Part D. Chapter 3: Individual Diet and Physical Activity Behavior Change

INTRODUCTION

Individual behavior change lies at the inner core of the social-ecological model that forms the basis of the 2015 Dietary Guidelines for American Advisory Committee (DGAC) conceptual model (see ***Part B. Chapter 2: 2015 DGAC Themes and Recommendations: Integrating the Evidence***). For this reason, it is crucial to identify the behavioral strategies that individuals living in the United States can follow to improve their healthy lifestyle behaviors as well as the key contextual factors that facilitate the ability of individuals to consume healthy diets.

In the past, American families seldom consumed food prepared outside their homes and, for the most part, consumed their meals as a family unit. However, these behaviors have changed dramatically in recent years. Today, 33 percent of calories are consumed outside the home and it is becoming more common for individuals to eat alone and to bring meals prepared outside into their homes (see ***Part D. Chapter 1: Food and Nutrient Intakes, and Health: Current Status and Trends***). Eating away from home is associated with increased caloric intake and poorer dietary quality compared to eating at home.[1] As recognized by the 2010 DGAC these major changes in eating behaviors can be expected to have a negative impact on the quality of the diets consumed and the risk of obesity among the U.S. population.[2]

Other individual lifestyle behaviors related to dietary intakes and obesity risk also have changed in recent decades. The U.S. population has become increasingly sedentary,[3] with daily hours of screen time exposure becoming a serious public health concern due to its potential negative influence on dietary and weight outcomes. For example, it has been hypothesized that TV viewing time has a negative influence on dietary habits of individuals because of unhealthy snacking while watching TV and through exposure to advertisements of unhealthy food products.[4] In turn, excess caloric intake coupled with sedentary time directly resulting from excessive TV may increase the risk of obesity. Suboptimal sleep patterns associated with today's busy lives also have been identified as a potential risk factor for poor dietary behaviors and body weight outcomes.[5]

In response to these trends, interest has grown in the potential of behavioral strategies that individuals can use to improve their dietary behaviors. Specifically, self-monitoring of diet, physical activity, and body weight has been identified as a potential key component of successful healthy lifestyle interventions.[6] Diet self-monitoring may, in turn, be facilitated by the availability and use of menus displaying calorie labels and the Nutrition Facts label on packaged foods.

Recognizing the importance of these dietary and lifestyle behaviors to the health and well-being of the U.S. population, the DGAC reviewed recent evidence to address questions on the relationship between eating out, family shared meals, sedentary behavior, and diet and weight outcomes. The DGAC also sought to examine associations between sleep patterns, dietary intakes, and obesity risk. However, after conducting preliminary literature searches, the Committee determined sleep patterns was an emerging area with an insufficient body of evidence and did not include specific questions on this topic.

The DGAC also focused on identifying evidence that could provide individuals with tools to improve their dietary choices and body weight status. Specifically, the Committee reviewed recent evidence on the impact of diet and weight self-monitoring, and on use of food and menu labels on dietary intake and weight outcomes. The DGAC was interested in reviewing the evidence on the use of mobile health (m-health) technologies to improve dietary and weight outcomes, and after a preliminary review was conducted, determined that this, too, was an emerging area and that a full evidence review was premature. However, key m-health studies focused on self-monitoring were identified, and thus were reviewed as part of the body of evidence on self-monitoring. This chapter addresses sedentary behaviors, but not physical activity behaviors in general because these are addressed in ***Part D. Chapter 7: Physical Activity***.

Consistent with the DGAC conceptual model presented in ***Part B. Chapter 1: Introduction***, this chapter also addresses major contextual factors that influence the ability of individuals to implement healthy dietary and other lifestyles, including the prevention of sedentary behaviors. The Committee focused on the association between diet, body weight, and chronic disease outcomes and two contextual factors that are highly relevant in the United States—household food insecurity and acculturation.

Household food insecurity is defined as "access to enough food for an active, healthy life. It includes at a minimum (a) the ready availability of nutritionally adequate and safe foods, and (b) an assured ability to acquire acceptable foods in socially acceptable ways (e.g., without resorting to emergency food supplies, scavenging, stealing, or other coping strategies)".[7] Thus, household food insecurity is a condition that exists whenever the availability of nutritionally adequate and safe foods, or the ability to acquire acceptable foods in socially acceptable ways, is limited or uncertain.[7] In 2013, 49.1 million people in the United States lived in food insecure households, and of these, 8.6 million are children.[1] Household food insecurity is suggested to be an independent risk factor for poor physical and mental health outcomes across the lifespan.[8, 9]

The second contextual factor the DGAC addressed—acculturation—reflects that the United States continues to be a nation of immigrants.[10, 11] Acculturation has been defined both as the "process by which immigrants adopt the attitudes, values, customs, beliefs, and behaviors of a

new culture",[12] and as the "gradual exchange between immigrants' original attitudes and behavior and those of the host culture".[13] Acculturation is relevant for individual dietary behaviors because evidence suggests that the healthy lifestyles with which immigrants arrive deteriorate as they integrate or assimilate into mainstream American culture.[14] Moreover, evidence suggests that to be effective in helping immigrants retain their healthy lifestyles, nutrition education programs, including those that are a part of food assistance programs, must be tailored to their different levels of acculturation.[14]

Given the strong relevance of household food insecurity and acculturation as contextual factors influencing healthy lifestyles, the DGAC examined associations between them and diet, obesity risk, and whenever possible, corresponding chronic disease risk factors.

LIST OF QUESTIONS

Eating Out

1. What is the relationship between eating out and/or take away meals and body weight in children and adults?

Family Shared Meals

2. What is the relationship between frequency and regularity of family shared meals and measures of dietary intake in U.S. population groups?
3. What is the relationship between frequency and regularity of family shared meals and measures of body weight and obesity in U.S. population groups?

Sedentary Behavior, Including Screen Time

4. What is the relationship between sedentary behavior and measures of dietary intake and body weight in adults?
5. How effective are behavioral interventions in youth that focus on reducing recreational sedentary screen time and improving physical activity and/or diet?

Self-Monitoring

6. What is the relationship between use of diet and body weight self-monitoring strategies and body weight outcomes in adults and youth?

Food and Menu Labeling

7. What is the relationship between knowledge and use of food and menu labels and measures of dietary intake in U.S. population groups?

Household Food Insecurity (HFI)

8. What is the relationship between household food insecurity (HFI) and measures of dietary intake and body weight?

Acculturation

9. What is the relationship between acculturation and measures of dietary intake?
10. What is the relationship between acculturation and body weight?
11. What is the relationship between acculturation and risk of cardiovascular disease (CVD)?
12. What is the relationship between acculturation and risk of type 2 diabetes?

METHODOLOGY

All of the questions covered in this chapter— eating out, family shared meals, sedentary behavior, self-monitoring, food and menu labeling, household food insecurity, and acculturation—were answered using Nutrition Evidence Library (NEL) systematic reviews. A description of the NEL process is provided in ***Part C: Methodology***. All reviews were conducted in accordance with NEL methodology, and the DGAC made all substantive decisions required throughout the process to ensure that the most complete and relevant body of evidence was identified and evaluated to answer each question. All steps in the process were documented to ensure transparency and reproducibility. Specific information about individual systematic reviews can be found at www.NEL.gov, including the search strategy, inclusion and exclusion criteria, a complete list of included and excluded articles, and detailed documentation describing the included studies and the body of evidence. A link to this website is provided following each evidence review.

EATING OUT

The majority of Americans consume meals outside of the home one or more times per week (see ***Part D. Chapter 1: Food and Nutrient Intakes, and Health: Current Status and Trends***). The 2010 DGAC concluded that "strong and consistent evidence indicates that children and adults who eat fast food are at increased risk of weight gain, overweight, and obesity".[2] With this relationship as a foundation, the 2015 DGAC updated and expanded the review of the "eating out" topic. Specifically, the "fast food" category was broadened to capture other types of eating out venues (e.g., quick serve, casual, formal restaurants, and grocery store take-out).

Terminology used to define the exposure was modified from "eating out," to the broader term "eating out and/or take away meals" to reflect the inclusion of meals eaten out at a broader array of restaurant venues as well as takeout or ready-to-eat foods or meals purchased and consumed either away from or in the home. The population of interest remained healthy individuals ages 2 years and older.

Question 1: What is the relationship between eating out and/or take away meals and body weight in children and adults?

Source of evidence: Update to 2010 DGAC's NEL systematic review

Conclusion

Among adults, moderate evidence from prospective cohort studies in populations ages 40 years or younger at baseline indicates higher frequency of fast food consumption is associated with higher body weight, body mass index (BMI), and risk for obesity. **DGAC Grade: Moderate**

Among children, limited evidence from prospective cohort studies in populations ages 8 to 16 years at baseline suggests that higher frequency of fast food consumption is associated with increased adiposity, BMI z-score, or risk of obesity during childhood, adolescence, and during the transition from adolescence into adulthood. **DGAC Grade: Limited**

Insufficient evidence is available to assess the relationship between frequency of other types of restaurant and takeout meals and body weight outcomes in children and adults. **DGAC Grade: Grade Not assignable**

Implications

Given that one-third of calories are consumed outside of the home (see ***Part D. Chapter 1: Food and Nutrient Intakes, and Health: Current Status and Trends***), individuals should limit the frequency of eating at fast-food establishments. When eating out, one should choose healthy foods and beverages within their calorie needs to avoid increases in body weight.

Review of the Evidence

Fifteen prospective studies examined the relationship between eating out and/or take away meals and measures of body weight in adults and children.[15-29] Eleven studies in the United States [16-18, 20-23, 25-28] and four international studies (one each from Canada, the United Kingdom, Australia, and Spain)[15, 19, 24, 29] were reviewed. Men and women and boys and girls were well represented and the majority of studies within the United States included diverse populations.

In children, seven prospective cohort studies[19, 21, 22, 24, 27-29] examined the relationship between frequency of fast-food meals, or consumption of other types of meals and anthropometric outcomes and, overall, found mixed results. Six studies examined fast-food meals[19, 21, 22, 24, 28, 29]: three studies[19, 28, 29] indicated increased fast food intake, particularly more than twice per week, was associated with increased risk of obesity, BMI/BMI z-score or body fat, two[22, 24] found no association, and one[21] found no association in boys and a negative association in girls. Two studies looked at a variety of non-fast-food meals away from home, using varying definitions of food establishments and meal types and reported mixed findings for a relationship with weight-related outcomes.[27, 28]

In adolescents transitioning to adulthood, one study found high baseline frequency of fast food intake was associated with increased BMI z-scores at 5-year follow-up.[25] In adults, evidence consistently demonstrated a relationship between higher frequency of fast-food meal consumption and body weight outcomes. Five prospective cohort studies (three cohorts) reported a higher frequency of intake of meals from fast food locations, or intake exceeding once per week, was associated with higher weight gain, BMI, and risk of obesity.[17, 18, 20, 23, 26] A "moderate" grade was assigned (as opposed to the "strong" grade assigned by the 2010 DGAC) because the evidence based was small (five studies focused on fast food, three from the same cohort), all of which were prospective cohort studies; few studies controlled for energy intake and no study reported actual food consumed; and the method of measurement of "eating out" varied among studies. Evidence related to the association between frequency of meals from other types of restaurants and intake of all takeout meals and weight is limited, but indicates traditional restaurant meal frequency may not be associated with weight outcomes.[17, 18] Two studies[15, 16] examined total meals away from home or meal types eaten away from home, which came from both fast food and restaurant locations, and reported frequency was associated with increased body weight outcomes for most meal types. Two studies from the same cohort found no significant relationship between frequency of meals from restaurants (non-fast-food establishments), and weight-related outcomes.

For additional details on this body of evidence, visit: http://NEL.gov/topic.cfm?cat=3371

FAMILY SHARED MEALS

Data from cross-sectional studies suggest that when families share meals, they achieve better diet quality and improved nutrient intake, and to some extent, are better able to maintain appropriate body weight.[30-36] The definition of family shared meals in the literature varies, with some defining it as the number of a specific meal eaten together (e.g., dinner), or any meal, prepared at home or outside of home, that is shared among individuals living in the same household.[37] Family mealtime may act as a protective factor for many nutritional health-related problems. For example, they provide an opportunity for parents to model good eating behaviors and create a

positive atmosphere by providing time for social interaction and thus a sense of social support for all members.[38, 39] Shared meals may be important in every stage of the lifecycle to support healthy growth, development, and weight, though the evidence for adults is mixed. The importance of the family in supporting positive behaviors is clearly part of the life course approach embodied in the DGAC's conceptual model (see ***Part B. Chapter 2: 2015 DGAC Themes and Recommendations: Integrating the Evidence***). As a result, the Committee decided to explore the relationship between family shared meals and dietary intake as well as weight outcomes from high-quality epidemiological studies to determine if there is a cause and effect association.

Question 2: What is the relationship between frequency/regularity of family shared meals and measures of dietary intake in U.S. population groups?

Source of evidence: NEL systematic review

Conclusion

Insufficient evidence on the association between frequency of family shared meals and measures of dietary intake is available to draw a conclusion. **DGAC Grade: Grade not assignable**

Implications

The DGAC determined that a grade was not assignable due to the insufficient evidence for this question. Therefore, no implications were developed.

Review of the Evidence

Two studies in the United States with the duration of 5 to 10 years from one prospective cohort examined the relationship between frequency/regularity of family meals and measures of dietary intake in U.S. population groups.[40, 41] The studies included adolescents transitioning from early to middle adolescence (middle school to high school)[40] and adolescents transitioning to early adulthood.[41] These studies found more frequent consumption of family meals was associated with improved dietary intake, specifically an increase in fruits and/or vegetables, and calcium-rich or milk-based foods.[40, 41] Given that the evidence is limited to these two studies using data from the same cohort at two time points, the Committee could not assign a grade.

For additional details on this body of evidence, visit:
http://NEL.gov/conclusion.cfm?conclusion_statement_id=250455

Question 3: What is the relationship between frequency/regularity of family shared meals and measures of body weight in U.S. population groups?

Source of evidence: NEL systematic review

Conclusion

Limited evidence from prospective studies shows inconsistent relationships between the number of family shared meals and body weight of children and adolescents. **DGAC Grade: Limited**

Implications

The very limited evidence available on the relationship between family shared meals and measures of body weight precludes developing implications for this question. Shared meals may be important in every stage of the lifecycle to support healthy growth, development, and weight; however, more studies are warranted to determine if there is a direct effect. In the absence of such studies, meal times may still be an optimal time for parents to provide role modeling behaviors in terms of what foods to eat and, for the elderly encouragement to eat given the social support of other individuals.

Review of the Evidence

Six studies, which included one randomized control trial (RCT)[42] and five prospective cohort studies (4 cohorts)[43-47] examined the relationship between frequency/regularity of family meals and measures of body weight in U.S. populations. The study duration for the RCT was 6 months[42] and the prospective cohort studies[43-47] ranged in duration from 1 to 5 years. The study population was children and adolescents ages 4 to 15 years.

Three out of four prospective cohort studies found no significant association between the frequency of family shared meals, BMI, or overweight status. Evidence from one prospective study (two articles) showed that an increase in the frequency of family shared meals lowered the likelihood of becoming overweight or the persistence of overweight. One study found that among overweight children, eating more family breakfast and dinner meals was associated with lower likelihood of becoming overweight or remaining overweight over a 4-year period. Another article reported children who typically ate more breakfast meals with their families had a lower rate of increase in BMI over 5 years. The number of dinner meals eaten with the family was not associated with a change in BMI.

One RCT included an intervention that simultaneously focused on four household routines, including family shared meals.[42] Although a reduction in body weight occurred, family meal frequency did not change.[42]

This body of evidence had several limitations, including that studies did not use a standard definition for family shared meals, two studies assessed only family dinners, two studies assessed breakfast and dinner meals, and two studies assessed all meals. No study assessed the quality or source of meals consumed.

For additional details on this body of evidence, visit:
http://NEL.gov/conclusion.cfm?conclusion_statement_id=250460

SEDENTARY BEHAVIOR, INCLUDING SCREEN TIME

The *Physical Activity Guidelines for Americans* recommend that adults engage in at least 150 minutes (2.5 hours) of moderate- to vigorous-intensity physical activity each week and two days a week of strength training.[48] Youth ages 6 to 17 years should engage in 60 minutes or more of daily physical activity.[48] Unfortunately, the vast majority of Americans do not get the physical activity they need; only 20 percent of adults meet both the aerobic and strength training recommendations and less than 20 percent of adolescents meet the youth guideline. [49, 50] In addition, one-third of adults engage in no leisure-time physical activity.[51] Regular physical activity is associated with myriad health benefits, including reduced risk of chronic disease, and physical, mental, and cognitive benefits, irrespective of body weight.[48] Physical inactivity is associated with increased risk of overweight and obesity, CVD, type 2 diabetes, breast and colon cancer, and overall all-cause mortality.[52]

Sedentary behavior, which refers to any waking activity predominantly done while in a sitting or reclining posture, is gaining considerable public health interest as a chronic disease risk factor and therefore a potential area for interventions to target, with reducing screen time often a focus. The American Academy of Pediatrics (AAP) recommends no more than 2 hours a day of screen time (including television and other types of media) for children ages 2 years and older and none for children younger than age 2 years.[53] However, children ages 8 to 18 years spend an average of 7 hours on screen time each day.[54] The U.S. Report Card on Physical Activity for Youth gave the sedentary behavior indicator a grade of "D" for youth meeting the AAP's screen time recommendation.[55] Rates of screen time are similar among males and females, yet disproportionately higher for African American youth compared to Caucasian youth (63.3 percent not meeting AAP recommendation vs. 44.6 percent).[56] For this topic, two questions were addressed by the DGAC, the first with a NEL systematic review focused on the transition from childhood to adulthood and sedentary behavior in adults. The second question used the 2014 Community Preventive Services Task Force Obesity Prevention and Control (Community Guide) systematic review to examine the effectiveness of interventions among youth to reduce sedentary screen time and increase physical activity.

Question 4: What is the relationship between sedentary behavior and dietary intake and body weight in adults?

Source of evidence: NEL systematic review

Conclusion

Moderate and consistent evidence from prospective studies that followed cohorts of youth into adulthood supports that adults have a higher body weight and incidence of overweight and obesity when the amount of TV viewing is higher in childhood and adolescence. **DGAC Grade: Moderate**

Moderate evidence from prospective studies suggests no association between sedentary behavior in adulthood and change in body weight, body composition, or incidence of overweight or obesity in adulthood. **DGAC Grade: Moderate**

Insufficient evidence exists to address the association between sedentary behavior and dietary intake in adults. **DGAC Grade: Grade Not Assignable**

Implications

Sedentary behavior, including TV watching and screen time, should be limited during childhood to lower the likelihood of excess body weight or overweight and obesity in adulthood. Federal, state, and local policies and programs to support school and community-based programs to identify and reduce sedentary behavior among children and adolescents are needed to help them achieve and maintain healthy weight status as they transition into adulthood. Although an apparent lack of association exists between sedentary behavior and change in body weight status in adulthood, adults are encouraged to adopt and sustain levels of physical activity consistent with the *Physical Activity Guidelines for Americans* to promote health and to achieve and sustain a healthy weight status.

Review of the Evidence

This evidence review included 23 studies from 18 prospective cohorts that examined the relationship between sedentary behavior and body weight status in adults.[57-79] Study locations included six studies from Australia,[59, 60, 65, 74, 75, 77] six studies from the United Kingdom,[61, 69, 70, 73, 76, 78] seven studies from the United States,[57, 58, 62, 66, 67, 71, 79] two studies from New Zealand,[63, 64] and one study each from Canada[72] and Spain.[68] The mean age of participants ranged from 23 years to 60 years. Longitudinal studies followed participants from childhood (5 to 16 years) to adulthood (21 to 45 years). Three studies (two cohorts)[57, 59, 75] had an all-female sample and the remainder of the studies included both males and females.

Increasing levels of TV viewing during childhood and adolescence predicted higher BMI[64, 65, 69, 76] and increased incidence of overweight and obesity in adulthood.[58, 64, 65, 76] The lack of association between adult sedentary behavior (TV viewing, commute time or composite measures of sedentary behavior) and body weight change or body weight status are mostly consistent, despite methodological differences in measurement of sedentary behavior. Among two studies that assessed the relationship between sedentary behavior in adulthood and dietary intake, one study found an association between TV viewing and lower compliance with recommended dietary guidance.[66] The other study found that more TV viewing was associated with greater intake of calories from fat, but not total calories or calories from sweets.[71]

Methodological approaches differed with regard to population and cohort size, types of sedentary behavior considered, and timeframes studied. Only one study directly measured sedentary behavior[61] and few studies adjusted analysis for energy intake and other potential mediators, such as dietary intake. The majority of studies were conducted in Caucasian populations; therefore diverse ethnic and racial groups were underrepresented.

For additional details on this body of evidence, visit: http://NEL.gov/topic.cfm?cat=3343

Question 5: How effective are behavioral interventions in youth that focus on reducing recreational sedentary screen time and improving physical activity and/or diet?

Source of evidence: *Community Preventive Services Task Force Obesity Prevention and Control: Behavioral Interventions that Aim to Reduce Recreational Sedentary Screen Time (Community Guide)*[80] Available at: http://www.thecommunityguide.org/obesity/RRbehavioral.html

Conclusion

The DGAC concurs with the Community Guide,[80] which found strong evidence that behavioral interventions are effective in reducing recreational sedentary screen time among children ages 13 years and younger. Limited evidence was available to assess the effectiveness of these interventions among adults and no evidence was available for adolescents ages 14 years and older.
DGAC Grade: Strong

Implications

The Community Guide identified effective behavioral interventions to reduce recreational screen time and recommended that they be implemented in a variety of settings. The DGAC concurs with this recommendation because of the potential for these interventions to have beneficial effects on children's diet and weight status. Multifaceted interventions to reduce recreational sedentary screen

time may include home, school, neighborhood, and pediatric primary care settings, and emphasize parental, family, and peer-based social support, coaching or counseling sessions, and electronic tracking and monitoring of the use of screen-based technologies.

Review of the Evidence

The Community Guide review classified behavioral screen time interventions as: 1) screen-time-only interventions that focus only on reducing recreational sedentary screen time, and 2) screen-time-plus interventions, which focus on reducing recreational sedentary screen time and increasing physical activity and/or improving diet. These interventions are used to teach behavioral self-management skills through one or more of the following components: classroom-based education, tracking and monitoring, coaching or counseling sessions, and family-based or peer social support. The Community Guide review focused on both high- and low-intensity interventions to reduce sedentary behavior in youth. High-intensity interventions included the use of an electronic monitoring device to limit screen time or at least three personal or computer-tailored interactions. Low-intensity interventions included two or fewer personal or computer-tailored interactions. This review included 49 studies with 61 arms. Studies were included that had an intervention component with one or more outcomes of interest. Study duration was 1.5 months to 2 years.

The study populations were mostly children younger than age 13 years and collectively were racially and ethnically diverse. All studies were conducted in the United States within a variety of settings, including schools (20 studies), homes (8 studies), communities (6 studies), primary care clinics (4 studies), research institutes (5 studies), and in multiple settings (4 studies). Settings were a mix of urban and suburban areas.

Evidence indicated that behavioral screen time interventions are effective in reducing recreational sedentary screen time (47 study arms), improving physical activity (42 study arms), improving diet (37 study arms), and improving or maintaining weight status (38 study arms). Studies were found to be effective among children ages 13 years and younger. The evidence showed that both screen-time-only and screen-time-plus interventions are both effective at reducing recreational sedentary screen time. However, screen-time-only interventions showed greater reductions in TV viewing and composite screen time compared to screen-time-plus interventions. All studies demonstrated effectiveness among both males and females. Forty-five studies that reported racial distribution showed intervention effectiveness in all groups: white (20 studies), black (14 studies), Hispanic (11 studies), Asian/Pacific Islander (10 studies), American Indian or Alaska Native (3 studies), and other (7 studies).

For additional details on this body of evidence, visit:
http://www.thecommunityguide.org/obesity/RRbehavioral.html

SELF-MONITORING

In the context of comprehensive behavioral lifestyle interventions for weight management, self-monitoring refers to the process by which an individual observes and records specific information reflecting his or her dietary intake, physical activity, and/or body weight. As a component of behavioral weight-management programs, self-monitoring is typically coupled with goal setting and performance feedback. Goal setting involves specifying a target or recommended level for dietary intake, physical activity, and/or body weight. Self-monitoring provides information that allows the individual to judge whether targets have been met, and if not, to use the feedback from self-monitoring to adjust future actions so as to meet the target. A high frequency of self-monitoring is commonly associated with greater adherence to other weight management strategies and with greater success in lifestyle programs for weight management.[81]

The goal of this systematic review was to determine whether self-monitoring of diet and/or weight is associated with body weight outcomes. This review included studies examining the effect of self-weighing or self-monitoring of diet, such as counting calories and/or monitoring foods consumed. Although paper diaries are the traditional method for self-monitoring new technological approaches are emerging, such as the use of websites, smart phone "apps," and interactive voice response phone calls. Because self-monitoring is often a component of weight loss and weight maintenances interventions, it is important to understand its effect on body weight outcomes.

Question 6: What is the relationship between use of diet and weight self-monitoring strategies and body weight outcomes in adults and youth?

Source of evidence: NEL systematic review

Conclusion

Moderate evidence, primarily in overweight adult women living in the United States, indicates that self-monitoring of diet, weight, or both, in the context of a behavioral weight management intervention, incorporating goal setting and performance feedback, improves weight-loss outcomes. **DGAC Grade: Moderate**

Limited but consistent evidence suggests that higher frequency or greater adherence to self-monitoring of diet, weight, or both, in the context of a behavioral weight management program, is associated with better weight-loss outcomes. **DGAC Grade: Limited**

Implications

Self-monitoring coupled with goal setting and performance feedback can be used to enhance outcomes in weight management programs and should be incorporated into these programs for weight management.

Review of the Evidence

Twenty studies (4 RCTs,[82-85] 15 prospective cohort studies,[86-100] and 1 retrospective cohort study[101]) examined the relationship between diet and weight self-monitoring strategies and body weight outcomes in adults and youth. The study durations ranged from 3 months to 3.25 years. The study samples predominantly included women. Five studies were exclusively in women, one study was in pregnant women,[88] and one study was in children.[83] Sixteen studies were conducted in the United States[84-87, 89-100] and four were international (one each from the United Kingdom, Australia, Netherlands, and Japan).[82, 83, 88, 101]

Three RCTs showed that weight management interventions, delivered through mail or email which included self-monitoring of diet, weight, or both, coupled with behavioral change strategies, such as goal setting, personalized feedback, shaping, stimulus control, and problem solving, resulted in significantly greater weight losses than did interventions that did not emphasize self-monitoring.[82, 84, 85] One weight loss maintenance study in children found no effect for self-monitoring through Short Message Service on BMI.[83]

Sixteen cohort studies in adults found higher frequency or greater adherence to diet and weight self-monitoring was associated with favorable body weight outcomes.[86-101] One study with overweight pregnant women provided a four-session behavior change program with a gestational weight gain chart and a recommendation for regular self-weighing.[88] The women in the intervention arm lost more weight 6 weeks after delivery compared to a control group that received one brief education session. Four studies assessed different methods of self-monitoring, including paper diaries, Internet-based or mobile applications, and found that no specific method was superior to others.[87, 93, 94, 98]

The limitations of the evidence were that study participants were predominately overweight or obese, educated, Caucasian, females between the ages of 30 to 60 years, thus limiting generalizability to broader population groups.

For additional details on this body of evidence, visit: http://NEL.gov/topic.cfm?cat=3374

FOOD AND MENU LABELING

Food and menu labels can provide information that improves an individual's food selection and potentially improves body weight outcomes. Research focusing upon the impact of food labeling on body weight and other health outcomes is beginning to emerge. The U.S. Food and Drug Administration (FDA) recently finalized regulations requiring calorie information to be listed on menus and menu boards in chain restaurants, similar retail establishments, and vending machines with 20 or more locations. Studying the effects of this regulation on dietary choices, weight and chronic disease outcomes will provide an opportunity to understand how policy works in real-world conditions.

Some studies, including existing reviews, have examined the impact of restaurant calorie labeling on free-living consumer food selection and have had mixed results. Few studies have actually measured calories consumed as a result of menu labeling. A recent systematic review including 17 studies with experimental or quasi-experimental designs evaluated whether menu-based nutrition information affects the selection and consumption of calories in restaurants and other foodservice establishments.[102] Five of these studies measured the association between the introduction of menu labeling and average calories purchased per transaction in fast-food restaurants before and after implementation of policies that required restaurants to add calorie values to menus. Data collection varied in terms of duration (2 weeks to 6 months) and time from menu changes (from 4 weeks to one year after menu calorie labeling took place). Only one of the five reported a statistically significant association between the introduction of menu labeling and the selection of fewer calories.

Overall, however, the review concluded that menu labeling of calories alone did not decrease calories selected or consumed but that the addition of contextual or interpretive information on menus, such as daily caloric recommendations or physical activity equivalents, assisted consumers to select and consume fewer calories. [102] Additionally, there appeared to be a difference in sex response such that women tended to use the information to select and consumer fewer calories than men.

The intent of this NEL systematic review was to focus on controlled trials that isolated the impact of menu labeling on food selection and consumption at the individual level. The Committee was also interested in the effects of menu labeling on body weight outcomes; however there was insufficient evidence from RCTs examining the association between food and menu labels and body weight to complete a systematic review with body weight as the outcome.

Question 7: What is the effect of use of food and menu labels on measures of food selection and dietary intake in U.S. population groups?

Source of evidence: NEL systematic review

Conclusion

Limited and inconsistent evidence exists to support an association between menu calorie labels and food selection or consumption. **DGAC Grade: Limited**

Implications

The impact of food and menu labeling on food selection and health outcomes is limited by the heterogeneous approaches and the modest number of high quality studies, particularly RCTs. Thus, no implication could be drawn from the RCTs although policy level studies suggest that menu labeling of calories alone will not decrease calories selected or consumed but that addition of contextual or interpretive information on menus, such as daily caloric recommendations or physical activity equivalents, can assist consumers to select and consume fewer calories.[102] The new menu labeling regulations recently finalized by the FDA will provide an opportunity for further food and nutrition policy research in real-world settings.

Review of the Evidence

Ten RCTs[103-112] were included in this body of evidence that compared menu calorie labeling on food selection. Three of the ten studies also measured calorie intake of a test meal.[107-109] Results were mixed regarding the influence of menu calorie labeling on food selection. Five studies found no effect of calorie information alone on food selection.[104, 105, 107, 108, 110] Three studies found calorie labeling led to selection of fewer calories.[103, 109, 112] Two studies showed mixed results. One[106] found an impact of calorie labeling with women, but not men, and another[111] found that parents ordered fewer calories for their children, but not for themselves when calorie information was included on a test menu.

Two studies found that providing calorie labels with either recommended daily caloric intake information[109] or physical activity equivalents[108] resulted in the consumption of fewer calories at a test meal. One study did not find an effect of calorie labeling on calorie consumption.[107] Two studies examining physical activity equivalents as a component of the calorie labeling found a decrease in the calorie content of selected food items.[104, 108] One study that examined the effect of calorie labeling and value pricing (structuring product prices such that the per unit cost decreases as portion size increases) also showed no association between calorie labeling and food selection or consumption.

This body of evidence has many limitations: two of the ten studies were conducted in actual restaurant settings, limiting the external validity of the findings; three studies measured food intake; some studies included pricing as a confounder, while others did not; and all studies were conducted in one session. The methodological complexities of laboratory studies limit generalizability to free living populations.

For additional details on this body of evidence, visit: http://NEL.gov/topic.cfm?cat=3379

HOUSEHOLD FOOD INSECURITY

Food insecurity is a leading nutrition-related public health issue that is associated with reduced food intake or hunger because the household lacks money and other resources for food. Food insecurity can compromise nutritional intake, potentially leading to increased risk of chronic diseases.[9] In addition, food insecurity may promote anxiety and psychological distress, further affecting the health and well-being of an individual or family.[113, 114] Food insecurity is typically measured by survey questionnaires, such as the U.S. Household Food Security Survey Module, an 18-item questionnaire that assesses characteristics at the household level and severity of food insecurity (e.g., moderate or severe) over the past 12 months. The standard method of scoring consists of households being considered food secure if respondents affirm less than 3 scale items, food insecure if 3 to 7 items are affirmed, and severely food insecure if 8 or more items are affirmed.[9] Surveys in the United States indicate that 14.3 percent or more of households experienced food insecurity at least once during 2013.[1] Rates of food insecurity are substantially higher than the national average for those households with incomes near or below the Federal poverty line (38.4 percent vs. 14.3 percent), those households with children and a single parent, and for African American- and Hispanic-headed households.[1] Rates of food insecurity are more common in rural areas and large cities compared to suburban and exurban areas surrounding cities.[1] Among food-insecure households, 62 percent are participating in one or more of the three largest Federal food and nutrition assistance programs (Supplemental Nutrition Assistance Program [SNAP], Special Supplementation Program for Women, Infants, and Children [WIC], and the National School Breakfast and Lunch Programs).[1] The causes of food insecurity are multifactorial and the types of nutrition-related problems resulting from food insecurity are diverse, differing across the life cycle. Among food insecure households, the cycle of having enough food followed by inadequate amounts has been associated with stress in pregnant women,[113] poor diet quality among adults,[115, 116] poor glycemic control among diabetics,[117] and high visceral body fat and body weight gain in some but not all cross-sectional studies of children and adults.[118-120] Each of these conditions has a well-documented impact in the development of chronic diseases.[121, 122] Thus, the 2015 DGAC chose to examine the relationship between food insecurity and diet quality as well as the causal nature of this public health issue on body weight with a systematic review of prospective cohorts.

For additional details on this body of evidence, visit: http://NEL.gov/topic.cfm?cat=3372

Question 8: What is the relationship between household food insecurity (HFI) and measures of diet quality and body weight?

Source of evidence: NEL systematic review

Conclusion

Limited and inconsistent evidence from studies conducted in adults and children ages 3 to 6 years suggests that a positive association may exist between persistent and/or progressing household food insecurity and higher body weight in older adults, pregnant women, and young children. No studies reported a relationship with lower body weight. **DGAC Grade: Limited**

Insufficient evidence was available from prospective studies to assess the relationship between household food insecurity and dietary intake. **DGAC Grade: Grade Not assignable**

Implications

Federal food assistance programs, which play an important role in providing relief to families in economic distress, should carefully document and monitor food insecurity and nutritional risk in program participants. Participants should receive tailored counseling to choose foods with their limited budgets that meet the *Dietary Guidelines for Americans* and to achieve or maintain a healthy body weight. Federal food assistance programs should also regularly assess, evaluate, and update the methods they use to help recipients select healthier foods, consistent with best practices.

Review of the Evidence

This systematic review included nine prospective cohort studies examining the relationship between household food insecurity and body weight status.[118, 123-130] In adults, four prospective cohort studies assessed the relationship between household food insecurity and measures of body weight, with one study focusing on elderly men and women[126] and three studies focusing only on women.[118, 128, 130] The study of older adults derived data from two large cohorts including the Health and Retirement Survey and the Asset and Health Dynamics among the Oldest Old.[126] The studies on women ranged in size from 303 to 1,707, with the data derived from relatively small cohort study populations, including the Bassett Mothers Health Project cohort study,[128] the Pregnancy, Infection, and Nutrition cohort,[118] and the Fragile Families and Child Wellbeing Study.[130] The study of older adults focused on a relatively homogenous population who were mostly Caucasian.[126] Of the studies of women, two assessed diverse populations,[118, 130] while one had a study population almost entirely composed of Caucasian women.[128]

In children, a total of five prospective cohort studies (three cohorts)[123-125, 127, 129] assessed the relationship between household food insecurity and measures of body weight, with one of the five studies assessing household food insufficiency, a similar measure considered more severe than the concept of food security, although not as severe as hunger.[124] Four of the studies were conducted on populations in the United States[123, 125, 127, 129] and one study in a Canadian population.[124] The studies ranged in size from 1,514 to 28,353 subjects. The data were derived from nationally representative cohorts, including three studies using data from the Early Child Longitudinal Study-Kindergarten Cohort,[123, 125, 129] one study using data from the Longitudinal Study of Child Development in Quebec,[124] and one study deriving data from a large cohort participating in the Massachusetts WIC Program.[127]

Based on this evidence, the impact of food insecurity on body weight is not clear. Among older adults, becoming food insecure during follow-up was positively associated with BMI in one large cohort but there was no association in a different cohort from the same study.[126] Among pregnant women, findings were inconsistent, with 1 of 2 studies suggesting no association between food insecurity and pregnancy weight gain outcomes.[128] One study found null findings among the marginally food secure, but greater weight gain (absolute and relative to the 2009 IOM Guidelines),[131] and severe pre-gravid obesity among food insecure women.[118] Among children, findings were inconsistent. Two studies found no association between food insecurity and body weight outcomes.[123, 129] Dubois et al. found that food insufficiency was associated greater likelihood of overweight and obesity in preschool-aged children.[124] One study found that persistent food insecurity without hunger was associated with child obesity but non-persistent food insecurity with hunger was not associated with obesity risk.[127] Jyoti et al. reported that there was an association between food insecurity and weight gain for girls but not boys.[125] However, the data provided some suggestion of an association between food insecurity and higher body weight among girls and those who are of low birth weight.

For additional details on this body of evidence, visit: http://NEL.gov/topic.cfm?cat=3372

ACCULTURATION

Immigrants continue to represent a significant proportion of the United States population and evidence indicates that immigrants adopt the dietary habits and disease patterns of host cultures.[14] Federal food assistance and nutrition education programs are aware of the need to tailor services and messaging according to the level of acculturation of immigrant communities. It is essential for this acculturation-sensitive tailoring to take into account the level of dietary acculturation and the socio-economic characteristics such as health literacy, language, and other cultural preferences of immigrant communities. Thus, understanding how dietary habits, body weight, and chronic disease outcomes are influenced by the process of acculturation is an important public health issue for the United States. However, because immigrants can take

different paths during the process of acculturation, this construct has proven to be difficult to conceptualize and measure. The four paths of acculturation (assimilation, integration, segregation, and marginalization) refer to the degree in which immigrants retain their host culture and adopt the culture of their new country.[14] This explains, at least in part, why the evidence from prospective studies continues to be limited in nature, as shown in this chapter.

Question 9: What is the relationship between acculturation and measures of dietary intake?

Source of evidence: NEL systematic review

Conclusion

Limited evidence from cross-sectional studies suggests that in adults of Latino/Hispanic national origin, particularly among women and persons of Mexican origin, higher acculturation to the United States is associated with lower fruit and vegetable intake, as well as higher intake of fast food. Insufficient evidence is available for children, Asians and African Americans in general, and among populations of diverse Latino/Hispanic national origin to draw a conclusion regarding the association between measures of acculturation and dietary intake. **DGAC Grade: Limited**

Implications

Federal food assistance and nutrition education programs need to support immigrants in maintaining the healthy dietary habits they had when they arrived and in not acquiring unhealthy dietary patterns as they acculturate to mainstream America. This can be achieved by, among other things, effectively reaching out to immigrant families to facilitate their enrollment in programs such as SNAP and WIC and ensuring access to fresh vegetables and fruits. These community outreach programs are needed because in addition to their risk of adopting unhealthy dietary behaviors, immigrants may also have language limitations and/or a lack of understanding of the program enrollment procedures.

Review of the Evidence

This systematic review included 17 studies, 15 cross-sectional studies,[132-146] and two longitudinal studies[147, 148] that examined the relationship between multidimensional or multiple proxy measures of acculturation and dietary intake. Study populations included ten Latino/Hispanic populations[132-136, 138-140, 144, 145] (five in Mexican Americans) and [132, 133, 135, 136, 140] six Asian populations;[137, 141-143, 146, 147] one study included both Asian and Latino/Hispanic populations.[148] Two studies included children[135, 148] and three studies included only women.[134, 138, 140] Study locations included one national[140] and one U.S.-Mexican border state study,[136] ten studies from California,[132, 133, 135, 137-139, 143, 145, 146, 148] and one study each from Massachusetts, Hawaii,[147] New York,[141] and a Midwestern city.

In adults of Latino/Hispanic national origin, evidence from nine cross-sectional analyses suggests that higher acculturation to the United States is associated with lower adherence to recommended dietary patterns. Among adults of Latino/Hispanic national origin, primarily women and those of Mexican origin, higher acculturation is consistently associated with lower fruit and vegetable intake, as well as higher intake of fast food. In children and youth of Latino/Hispanic national origin, emerging evidence was identified from two cross-sectional studies suggesting a negative association between acculturation and dietary behaviors. In a study of children ages 3 to 5 years who were proxied by caregiver acculturation, acculturation was associated with higher intake of sweets. In a study among adolescents, acculturation was associated with higher intake of fast foods.

Among Asian populations, emerging evidence from five cross-sectional and two longitudinal studies suggests that higher acculturation is associated with lower adherence to recommended dietary patterns. In adults, six studies among Asian populations (mainly Korean, Chinese and Filipino) suggest higher acculturation is associated with higher fast food and alcohol consumption.[137, 141-143, 146, 147] One study suggests higher acculturation is associated with increased fast food consumption among Asian adolescents.[148]

Insufficient evidence is available among children, those of Latino/Hispanic national origin (other than Mexican-Americans), and among immigrant populations from Asia, Africa, Europe, and the Middle East regarding the association between measures of acculturation and dietary intake.

For additional details on this body of evidence, visit:
http://NEL.gov/conclusion.cfm?conclusion_statement_id=250436

Question 10: What is the relationship between acculturation and body weight?

Source of evidence: NEL systematic review

Conclusion

Limited evidence suggests a relationship between higher acculturation to the United States and increased body weight. This relationship varies by national origin and gender. Specifically, findings were mixed in both Asian and Latino/Hispanic populations. In Asians, the association was stronger in women than men and in Latino/Hispanic populations; associations were stronger in Mexican-born women. **DGAC Grade: Limited**

Implications

Federal food assistance and nutrition education programs need to support immigrants against the risk of becoming overweight or obese as they acculturate to mainstream America. This can be achieved by among other things, effectively reaching out to immigrant families to facilitate their enrollment in programs such as SNAP and WIC and ensuring access to low-energy and high-nutrient dense dietary patterns rich in vegetables and fruits and whole grain foods. These community outreach programs are needed because in addition to their risk of adopting unhealthy dietary behaviors, immigrants may also have language limitations and/or a lack of understanding of the program enrollment procedures.

Review of the Evidence

This systematic review includes 13 studies:[133, 137, 141, 143, 144, 146, 147, 149-154] 12 cross-sectional studies,[133, 137, 141, 143, 144, 146, 149-154] and one longitudinal study.[147] The populations included seven Asian,[137, 141, 143, 146, 147, 150, 151] five Latino/Hispanic (four Mexican-American and one Puerto Rican),[133, 144, 149, 152, 153] and included adults ranging in age from 35 to 75 years. Five studies were analyzed by gender.[141, 143, 146, 153, 154] Three of the studies included national samples,[149, 152, 154] five studies were from California,[133, 137, 143, 146, 153] and one study each was from Hawaii,[147] Louisiana,[151] Maryland,[150] Massachusetts,[144] New York.[141] Two studies included samples from the country of origin (Vietnam and Korea).[143, 151]

Among Asian populations, the majority of the data suggest a positive relationship between acculturation and increased body weight, but results are not consistent. Among Latinos/Hispanic populations, the association has been documented mostly among women of Mexican origin.

For additional details on this body of evidence, visit:
http://NEL.gov/conclusion.cfm?conclusion_statement_id=250437

Question 11: What is the relationship between acculturation and risk of cardiovascular disease (CVD)?

Source of evidence: NEL systematic review

Conclusion

No conclusion can be drawn regarding the relationship between acculturation to the United States and the risk of CVD. This is due to the small number of studies, wide variation in methodology used to assess acculturation, and limited representation of ethnic groups in the body of evidence. Very limited evidence from a small number of cross-sectional studies conducted in Latino/Hispanic populations suggest a positive relationship between language acculturation and elevation in LDL cholesterol and no relationship between acculturation and blood pressure.

Insufficient evidence is available for other race/ethnic populations and among children for these outcomes and other CVD outcomes. **DGAC Grade: Grade not assignable**

Implications

The DGAC determined that a grade was not assignable due to the insufficient evidence for this question. Therefore, no implications were developed.

Review of the Evidence

This systematic review includes six cross-sectional studies in adult men and women between the ages of 40 to 60 years.[144, 154-158] The study populations included five Latino/Hispanic[144, 155-158] and one multicultural population[154] and the data were predominately derived from large, multi-state or national data sets.

Three studies found a positive relationship between language acculturation and elevated blood lipid levels,[154, 156, 157] but results varied by acculturation indicator. Two studies assessed the association between acculturation and blood pressure in Latino/Hispanic populations and no association was found.[156, 157] Two studies assessed the relationship between acculturation and hypertension in Latino/Hispanic and a multicultural population and found no association.[144, 154] Two studies suggest a positive association between language acculturation and CVD risk factors,[155, 158] but results varied as a function of language acculturation indicator used. The studies used different methods to assess acculturation, including three studies that used multidimensional scales[144, 155, 157] and three studies that relied on the assessment of acculturation proxies.[154, 156, 158]

The preponderance of evidence was in predominately Mexican American populations, but other Hispanic/Latino national origin groups were represented.

For additional details on this body of evidence, visit:
http://NEL.gov/conclusion.cfm?conclusion_statement_id=250438

Question 12: What is the relationship between acculturation and risk of type 2 diabetes?

Source of evidence: NEL systematic review

Conclusion

Conclusions regarding the relationship between acculturation and type 2 diabetes cannot be drawn due to limited evidence from a very small number of cross-sectional studies and study populations, limitations in acculturation assessment methodology that did not take into account potential

confounders and effect modifiers, and lack of standardized assessment of outcomes. **DGAC Grade: Grade not assignable**

Implications

The DGAC determined that a grade was not assignable due to the insufficient evidence for this question. Therefore, no implications were developed.

Review of the Evidence

This systematic review included four cross-sectional studies.[144, 152, 159, 160] Two of the studies used National Health and Nutrition Examination Survey (NHANES) data on Hispanic/Latino participants,[152, 160] one study used the Multi-Ethnic Study of Atherosclerosis (MESA) cohort,[159] which included Mexican, other Hispanic, and Chinese populations, and one study used the Boston Puerto Rican Health Study cohort.[144]

The studies used different methods to assess acculturation. Four different multidimensional scales were used[144, 159, 160] and one study relied on the assessment of two acculturation proxies.[152] All measures took into consideration language usage with some only using this proxy and others including additional proxies for acculturation.

For additional details on this body of evidence, visit:
http://NEL.gov/conclusion.cfm?conclusion_statement_id=250439

CHAPTER SUMMARY

The individual is at the innermost core of the social-ecological model. In order for policy recommendations such as the *Dietary Guidelines for Americans* to be fully implemented, motivating and facilitating behavioral change at the individual level is required. The collective work presented in this chapter suggests a number of promising behavior change strategies that can be used to favorably impact a range of health related outcomes and to enhance the effectiveness of interventions. These include reducing screen time, reducing the frequency of eating out at fast- food restaurants, increasing frequency of family shared meals, and self-monitoring of diet and body weight as well as effective food labeling to target healthier food choices. These strategies complement comprehensive lifestyle interventions and nutrition counseling by qualified nutrition professionals. Timely feedback from registered dietitians/nutritionists and other qualified health professionals and engagement of the individual as appropriate in individual and group counseling will enhance outcomes. For this approach to work, it will be essential for the food environments where low-income individuals live to facilitate access to the selection of healthy food choices that respect their cultural preferences. Likewise, food and calorie label education should be designed to be understood for low literacy

audiences some of which may have additional English language fluency limitations. While viable approaches are available now, additional research is necessary to improve the scientific foundation for more effective guidelines on individual level behavior change for all individuals living in the United States, taking into account the social, economic and cultural environments in which they live.

The evidence reviewed in this chapter indicates that the social, economic, and cultural context in which individuals live may facilitate or hinder their ability to choose and consume dietary patterns that are consistent with the Dietary Guidelines. Specifically household food insecurity hinders the access to healthy diets for millions of Americans. Also, immigrants are at high risk of losing the healthier dietary patterns characteristic of their cultural background as they acculturate into mainstream America. Furthermore, preventive nutrition services that take into account the social determinants of health are largely unavailable in our health system to systematically address the nutrition-related health problems of Americans including overweight and obesity, CVD, type 2 diabetes, and other chronic diseases. In summary, this chapter calls for: a) continuous support of Federal programs to help alleviate the consequences of household food insecurity, b) food and nutrition assistance programs to take into account the risk that immigrants have of giving up their healthier dietary habits soon after arriving in the United States, and c) efforts to provide all individuals living in the United States with the environments, knowledge, and tools needed to implement effective individual- or family-level behavioral change strategies to improve the quality of their diets and reduce sedentary behaviors. As indicated in ***Part D Chapter 4: Food Environment and Settings*** and ***Part D Chapter 5: Food Sustainability and Safety***, achieving these goals will require changes at all levels of the social-ecological model through coordinated efforts among health care and social and food systems from the national to the local level.

NEEDS FOR FUTURE RESEARCH

Eating Out

1. Develop a standard methodology to collect and characterize various types of eating venues.

   Rationale: This recommendation is fundamental to conducting rigorous research, evaluating findings from multiple studies, and developing policies to promote healthy eating among people who frequent eating out venues and/or consume take away meals.

2. Conduct rigorously designed research to examine the longitudinal impact of obtaining or consuming meals away from home from various types of commonly frequented venues on changes in food and beverage intakes (frequency, quantity, and composition), body weight, adiposity, and health profiles from childhood to adulthood in diverse (racial/ethnic, socioeconomic, cultural, and geographic) groups of males and females.

Rationale: Most groups in the U.S. population regularly consume meals that are prepared away from home and the landscape of fast food and other types of food procurement and consumption venues is increasingly complex. The potential for eating out and/or take away meals to influence diet quality, energy balance, body mass and composition, and the risks of health-related morbidities across the lifespan among our diverse population underscores the importance of understanding this issue.

Family Shared Meals

3. Conduct studies in diverse populations that assess not only frequency of family shared meals, but also quality of family shared meals.

Rationale: Our understanding of the importance of family shared meals in terms of how they contribute in a positive way to body weight and overall health and well-being requires a rigorous examination of the dietary quality of these meals compared to other meals consumed by family members.

4. Conduct RCTs to isolate the effect of interventions that increase the frequency of family meals from other health and parenting behaviors that may be associated with dietary intake and weight status.

Rationale: Family shared meals are commonly implemented as one component of lifestyle interventions that include an array of other behavioral and parenting strategies for weight management. To improve our understanding of the causal pathway of how family shared meals contributes to maintaining or achieving a health weight, the specific contribution of family shared meals to weight outcomes independent of other behavioral strategies needs to be ascertained.

Sedentary Behavior

5. Develop improved and better standardized and validated tools to assess sedentary behaviors and activities that children, adolescents, and adults regularly engage in.

Rationale: Our understanding of the impact of sedentary behaviors on diet, energy balance, body mass, adiposity, and health is currently compromised by reliance on subjective assessments, including self-reports of daily activity patterns, and by inadequate techniques to document and quantify the array of sedentary activities people engage in (beyond TV viewing and (or) computer screen time). It also would be beneficial for researchers to document the potential benefits and implications of reducing one type of sedentary behavior (e.g. screen time) on other sedentary behaviors (e.g., reading for leisure, arts and crafts, listening to music) and indices of health (e.g. sleep quality and duration).

6. Conduct prospective research to examine the effects and mechanisms of the quantity, patterns, and changes of sedentary behaviors on diet quality, energy balance, body weight, adiposity, and health across the life span in groups within the U.S. population with diverse personal, cultural, economic, and geographic characteristics.

   Rationale: Emerging, but limited, evidence implicates sedentary behaviors with adverse health-related outcomes, especially in children and adolescents as they transition into adulthood. However, an improved understanding of why these relationships exist will help in developing appropriate and effective approaches and policies to reduce the amount of time people spend engaging in sedentary behaviors.

Self-Monitoring

7. Evaluate the impact of different types, modalities, and frequencies of self-monitoring on body weight outcomes during both the weight loss intervention and maintenance periods.

   Rationale: Self-monitoring is associated with improved weight management. However, the current practice of recommending daily self-monitoring may represent a barrier to its implementation and/or continued use. Hence, it is important to determine whether lower frequencies of self-monitoring can produce beneficial effects on weight outcomes.

8. Evaluate the comparative effectiveness of performance feedback from self-monitoring delivered through automated systems versus personal interactions with a counselor.

   Rationale: Automated feedback derived from self-monitoring data and delivered electronically can produce beneficial changes on weight outcomes. However, the comparative effectiveness and cost efficiency of feedback delivered through non-personal modalities versus personal interactions has yet to be determined.

9. Test the effectiveness of self-monitoring on weight outcomes in understudied groups, including ethnic/racial minorities, low education, low literacy, and low numeracy populations, males, and subjects younger than age 30 years and older than age 60 years.

   Rationale: Evidence regarding the effectiveness of self-monitoring has been derived largely from research conducted on well educated, middle-class, white women. Hence, it is important to determine whether the beneficial effects of self-monitoring on weight outcomes are generalizable to understudied groups.

10. Conduct RCTs based on sound behavioral change theories that incorporate self-monitoring, employ heterogeneous populations, and are powered for small effect sizes and high attrition rates, to test the short- (e.g., 3 months) and long-term (e.g., 12 months) effects of mobile health technologies on dietary and weight outcomes.

Rationale: Mobile health technologies have the potential to reach larger portions of the populations than face-to-face interventions, but the effect sizes of mobile technologies may be small and the attrition rates may be large. Larger, more representative study populations and longer study periods will permit an assessment of the generalizability and sustainability of mobile health technologies.

Food and Menu Labeling

11. Develop novel labeling approaches to provide informative strategies to convey caloric intake values on food items consumed at home and in restaurant settings.

Rationale: Menu labels can include different types of information in addition to calories. These include physical activity equivalents, and daily caloric needs. Very few studies have been designed to examine the optimal combination of menu label information to prevent excessive caloric intake. This will be very valuable evidence to inform the calorie label policy that has just been enacted by the FDA.

12. Compare labeling strategies across various settings, such as restaurants, stores, and the home to determine their efficacy in altering food selection and health outcomes, including weight.

Rationale: The great majority of menu labeling RCT's have been conducted under laboratory conditions. Given the recent FDA regulations, future studies will be able to impact the effectiveness of these polices across settings as accessed by diverse free living populations.

13. Evaluate the process and impact of recent FDA menu labeling regulation.

Rationale: The new FDA regulation provides a unique opportunity to understand the impact of menu labeling on consumers dietary behaviors in "real world" settings.

Household Food Insecurity

14. Conduct prospective cohort studies that cover a wide age range and include children, families, older adults, and ethnically/racially diverse populations and describe potential effect modifiers such as gender, ethnic and cultural factors, family structure, area of residence (i.e., urban vs. rural), employment, and use of social support systems while examining the relationship between household food insecurity, dietary intake, and body weight.

Rationale: Understanding the temporal process of when and how long food insecurity occurs within a family/individual’s lifetime and their response to this economic stressor is critical to conducting rigorous research and comparing finding across studies in order to develop and implement intervention studies and policies to alleviate this public health problem.

15. Standardize research methodology, including developing a consistent approach to measuring food insecurity and use of measured height and weight to reduce the likelihood of responder bias.

    Rationale: The measurement error issues related to the use of self-reported weight have been well documented in the literature. In order to conduct rigorous studies in this area that can be compared and evaluated as to the causal nature of the role of food insecurity on body weight, standard methodology is warranted both in the measurement of the exposure as well as the outcome.

Acculturation

16. Conduct prospective longitudinal studies including those that start in early childhood to track dietary intake, sedentary behaviors, body weight, and chronic disease outcomes across the lifespan. Include the diversity of ethnic/racial groups in the United States, including individuals and families of diverse national origins. Include comparison groups in countries of origin to rule out, among other things, the potential confounding by internal migration from rural to urban area within the country of origin.

    Rationale: Acculturation is a time-dependent life course process that requires longitudinal studies to be properly understood. Because the impact of acculturation on dietary, weight and health outcomes can be expected to be modified by the life course stage of life when individuals migrate to the United States, prospective acculturation studies need to start following individuals from very early childhood.

17. Develop a standard tool to measure acculturation or validation of multidimensional acculturation scales in different immigrant groups and in different languages.

    Rationale: Acculturation is a complex construct that is seldom measured with multidimensional scales that can capture the different paths that migrant scan take with regards to the acculturation process, including assimilation, integration, segregation, and marginalization. Although research in acculturation measurement has been conducted among Hispanic/Latinos, it has been predominantly based on Mexican American populations and little acculturation measurement research has been conducted among other groups, including individuals from Asia, Africa, Europe, and the Middle East.

Sleep Patterns

18. Conduct prospective studies that start in childhood (including transition to adulthood), to investigate the longitudinal effect of sleep patterns on diet and body weight outcomes while accounting for confounders, mediators, and moderators including: physical activity, socioeconomic variables (such as education, employment, household income), sex, alcohol

intake, smoking status (including new smoker, new non-smoker), media use/screen time, and depression.

Rationale: While research associates short sleep duration and disordered sleep patterns with adverse differences and changes in food and beverage consumption, body weight, and indices of metabolic and cardiovascular health, less is known about the impact of potential modifying lifestyle factors. This research will help delineate the role of sleep patterns, duration and quality, i.e., mediator or moderator, on diet and weigh-related outcomes. Research in children shows that sleep deprivation and weight are related but this relationship is not apparent in adult studies. This may be due to the fact that energy intake increases during transition to short sleep duration, but levels off when short sleep duration becomes consistent.

19. Conduct studies to assess the effects of diet on sleep quality to examine the mechanism by which dietary intake, energy intake, and energy expenditure may impact sleep.

Rationale: Most research has focused on sleep quality and duration as modifying factors on diet, body weight, and health. A paucity of research exists on the potential impact of diet on sleep-related outcomes. This line of research would use diet as the means to improve indices of sleep, which in turn may subsequently improve health-related outcomes.

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