<sup>1</sup> At this time, as long as the diet helps to reduce energy intake by 500 to 750 kcal/day, there is no one diet that falls into this category that has been

shown to be more efficacious than another at producing clinically meaningful weight loss.

**Dietary-timing focused.** While research on dietary interventions for obesity have predominantly focused on food choices that impact energy, macro- and micronutrient, and food group intake,<sup>55</sup> dietary interventions can also address factors that influence the overall timing of the diet (eg, frequency of consumption, timing of consumption, and breakfast consumption). It is important to note that research on the effect of timing of intake on obesity treatment outcomes is very limited.

**Eating frequency.** Eating frequency is commonly defined as the number of eating occasions (meals and snacks) occurring per day. A greater number of eating occasions consumed increases overall eating frequency. At this time, there is no standardized definition of what constitutes an eating occasion.<sup>56</sup> Common parameters used to define an eating occasion include amount of energy consumed, type of substance ingested (eg, food or beverage), and the amount of time that has elapsed since the start of the previous eating occasion.<sup>56,57</sup> Few RCTs have been conducted that examine the influence of eating frequency on weight loss, and those that have been conducted have not found that a higher eating frequency produces greater weight loss.<sup>56</sup>

**Timing of eating.** When and how much energy you eat during the day can also be important for weight management. Potentially consuming more energy earlier in the day, rather than later in the day, can assist with weight management.<sup>55</sup> The mechanism of action by which timing of eating might assist with weight management is by influencing circadian rhythm.<sup>55</sup> Potentially, eating a greater amount earlier in the day may assist with synchronization of peripheral oscillators with the suprachiasmatic nucleus, assisting with maintenance of an appropriate circadian rhythm.<sup>55</sup>

There is only one RCT that has been conducted to examine timing of energy intake and weight loss.<sup>58</sup> In this 12-week intervention, the overweight and obese women with metabolic



syndrome who were randomized to the group that consumed most of their energy earlier in the day lost more weight ( $-8.7 \pm 1.4$  kg vs  $-3.6 \pm 1.5$  kg).

**Breakfast consumption.** One dietary pattern factor that has been proposed to influence weight status is regular consumption of breakfast.<sup>59</sup> Similar to eating frequency, there is no standardized definition of breakfast, but common parameters that are believed to be important in defining breakfast include time of day of consumption, time of consumption after ending daily sleep, and types of foods and beverages consumed at breakfast. Only three RCTs have examined the influence of breakfast consumption on weight loss, with all trials being of short duration ( $\leq 16$  weeks), and no investigation found greater weight loss with breakfast consumption.<sup>60-62</sup>

Overall, the results of intervention research examining the effect of dietary-timing focused interventions do not suggest that increasing eating frequency or consuming breakfast improve weight-loss outcomes, but consuming most of an individual's energy earlier in the day may enhance weight loss.

**EAL Recommendation:** "For weight loss and weight maintenance, the RDN should individualize the meal pattern to distribute calories at meals and snacks throughout the day, including breakfast." (Rating: Fair, Imperative)

**Activity Intervention.** Activity interventions are designed to enhance energy expenditure, which assists with the achievement of negative energy balance that is required for weight loss. However, it is important to recognize that activity interventions may assist with weight management via other mechanisms that are not well understood (eg, sparing of fat-free mass with weight loss, enhanced ability for energy regulation, and ability to buffer the negative effects of stress on weight).<sup>63</sup> Traditionally, activity interventions have focused on increasing MVPA, as this type of activity has higher energy expenditure than other activities (eg, light physical activity) and also improves cardiovascular health. Recently, focus has turned to

the role of sedentary behaviors and obesity treatment.

**Physical activity.** MVPA is defined as activity that is  $\geq 3.0$  metabolic equivalent units (METs; a MET of 1 is generally considered the RMR).<sup>9</sup> There is a large body of research, including RCTs, examining the influence of MVPA on obesity treatment.<sup>9</sup> While increasing MVPA alone is not believed to be the best strategy for weight loss and produces less weight loss than decreasing energy intake, the combination of increasing MVPA with decreasing energy intake produces the largest weight loss.<sup>9,64</sup> For example, a recent meta-analysis of diet or exercise interventions vs combined behavioral weight-management programs found at 12 months that the combined program had greater weight loss than the diet-only programs (mean difference in weight loss achieved for combined behavioral weight management vs diet only was  $-1.72$  kg) and the exercise-only programs (mean difference in weight loss achieved for combined behavioral weight management vs exercise only was  $-6.29$  kg).<sup>64</sup> However, for weight-loss maintenance, research has consistently demonstrated that a high level of MVPA is imperative.<sup>9</sup> The difference in the roles of MVPA for weight loss and weight-loss maintenance is believed to be due to the degree of energy deficit required. Weight loss requires a larger energy deficit (approximately  $-500$  to  $-1,000$  kcal/day for 1 to 2 lb of weight loss per week), which is challenging to achieve via increased MVPA alone. For weight-loss maintenance, equilibrium of energy intake to expenditure is needed; thus, higher levels of MVPA allow energy intake to be greater, which may help long-term adherence to dietary goals. The current recommendation for physical activity is a minimum of 30 minutes of moderate-intensity activity on most days of the week (150 min/wk).<sup>8</sup> However, higher levels of MVPA ( $>250$  min/week) are recommended for weight-loss maintenance.<sup>9</sup> To enhance cardiovascular outcomes associated with increasing MVPA, ideally minutes spent in MVPA is accumulated in bouts of at least 10 minutes.<sup>5</sup>

**EAL Recommendation:** "For weight loss the RDN should encourage physical

activity as part of a comprehensive weight-management program, individualized to gradually accumulate 150 to 420 minutes or more of physical activity per week, depending on intensity, unless medically contraindicated." (Rating: Consensus, Imperative)

**EAL Recommendation:** "For weight maintenance the RDN should encourage physical activity as part of a comprehensive weight-management program, individualized to gradually accumulate 200 to 300 minutes or more of physical activity per week, depending on intensity, unless medically contraindicated." (Rating: Consensus, Imperative)

**Sedentary behavior.** Sedentary behavior is defined as sitting activities with a very low level of energy expenditure ( $<1.5$  METs).<sup>65</sup> Sedentary behavior occurs in a variety of domains (ie, leisure, occupation, transportation, and recreation), and includes working/playing on the computer or tablet, driving a car, and watching television (TV). Given that greater time spent in sedentary behavior, independent of time performing MVPA, has been associated with increased risk of obesity,<sup>66</sup> it is now recommended that sedentary behavior, particularly leisure screen time (eg, TV watching; computer and tablet use), be reduced in adults to improve weight and health status.<sup>66,67</sup>

There are several mechanisms by which reducing sedentary behavior may assist with weight management. The first is through increasing energy expenditure. Research indicates that when time engaged in sedentary behavior is reduced, while little to none of the newly acquired free time is reallocated to MVPA, a significant amount of time is reallocated to light physical activity (1.5 to 2.9 METs).<sup>68,69</sup> The reallocation of time spent in sedentary behavior to light physical activity may increase overall energy expenditure due to light physical activity's higher MET values as compared with sedentary behavior. The second mechanism is through reducing food consumption. Eating appears to be a complementary behavior to some sedentary behaviors, particularly TV watching.<sup>70</sup> As TV watching is reduced, energy consumed while watching TV decreases, thus

lowering intake.<sup>69</sup> Few RCTs have examined reducing sedentary behavior during obesity treatment, and the two trials that have were of a small sample size (<15 participants) and of short duration (8 weeks), and did not find significantly greater weight loss with the conditions that prescribed reducing sedentary behavior to <10 hours/week of TV watching (comparison was an intervention that prescribed increasing MVPA to 200 minutes/wk).<sup>69</sup>

The research on activity interventions demonstrate that increasing MVPA is an important behavioral target in weight management, particularly in weight-loss maintenance. Additional research is required to understand if reducing sedentary behavior should also be a behavioral target in obesity treatment interventions.

### Behavior-Change Intervention.

Behavior-change theories and models provide an evidence-based approach for changing energy-balance behaviors that are important for obesity treatment.<sup>71</sup> At this time, it is not known what is the best combination of behavior-change strategies and techniques to apply in treating obesity.<sup>72</sup> Instead, it is believed that a variety of strategies from different behavior change theories can be applied to assist with changing behaviors.<sup>71</sup> Evidence-based interventions for behavior change have developed from behavioral theory, which is a theoretical framework that proposes that with the use of learning principles, such as classical and operant conditioning, healthy behaviors can be learned.

### Cognitive behavioral therapy.

Cognitive behavioral therapy (CBT) uses a directive, action-oriented approach and provides skills to help individuals learn to develop functional thoughts and behaviors.<sup>71</sup> CBT proposes that thoughts, feelings, and behaviors interact to impact health outcomes. Cognitive and behavioral strategies are emphasized to effect change. Commonly used strategies in CBT include self-monitoring, goal setting, problem-solving and preplanning, stimulus control, cognitive restructuring, and relapse prevention. Two widely recognized obesity intervention trials, the Diabetes Prevention Program (DPP) and the Look AHEAD trial, provide examples of the use of CBT in assisting

with changing eating and activity behaviors.<sup>73,74</sup> In DPP, the lifestyle intervention received a reduced-energy diet and a physical activity prescription within the context of a CBT intervention.<sup>74</sup> In DPP, during the 2.8 mean years of follow-up, the lifestyle intervention lost 5.6 kg of weight, which was significantly greater than the other two conditions (placebo=-0.1 kg; metformin=-2.1 kg).<sup>74</sup> As mentioned previously, Look AHEAD produced significant weight-loss outcomes in the condition that received the CBT intervention, with significant weight loss reported across time, even up to 8 years follow-up (lifestyle intervention with CBT=-4.7%±0.2%; education comparison=-2.1%±0.2% of initial weight).<sup>5</sup> The materials for the CBT intervention for both DPP and Look AHEAD are available and accessible to the public (DPP: <https://dppos.bsc.gwu.edu/web/dppos/dpp>; Look AHEAD: [www.lookaheadtrial.org/public/home.cfm](http://www.lookaheadtrial.org/public/home.cfm)). RDNs played a large role in intervention in Look AHEAD.<sup>75</sup>

**Motivational interviewing.** Motivational interviewing focuses on the style of interaction between a practitioner and client. Motivational interviewing emphasizes collaboration, evocation, and autonomy.<sup>76</sup> Collaboration guides practitioners to be “supportive partners” rather than “persuasive experts,” which contrasts with the prescriptive, expert-driven style commonly used in dietary interventions. Evocation encourages the practitioner to draw out the client’s personal motives and values regarding behavior change. Finally, autonomy emphasizes a client’s personal choice, in which the responsibility and decisions about behavior changes fall under the client’s, rather than practitioner’s, control. Motivational interviewing emphasizes that the intervention for obesity would be driven by the client, rather than the practitioner. Using this approach, motivational interviewing is believed to enhance motivation and self-efficacy, which are considered to be key for changing, and sustaining, behavior change.<sup>76</sup> Motivational interviewing has an additional benefit, in that it can be delivered at a low intensity (ie, shorter and less frequent dosages).<sup>77</sup> For example, a review of 10 RCTs examining motivational interviewing and obesity treatment found

that participants receiving a median amount of 60 minutes of motivational interviewing in an encounter, with number of encounters ranging from one to five or more, reduced BMI by 0.72 more so than participants only receiving usual care.<sup>77</sup>

### Acceptance and commitment therapy.

A “third wave” of behavioral therapy has developed, which is based on the use of acceptance-based strategies. These strategies shift the focus from reducing the occurrence of aversive internal thoughts and feelings to being able to experience these thoughts and feelings to assist with promotion of behavior that is congruent with personal values.<sup>78</sup> It is believed that these approaches enhance mindfulness, which can enhance understanding of the personal decision that one makes and reduce mindless behavior.<sup>78</sup> One acceptance-based approach that has recently been examined for improving obesity treatment is Acceptance and Commitment Therapy (ACT). While few RCTs have examined ACT and obesity treatment, ACT appears to produce an amount of weight loss similar to CBT and may produce greater weight loss in those more susceptible to eating cues (eg, have greater food-related thoughts and feelings when exposed to external food cues), disinhibited eating, or emotional eating.<sup>78</sup>

The research on behavior change interventions demonstrates that CBT and motivational interviewing effectively change eating and physical activity behaviors so that meaningful weight loss occurs. However, not all individuals respond to obesity treatment, even when CBT and/or motivational interviewing are implemented; thus, additional strategies, such as ACT, continue to be developed to assist with behavior change in obesity treatment.

**EAL Recommendation:** “For weight loss and weight maintenance, the RDN should incorporate one or more of the following strategies for behavior change: self-monitoring; motivational interviewing; structured meal plans and meal replacements and portion control; goal setting; and problem solving.” (**Rating: Strong, Imperative**)

**EAL Recommendation:** “For weight loss and weight maintenance, the RDN may consider using the following

behavior therapy strategies: cognitive restructuring; contingency management; relapse prevention techniques; slowing the rate of eating; social support; stress management; and stimulus control and cue reduction.” (**Rating: Fair, Imperative**)

**Comprehensive Lifestyle Intervention.** Obesity treatment incorporating a dietary prescription that results in an energy deficit of at least 500 kcal/day, a physical activity prescription of at least 150 minutes of MVPA per week, and a structured behavior-change intervention is classified as a lifestyle intervention.<sup>1</sup> Combining all three components—diet, physical activity, and behavioral strategies—in intervention produces greater weight loss than an intervention that uses these same components singularly. The lifestyle interventions of DPP and Look AHEAD that produced significant weight loss are examples of a comprehensive lifestyle intervention.<sup>73,74</sup>

**EAL Recommendation:** “For weight loss and weight maintenance, the RDN should include the following components as part of a comprehensive weight-management program: reduced-calorie diet, increasing physical activity, use of behavioral strategies.” (**Rating: Strong, Imperative**)

**Intensity of Intervention.** According to the 2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults, frequency of contact appears to be an important characteristic of intervention for weight-loss outcomes.<sup>1</sup> Comprehensive, lifestyle intervention, delivered on site, with face-to-face contact, providing an average of one to two treatment sessions per month (eg, 6 to 12 sessions in 6 months), produces about 2 to 4 kg of weight loss in 6 to 12 months, which is significantly greater than usual care (minimal intervention control group).<sup>1</sup> Comprehensive, lifestyle intervention delivered at a high intensity ( $\geq 14$  sessions in 6 months) produces greater weight loss relative to usual care than the weight loss that occurs with comprehensive, lifestyle intervention delivered at low-to-moderate intensity (eg, intervention delivered in  $\leq 12$  sessions in 6 months) relative to usual care.<sup>1</sup>

**EAL Recommendation:** “For weight loss, the RDN should prescribe at least 14 MNT encounters (either individual or group) over a period of at least 6 months.” (**Rating: Strong, Imperative**)

“For weight maintenance, the RDN should prescribe at least monthly MNT encounters over a period of at least 1 year.” (**Rating: Strong, Imperative**)

**eHealth in Intervention.** Interventions that can be delivered without face-to-face contact with the use of technology are believed to have the capability to decrease intervention costs and increase the reach of the intervention for those who are in need of treatment.<sup>79</sup> The development of efficacious technology-based weight-loss interventions are thought to have the potential for great public health impact.<sup>79</sup>

**Computer-based interventions.** The first modern technology-based intervention developed for weight loss was computer-based programs, in which various aspects of the Internet were used. These programs include those with an intervention website, which provided many different Internet-based features (posted education materials, tracking systems, discussion boards, chat rooms, e-mails), or more e-mail-based programs in which interventionists interacted with participants via e-mail. A Cochrane Review of computer-based programs for weight loss found that for interventions lasting 6 months, computer-based interventions produced greater weight loss than minimal interventions ( $-1.5$  kg).<sup>79</sup> However, face-to-face interventions produced greater weight loss than computer-based interventions ( $-2.1$  kg).<sup>79</sup> Only one study in the review reported the cost-effectiveness ratio, thus conclusions could not be drawn about this aspect of computer-based programs.<sup>79</sup> In agreement with this, the 2013 AHA/ACC/TOS Guidelines state that comprehensive interventions delivered onsite by a trained interventionist produce larger weight loss than comprehensive interventions delivered by the Internet or e-mail.<sup>1</sup>

**Smartphone-based interventions.** Unlike computers, smartphones are usually carried by users everywhere they go and are almost always on. These features of use provide the ability for real-time,

on-demand interaction. Thus, it is believed that smartphones provide the opportunity for frequent and interactive feedback, tailored messaging (via text or e-mails), and immediate access to social support.<sup>80</sup> Interactive applications, “apps,” can assist with decision making on behaviors, as they can provide timely feedback on health behaviors in real time.<sup>80</sup> Smartphones are theorized to have the ability to maintain important components of face-to-face interaction (eg, accountability, feedback, social support) without face-to-face time.<sup>80</sup> As this is a new area of research in weight management, it is not clear at this time how efficacious these programs will be, but it is believed that these types of programs will outperform computer-based interventions.<sup>80</sup>

**Supplements.** In a 2009 systematic review of the efficacy and safety of herbal medicines used for obesity treatment, Hasani-Ranjbar and colleagues<sup>81</sup> reported on weight change and body composition outcomes in 17 RCTs. Compounds containing ephedra, *Cissus quadrangularis*, ginseng, bitter melon, and zingiber were found to be helpful in significantly reducing body weight (summary data were not included in the review); however, supplements containing ephedra and bofutsushosan (an oriental herbal medicine) were found to have some adverse effects. Food-based supplements, such as caffeine, carnitine, calcium, choline, chromium, lecithin, fucoxanthin, garcinia cambogia, capsaicin (cayenne pepper), green tea extracts, kelp, taurine, conjugated linoleic acid, psyllium, pyruvate, leucine, forskolin,  $\beta$ -sitosterol, and tea, have been labeled “fat burners” and have been proposed to increase weight loss by increasing fat metabolism.<sup>82</sup> However, according to Jeukendrup and Randall, only caffeine and green tea have shown enhanced fat oxidation, but the effect of the increased fat oxidation on weight management is not clear. All other proposed food-based supplements lack sufficient evidence of increased fat metabolism at this time.<sup>82</sup> In 2013, Hasani-Ranjbar and colleagues<sup>83</sup> reported on another 33 RCTs using herbal- and food-based supplements and suggested that the efficacy and safety of these supplements is still mostly unknown and long-term RCTs are needed to enhance our understanding of the role of supplements and obesity treatment.

One helpful resource regarding supplements comes from the National Center for Complementary and Alternative Medicine, which houses a variety of fact sheets on a number of herbal- and food-based supplements (<http://nccam.nih.gov/health/atoz.htm>).

**Commercial Programs.** Commercial programs are weight-loss programs that are usually not delivered by a health care provider and can provide various options of types of support for weight loss to consumers. Options can include face-to-face programs, prepackaged food, and Internet-based programs. Little research has been conducted on commercial options for weight loss, but what has been conducted suggests that commercial-based, comprehensive weight-loss interventions delivered in face-to-face formats have produced an average weight loss of 4.8 to 6.6 kg at 6 months when conventional foods are consumed and 6.6 to 10.1 kg at 12 months with use of prepackaged food, and that these weight losses are greater than minimal-treatment control interventions.<sup>1</sup> This suggests that commercial programs that provide comprehensive programs may be a viable option for treatment.

**Medications.** Comprehensive lifestyle interventions are efficacious at producing weight loss, however, there is large variability in the ability to implement and maintain changes recommended in these interventions. For those that have difficulty losing weight (BMI  $\geq 30$  or BMI  $\geq 27$  with obesity-related medical issues, such as high blood pressure, high cholesterol, or type 2 diabetes),<sup>84</sup> medications may be helpful for achieving weight loss. There are three medications for obesity treatment approved for long-term use (up to 2 years).<sup>85</sup>

**Orlistat.** Orlistat is a lipase inhibitor that causes dietary fat to be excreted as oil in the stool and is recommended to be taken with a diet containing 30% fat. The nonprescription dose of orlistat provides approximately 80% of the weight loss seen with the prescription dose. Orlistat is not absorbed to any significant degree and the side effects relate to the fat in the stool, including abdominal cramps, flatus with discharge, oily

spotting, and fecal incontinence. Due to the potential loss of fat-soluble vitamins, orlistat should be taken with a vitamin supplement. A meta-analysis concluded that weight loss with orlistat (60 to 120 mg three times/day) was 2.9 kg greater than placebo at 12 months.<sup>86</sup>

**Lorcaserin.** Lorcaserin is an agonist of the serotonin (5-HT) 2c receptor in the hypothalamus and enhances feelings of satiety. Lorcaserin at a dose of 10 mg twice a day resulted in a 3.3% greater weight loss than placebo.<sup>85</sup> Lorcaserin was well tolerated with side effects in  $>5\%$  reported as headaches, dizziness, fatigue, nausea, dry mouth, and constipation. Lorcaserin is a Drug Enforcement Administration schedule IV drug, with low potential for abuse.<sup>85</sup>

**Phentermine/topiramate.** Phentermine, an appetite suppressant, causes a decrease in food intake by stimulating the release of norepinephrine in the hypothalamus. A controlled-release formulation of phentermine/topiramate, a schedule IV drug, is approved for the treatment of obesity. The dosage begins at a low dose for 14 days (3.75 mg phentermine/23 mg topiramate extended-release once a day), transitions to a mid-dose (double the low dose), and then to a high dose (mid-dose twice a day) if weight loss is not achieved after 12 weeks. If 5% weight loss is still not achieved after 12 weeks on the high dose, the medications should be discontinued. Weight loss was 3.5%, 6.2%, and 9.3% greater than placebo in the low, mid, and high doses, respectively.<sup>87,88</sup> Adverse events occurring in  $>5\%$  of patients include paresthesias, dizziness, dysgeusia, insomnia, constipation, and dry mouth. See the section on sleeve gastrectomy for the EAL recommendation for the use of medication.

**Surgery.** While comprehensive lifestyle interventions are considered the mainstay of all weight-management treatment, for patients who are unable to achieve or maintain weight loss that improves health or for obese patients at high medical risk, adjunctive treatments are needed.<sup>1</sup> Bariatric surgery is an option that is increasingly used in those individuals with extreme obesity, or with those with a lower BMI but with obesity-related comorbid conditions.<sup>1</sup>

**Laparoscopic gastric banding.** The lap-band does not permanently alter the anatomy of the gastrointestinal tract, but instead places a thin, inflatable band around the top of the stomach to create a new and smaller stomach pouch. This surgery requires extensive follow-up to make sure the band is properly adjusted. Ten-year follow-up of lap-band surgery indicates maximum weight loss was about 20% at 1 to 2 years, with maintenance of 15% weight loss at 10 years.<sup>89</sup> Popularity of the lap-band has decreased in the United States, primarily due to inferior weight loss, complexity of follow-up, a lower remission rate to diabetes, and a greater need for reoperation due to complications.

**Gastric bypass.** The bypass, long considered the gold standard obesity operation, permanently alters the anatomy of the gastrointestinal tract. In the bypass, a small pouch is created at the top of the stomach and a part of the small intestine, the jejunum, is attached to a small hole in the pouch. Thus, the surgery allows food to bypass part of the stomach and small intestine. The bypass results in a typical weight loss of 35% at 1 to 2 years, which has been shown to be maintained at 30% weight loss at 10 years.<sup>89</sup> The bypass has the highest mortality rate, rate of complications, and the most severe metabolic abnormalities of the three surgeries. With the bypass, there is greater need for protein, iron and vitamin supplementation, and monitoring of calcium and vitamin D levels.<sup>90</sup>

**Sleeve gastrectomy.** The sleeve, the newest of the three bariatric procedures, permanently alters the anatomy of the stomach because a portion of the stomach is removed, producing a tube-shaped stomach or sleeve, and now has data on more than 5 years of follow-up. The sleeve is gaining in popularity, as it produces similar weight loss and remission of type 2 diabetes (80% of patients with diabetes before surgery are able to control their blood glucose levels 5 years after bariatric surgery)<sup>91</sup> as occurs with the bypass, but at lower cost, with lower rates of complications and mortality.<sup>90,92,93</sup> Metabolic complications with the sleeve are also fewer than with the bypass, however, recommendations still include vitamin

supplementation and monitoring of iron, calcium, and vitamin D levels.

For bariatric surgery, the 2013 AHA/ACC/TOS Guideline states that for individuals who are obese, weight loss at 2 to 3 years after bariatric surgery ranges from 20% to 35% of initial weight, with a greater weight loss of 14% to 37% for bariatric surgery as compared with nonsurgical comparators.<sup>12</sup>

**EAL Recommendation:** “For weight loss and weight maintenance, the RDN should implement MNT and coordinate care with an interdisciplinary team of health professionals (may include specialized RDNs, nurses, nurse practitioners, pharmacists, physicians, physician assistants, physical therapists, psychologists, social workers, and so on) especially for patients with obesity-related comorbid conditions. Coordination of care may include collaboration on use of US Food and Drug Administration–approved weight-loss medications; and appropriateness of bariatric surgery for people who have not achieved weight-loss goals with less invasive weight loss-methods.” **(Rating: Consensus, Imperative)**

**Monitoring and Evaluation.** To determine effectiveness of any intervention implemented, outcomes need to be monitored over time and evaluated for degree of success achieved. See [Figure 1](#) for suggested areas to monitor and evaluate for effectiveness of a comprehensive weight-management program.

**EAL Recommendation:** “The RDN should monitor and evaluate the effectiveness of the comprehensive weight-management program for overweight and obese adults, through the following data: food and nutrition-related history; anthropometric measurements; biochemical data, medical tests, and procedures; and nutrition-focused findings.” **(Rating: Strong, Imperative)**

If weight loss is not occurring at the expected rate, total energy needs may need to be reassessed.

**EAL Recommendation:** “For weight loss and weight maintenance, the RDN should monitor and evaluate total energy needs and consider one of the following (if necessary): re-measure RMR using indirect calorimetry; recalculate Mifflin-St. Jeor equation; or re-apply a new physical activity factor to RMR to estimate total energy needs.” **(Rating: Consensus, Imperative)**

## Community-Level Obesity Intervention

Within the socioecological model framework, community-level obesity interventions focus on utilizing and strengthening existing community assets and capacity in changing energy balance behaviors that can produce weight loss. These types of interventions generally focus on increasing capacity for providing and enhancing access to intervention, with community-based organizations and/or interventionists providing the intervention, and/or altering the community environment to assist with promoting energy-balance behaviors helpful for weight management.

One example of a community-level intervention focusing on increasing capacity for providing and increasing access to intervention is the use of YMCAs as a site for delivering intervention. For example, a comprehensive lifestyle intervention modeled after the DPP delivered to community members at high risk for diabetes by YMCA employees produced 6% weight loss at 6 months.<sup>94</sup> A review of faith-based interventions designed for African-American females, which are implemented in faith-based settings in the community and are also designed to increase capacity for providing and access to intervention, also found significant reductions in anthropometric measures across reviewed studies (for studies reporting change in weight, the range of change in weight was  $-3.6$  to  $-9.8$  lb).<sup>95</sup> Another example that increases capacity and access to intervention and that often has a focus on changing the environment is worksite wellness programs. A review of worksite wellness weight-management programs found that those programs that focused on strategies to increase physical activity and change dietary intake were generally successful at assisting with weight maintenance or producing modest weight loss (for studies reporting change in BMI the range of change was  $-0.14$  to  $-1.4$ ).<sup>96</sup>

For changing the community environment, it is hypothesized that environments with a greater density of fast-food outlets and/or lower density of farmers' markets or other types of markets with fresh produce encourage dietary intakes that are high in energy

density and, thus, contribute to excessive energy intake and obesity.<sup>97</sup> In addition, it is proposed that environments with reduced access for physical activity (few greenways, parks, and sidewalks) produce inactivity, which also contributes to obesity.<sup>98</sup> Most of the research in this area is observational, so it is not clear at this time whether changing these environmental factors will reduce the prevalence of obesity.<sup>98</sup> When communities implement these environmental changes to assist with lowering the prevalence of obesity, a “natural experiment” is created, and evaluation is needed to understand how these environmental changes influence weight.

**EAL Recommendation:** “The RDN should recommend use of community resources, such as local food sources, food assistance programs, support systems, and recreational facilities.” **(Rating: Strong, Imperative)**

## Policy-Level Obesity Intervention

Policy-level obesity interventions are generally framed as interventions developed at the federal, state, or local government level that implement broad changes that are believed to help change energy-balance behaviors that can produce weight loss. The broad changes are designed to influence everyone for whom the policy has been developed. Two policy-level interventions that are believed to be helpful for reducing the prevalence of obesity include menu labeling and taxing the cost of certain foods. Menu labeling is under Section 4205 of the Patient Protection and Affordable Health Care Act ([www.gpo.gov/fdsys/pkg/BILLS-111hr3590enr/pdf/BILLS-111hr3590enr.pdf](http://www.gpo.gov/fdsys/pkg/BILLS-111hr3590enr/pdf/BILLS-111hr3590enr.pdf)). Ideally, consumers can use the labeling information on menus to make choices that could assist with reducing intake, provided they are motivated to do so.<sup>99,100</sup> Menu labeling does seem to influence purchasing decisions that cause a reduction in overall energy purchased in some, but not all, consumers in some types of restaurants.<sup>101</sup> For example, women were found to decrease mean amount of energy per purchase at coffee chain restaurants but men did not, and mean amount of energy per purchase did not decrease in burger and sandwich restaurants.<sup>101</sup> More research is needed to

understand what factors influence purchasing decisions in restaurants for menu labeling to have a broader impact.

Another policy-level intervention gaining momentum is creating a tax that can be levied on unhealthy foods (eg, non-nutrient-dense, energy-dense foods) to help reduce their consumption. The tax could also potentially be combined with a plan to subsidize healthier foods, thus potentially increasing consumption of healthy foods. It is not clear at this time how this type of policy would influence eating behavior and obesity, but the little research conducted in this area suggests that small excise taxes are unlikely to affect obesity rates and that while higher excise taxes are likely to reduce obesity in at-risk populations, higher excise taxes are believed to be less politically palatable or sustainable.<sup>102</sup>

## RESPONSIBILITIES OF FOOD AND NUTRITION PRACTITIONERS

To address obesity, it is believed that interventions are needed that can incorporate multiple levels of the socioecological model that can be sustained for many years.<sup>103</sup> Thus, interventions for obesity need to address changing individual-level energy balance behaviors; be delivered in many settings to increase accessibility to intervention; influence the environment in which clients live, work, and play; and impact on policy that can assist with providing a context for supporting engagement in energy-balance behaviors within the population to improve weight management.

### Understanding the Socioecological Model

Although obesity is a result of a chronic imbalance of energy intake and energy expenditure, it is now recognized that these individual-level behaviors are influenced by determinants at multiple levels, which enhances understanding that individual choices are shaped by the wider context in which they occur.<sup>103</sup> Thus, ecological models—models that incorporate multiple levels or systems—of health promotion are increasingly promoted to address chronic health conditions.<sup>104</sup> For RDNs to be included in the development,

implementation, and evaluation of these interventions, an understanding of the SEM is required. Interventions with a SEM approach will target change at one or more levels, either directly or indirectly, through multi-level, multisectoral interventions.<sup>104</sup> For example, an intervention designed to reduce overweight and obesity in adults might be developed in which a state enacts a law targeting worksites to ensure that worksite cafeterias provide nutrition information about available food choices to employees and provides financial incentives to companies to encourage the development of worksite wellness programs; a company with several worksites develops a wellness program that screens employees for health risks, refers employees who are overweight or obese to an on-site RDN, and provides financial incentives to employees to encourage improving improve weight status; and the worksite RDN provides MNT, incorporating employees' individualized needs and preferences, to referred employees and incorporates family members into sessions to assist with changing the home environment and increasing family support. This approach incorporates several levels of the socioecological model, allowing them to intersect, and enhance overall weight-management outcomes. To develop an ecological approach, developing collaborative partnerships among all stakeholders is key<sup>104</sup> and should be encouraged within the field of nutrition.

### Addressing Health Disparities

The prevalence of overweight and obesity continues to remain higher in non-Hispanic black adults and Hispanic adults, as compared with non-Hispanic white adults, indicating a health disparity.<sup>2</sup> To address these disparities, a greater understanding of the multi-level factors associated with energy balance is needed. While energy balance is influenced by a multitude of individual-level factors (eg, genetics, biology, individual behavior, and individual-level social determinants), research suggests that contextual aspects of social determinants, particularly those related to environmental factors, are important to address, as pervasive socioeconomic and racial

inequalities found within environmental contexts may underlie obesity disparities.<sup>105</sup> This suggests that interventions containing multiple levels of the socioecological model will be more effective at reducing health disparities.

### Addressing Weight Bias

Individuals with overweight and obesity can encounter weight bias in health care settings by health professionals.<sup>106</sup> Weight bias is demonstrated when health care professionals have beliefs that those with obesity are lazy, noncompliant to intervention, and lack self-control.<sup>106</sup> Those experiencing weight bias from health care professionals are more likely to avoid health screenings, cancel appointments, demonstrate maladaptive eating behaviors, and experience poorer outcomes when receiving treatment for overweight or obesity.<sup>107,108</sup> Thus, RDNs should ensure that health care experiences for individuals with overweight or obesity are free of weight bias. Ensuring that RDNs understand the complex etiology of obesity, thus that there are contributors to obesity that are outside of personal control, and the difficulties around achieving significant, sustainable weight loss, may increase empathy regarding the challenges of obesity treatment and reduce weight bias.<sup>108</sup>

### Scope of Practice

Integrated ecological-based interventions will provide solutions that cover multiple jurisdictions, requiring a wide range of skills.<sup>103</sup> No one profession will be able to provide all skills required for the development, implementation, and evaluation of these interventions to address obesity. Thus, rather than acting independently, RDNs will need to develop relationships with others to be involved in the SEM approach. These relationships will include traditional health care partners, such as physicians, pharmacists, and psychologists, but also nontraditional partners, such as city planners, architects, and legislators. Within these relationships, the role of the RDN is to provide expertise in the area of nutrition, which includes MNT and related areas, community and public health nutrition, foodservice systems, school

nutrition, and sustainable resilient healthy food and water systems.<sup>109</sup>

### REIMBURSEMENT FOR OBESITY TREATMENT INVOLVING MNT

Reimbursement for MNT provided by RDNs is essential to the field of dietetics.<sup>110</sup> The Patient Protection and Affordable Health Care Act provides coverage for nutrition services in the area of obesity counseling for adults.<sup>111</sup> However, the role of the RDN in providing nutrition services covered by the Patient Protection and Affordable Health Care Act is open to interpretation by those paying for these services.<sup>110</sup> In addition, the Centers for Medicare & Medicaid Services provides coverage for Intensive Behavioral Counseling for Obesity for eligible Medicare beneficiaries.<sup>112</sup> As with Patient Protection and Affordable Health Care Act, the role of the RDN in Intensive Behavioral Counseling for Obesity is not covered. While RDNs are not specifically designated as the sole providers of MNT under these reimbursement strategies, RDNs can provide services and receive reimbursement. Third-party payers use a standardized numeric coding set, and within this system the MNT codes, which include those for obesity, describe the services of RDN. The diagnostic codes are usually determined by the referring physician, as it is not within the scope of practice for a RDN to make a medical diagnosis.<sup>110</sup> However, the exception to this is in the case of BMI codes, as BMI represents a mathematical calculation based on measurements that are within the RDN's scope of practice to perform.<sup>113</sup> In a recent survey of coding practices of RDNs collected by the Academy, of those RDNs who completed the survey, obesity was the second highest disease or condition from which reimbursement was received from third-party payers.<sup>110</sup> Only diabetes was ranked higher than obesity for receiving reimbursement from third-party players from responding RDNs.<sup>110</sup>

### ROLE OF THE RDN AND NUTRITION AND DIETETICS TECHNICIAN, REGISTERED, IN TREATMENT OF OVERWEIGHT AND OBESITY IN ADULTS

Changing dietary intake so that a reduction in energy intake occurs is a

key component of obesity treatment.<sup>1</sup> Thus, the expertise of the RDN and nutrition and dietetics technician, registered (NDTR) is essential for the development, implementation, and evaluation of any intervention designed to reduce overweight and obesity.

#### MNT

The Academy's definition of MNT is broader than other entities.<sup>114</sup> MNT, as defined by the Academy, is an individualized approach to disease management that incorporates the nutrition care process and is provided by an RDN.<sup>114</sup> Thus, when treatment for overweight and obesity is being delivered at the individual level, the role of the RDN, along with the NDTR, is to provide evidence-based intervention that incorporates the nutrition care process.

#### Multidisciplinary Teams

As stated earlier, interventions for overweight and obesity that incorporate any level of the socioecological model will require an intervention that includes more than just a focus on dietary intake. A multidisciplinary approach to disease treatment, especially in the case of obesity and chronic disease, is recommended.<sup>115</sup> The type of intervention will designate what other disciplines should be involved, and what other training an RDN and NDTR may benefit from.

#### Medicare and Intensive Behavioral Counseling

The Centers for Medicare & Medicaid Services approved the provision of intensive behavioral counseling for obesity when delivered by qualified primary care and other select practitioners.<sup>112</sup> Intensive behavioral counseling includes a maximum of 22 face-to-face sessions over 12 months, but a weight-loss goal of 3 kg must be met by 6 months in order for counseling sessions to continue to 12 months. Frequency of contact is one face-to-face visit every week for the first month, one face-to-face visit every other week for months 2 to 6, and one face-to-face visit every month for months 7 to 12 if the weight-loss goal has been met. Each visit is to include the five As approach adopted by the US Preventive Services

Task Force. The five As are: 1) assess: ask about behavioral health risk(s) and factors affecting choice of behavior change goals or methods; 2) advise: provide specific and personalized behavior change advice; 3) agree: collaboratively select appropriate treatment goals and methods that take into account the client's values and motivation to changes; 4) assist: aid the client in achieving goals by incorporating behavior change techniques, supplemented with adjunctive medical treatments when appropriate; and 5) arrange: schedule follow-up sessions so that ongoing assistant and support can be provided.

While RDNs are not specifically outlined as a practitioner for delivery of intensive behavioral counseling, if an RDN provides care under conditions specified under the regulation, services can be billed by the one of the specified providers. RDNs developing relationships with the specified providers (general practice, family practice, internal medicine, obstetrics/gynecology, pediatric medicine, geriatric medicine, nurse practitioner, certified clinical nurse specialist, and physician assistant) may create avenues for RDNs to provide treatment for obesity that is reimbursed.

Wadden and colleagues<sup>116</sup> conducted a systematic review of behavioral counseling for overweight and obese primary care patients from RCTs published between 1980 and 2014, finding no studies in which primary care practitioners delivered counseling that followed the Centers for Medicare & Medicaid Services guidelines. However, the investigators found that trained interventionists (eg, those trained in lifestyle intervention, which included RDNs) succeeded in producing weight loss within patients from primary care.

#### Advocacy

To address the obesity epidemic, interventions need to include larger environmental and policy changes, or public health initiatives, that will provide opportunities to support and behaviors that assist with weight management.<sup>117</sup> These types of strategies have shown previous success at addressing public health concerns (eg, reducing smoking, increasing seat belt use).<sup>118</sup> To develop these strategies, advocacy from RDNs and NDTRs is

required. One advocacy effort in the area of obesity that is particularly focused on nutrition is having accessible healthy and affordable foods, which is especially important to address health disparities.<sup>119</sup> To assist RDNs and NDTRs with advocacy, the Academy has developed the Grassroots Manager. The Grassroots Manager assists RDNs with communicating with their legislators, elected officials, and others who may have the ability to influence policy and legislation that can assist with reducing obesity.

## Outcome Data

The role of diet in obesity treatment is established. However, the role of food and nutrition practitioners in obesity treatment is not well documented, thus the need to include an RDN and NDTR in planning or implementing obesity treatment is not clear to all stakeholders. RDNs and NDTRs can assist with documenting the importance of their role in obesity treatment by collecting outcomes related to dietary change and health status. Comparison of outcomes can be made between interventions including RDNs and those not, and with the relationship between frequency of contact with RDNs and outcomes. Thus, to support establishing the role of RDNs and NDTRs in obesity treatment, all practitioners are encouraged to collect and examine outcomes data. To help increase capacity in this effort, RDNs and NDTRs are encouraged to develop partnerships with others that may have skills that are needed in documenting the importance of the RDN in obesity treatment.

## CONCLUSIONS

The high prevalence of overweight and obesity in the United States negatively affects the health of the population, thus reducing the prevalence of overweight and obesity is considered to be a public health priority.<sup>4</sup> Weight loss of only 3% to 5% that is maintained has the ability to produce clinically relevant health improvement, with larger amounts of weight loss reducing additional risk factors for CVD. Successful treatment of overweight and obesity in adults requires the ability of adopting and maintaining lifestyle behaviors, which contribute to both sides of the energy-balance equation. Lifestyle

behaviors are influenced by several factors at differing levels of the socioecological model, which include factors at the intrapersonal, community and organizational, and government and public level.<sup>18</sup> To address obesity, it is proposed that several factors at differing levels need to be targeted to assist with the development and maintenance of behaviors that are necessary for weight loss and successful weight-loss maintenance.<sup>18</sup> The RDN and NDTR, as part of a multidisciplinary team, need to be current and skilled in weight management to effectively assist and lead efforts that can reduce the obesity epidemic. Due to the many factors and levels of the socioecological model that need to be addressed, these teams will include traditional health care partners, but also nontraditional partners. Within these relationships the role of the RDN is to provide expertise in the area of nutrition, which includes MNT and related areas, community and public health nutrition, foodservice systems, school nutrition, and sustainable resilient healthy food and water systems.<sup>109</sup>

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