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Obesity and Metabolic Conditions

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Introduction

Overweight and obesity are defined as “abnormal or excessive body fat accumulation that presents a risk to health” (World Health Organization (WHO), 2020a). People who are overweight or obese have increased adipose (fat) tissue, leading to increased risk for chronic disease (such as cardiovascular, respiratory, liver, and kidney disease; diabetes; and others); obesity in particular is also associated with increased risk for early mortality (Haidar & Cosman, 2011; Greenberg, 2013). Increased body

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fat is also associated with metabolic syndrome, a constellation of medical issues thought to relate to increased centrally distributed body fat and fat cell dysfunction (NHLBI, 2016). An individual must present with at least three from among these symptoms (central adiposity, glucose abnormalities, dyslipidemia, hypertriglyceridemia, and/or hypertension) to be diagnosed with metabolic syndrome (Punthakee, Goldenberg, & Katz, 2018). Overweight and obesity are critical public health issues due to their associated disease burden, cost, increased mortality, and their high and increasing rates across the globe.

Learning Objectives

After reading this chapter, the reader should be able to:

1. Define obesity and metabolic health conditions.
2. Outline the history of obesity and metabolic conditions research and practice, emphasizing current best practices.
3. Discuss current and emerging sustainable community-focused approaches for preventing and managing obesity and metabolic conditions.
4. Examine the cultural, professional, and legislative issues that influence the control and mitigation of obesity and metabolic conditions, addressing health disparities, equity and social justice concerns.
5. Summarize the role and significance of interdisciplinary approaches to managing obesity and metabolic conditions
6. Discuss the issues for research and practice in community-focused approaches to manage obesity and other metabolic conditions

The number of people dying from complications from obesity is approximately 2.8 million globally, a situation declared an epidemic by the W.H.O. (2020c). It is estimated that in the next three decades, obesity and overweight will claim about 92 million lives and reduce life expectancy by

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three years by 2050 (Sassi, Devaux, Cecchini, & Rusticelli, 2009). In 2014, the McKinsey Institute estimated that 5% of all global deaths were due to obesity. One estimate of the global economic impact of obesity indicates a cost of about \$2 trillion annually, second only to smoking and armed conflict (at about \$2.1 trillion each) (McKinsey Global Institute, 2014). However, as indicated, most obesity cost models estimate only direct and indirect costs but do not account for the cost of prevention efforts (Sassi et al., 2009), which will be essential to mitigating the impact of this disease.

Globally, the burden of obesity and related metabolic conditions is substantial and increasing at an alarming rate around the globe (U.S. Centers for Disease Control and Prevention (U.S. C.D.C.), 2017a, 2017b; Seidell & Halberstadt, 2015) in 2016, over 1.9 billion U.S. adults were overweight, including about 650 million adults who were obese (about 34% of the global population) (Hales, Carroll, Fryar, & Ogden, 2017). Global rates of overweight among adults range from 38.5% to 39.2% among men and women, respectively, and global rates of obesity range from 11.1% to 15.1% among men and women, respectively (Development Initiatives Poverty Research, 2019). In fact, the number of people in the world who are currently overweight or obese is almost 2.5 times the number who are undernourished (McKinsey Global Institute, 2014). The global prevalence of obesity increased by about one-third between 2000 and 2014 (McKinsey Global Institute, 2014). Kelly, Yang, Chen, Reynolds, and He (2008) indicated that over one billion people (about 20%) of the world population would be obese by 2030.

An additional 340 million children and adolescents aged 5 to 19 years are also overweight or obese (Flegal, Kit, Orpana, et al., 2013; Hales et al., 2017). Among children, stunting due to long-term undernutrition coexists with overweight in the same children in many countries (Development Initiatives Poverty Research, 2019). While children have lower rates of overweight compared to adults both globally and within the US, increasingly, children may have lower quality diets, including high-fat, high-sugar, energy-dense, high-salt diets, thus increasing their risk for both overweight/obesity and metabolic diseases such as hypertension, insulin resistance, and psychological disorders (Boutayeb, 2006; WHO, 2018). Programs attempting to prevent obesity in children, even longer-term, extensive programs, have also sometimes failed to elicit any improvements (DeHenauw et al., 2015).

Developed nations tend to have higher obesity rates than those that are developing (Omran, 2005; Hales, Carroll, Fryar, & Ogden, 2020), although prevalence in developing countries is on the rise, associated with the paradoxical effect of economic development and income growth (Bhurosy & Jeewon, 2014; Zukiewicz-Sobczak et al., 2014). The paradox is that as economies begin to improve, people in the emerging economies of the developing world begin to consume more easily available, highly processed foods of minimal nutritional value, resulting in overweight and obesity (Loring & Robertson, 2014; Zukiewicz-Sobczak et al., 2014; Petersen, Pan, & Blanck, 2019; Templin, Hashiguchi, Thomson, Dieleman, & Bendavid, 2019).

Several community health-based, obesity prevention programs based on various health behavior theories have been developed and tested, which aim to prevent obesity or mitigate its effects by improving dietary quality and physical activity levels in communities. Other approaches have focused on schools, daycare and after-school programs, health care-based interventions, media education, and even church-based programs. Typical stakeholders in these efforts may include local governments and nongovernmental organizations, transportation authorities, public health and safety officials, community organizers, clergy, and urban planning officials.

Professional and/or Legal Definitions of Obesity and Metabolic Syndromes

As discussed, obesity and overweight are terms used to describe a higher than usual level of body fat, which is associated with increased health risk. Both the W.H.O. and the U.S. C.D.C. (2017a, 2017b) define overweight and obesity using **body mass index (BMI)**, which is an estimation of excess fat made by comparing weight to height in meters squared (W.H.O., 2020b). Adults with a BMI of 18.5–24.9 are considered normal weight, while those with a BMI of 25–29.9 are considered overweight. Those with a BMI of greater than 30 are considered obese. The U.S. C.D.C. has further categorized obesity into three subgroups (see Table 16.1).

Some of the professional associations dedicated to comprehensive research on evidence-based approaches and methods for treating obesity include:

Table 16.1 BMI classification

BMI range	Weight classification
<18.5	Underweight
18.5–24.9	Normal weight
25.0–29.9	Overweight
30–34.9	Class 1 obesity
35–39.9	Class 2 obesity
≥40	Class 3/morbid obesity

1. Obesity Medicine Association (OMA)—an organization of physicians, physician assistants, nurse practitioners, and other health care providers in the US, employing scientific-based, individualized, and comprehensive approaches to treat obese people (OMA, 2020).
2. The Obesity Society (TOS)—located in the US and Canada, the organization is focused on understanding the causes, prevention strategies, and treatment of obesity (www.obesity.org).
3. Obesity Action Coalition (OAC)—a not-for-profit organization dedicated to advocating for individuals affected by obesity disease to access better services and improve their health (www.obesityaction.org).

As previously noted, obesity is associated with the development of metabolic syndrome (Micciolo et al., 2010; Moller & Kaufman, 2005). Metabolic syndrome occurs when a constellation of metabolic effects occurs together, such as central obesity (obesity around the waist); diabetes, insulin resistance, or impaired fasting glucose tolerance; dyslipidemia; and/or hypertension (Huang, 2009). This cluster of metabolic conditions (metabolic syndrome) contributes to the onset of cardiovascular disease, which is one of the leading causes of death in developed nations worldwide and the leading cause of death due to obesity (Zimmet, Magliano, Matsuzawa, Alberti, & Shaw, 2005; Barkowski & Frishman, 2008). Obesity is also associated with increased school and job discrimination, higher socioeconomic burden, and earlier mortality (Puhl & Brownell, 2001; U.S. C.D.C, 2020). For these reasons, obesity poses a critical public health challenge for which community-level interventions would provide more robust health outcomes than individual-level programs.

The etiology of overweight and obesity is hotly debated, with most researchers faulting the energy imbalance that has occurred with increasing

sedentary behaviors and larger portions, but others favoring social transmission theories, alterations in metabolism, or other theories (Christakis & Fowler, 2007; Hruby & Hu, 2015; Archer, Lavie, & Hill, 2018). Most obesity researchers agree that obesity is caused by energy imbalance (intake of energy from food and drink that exceeds expenditure) (Hruby & Hu, 2015). This change in average energy balance over time has been attributed to an “obesogenic” environment, one that promotes excess consumption and less physical activity. This modern shift toward an obesogenic environment is associated with social and economic changes, leading to “growing availability of abundant, inexpensive, and often nutrient-poor food, industrialization, mechanized transportation, urbanization” (Zukiewicz-Sobczak et al., 2014; Hruby & Hu, 2015). Social and environmental changes that promote greater energy consumption and less expenditure of energy interact with individual attitudes and behaviors affecting energy intake, physical activity, sedentary behaviors, and sleep, all of which are thought to influence obesity risk (Hruby & Hu, 2015). The physical/built environment, such as land use mix and walkability is also implicated in overweight and obesity, although the evidence is mixed (Mackenbach et al., 2014; see also Chap. 3, this volume).

Socioeconomic factors such as income status, education level, and belonging to a marginalized population (such as being of certain races or ethnicities) are associated with increased risk for obesity (Loring & Robertson, 2014; Petersen et al., 2019; Templin et al., 2019). In addition, obesity appears to occur in social networks, with those living together at similar risk for obesity (Christakis & Fowler, 2007). These social influence factors interact with genetic risk for obesity, which contributes from 40% to 70% of the risk for obesity (Sicat, 2018). An understanding of obesity risk requires social, economic, environmental, and genetic considerations.

History of Research and Practice in Obesity and Metabolic Syndrome

In ancient times, Hippocrates’ (460 BC–370 BC) work anticipated obesity as a medical condition, resulting from an unhealthy balance between four bodily fluids: phlegm, blood, yellow bile, and black bile (Christopoulou-Aletra & Papavramidou, 2004; see Table 16.2).

Table 16.2 Historical evolution of obesity research

460 BC– 370 BC	Hippocrates—defined obesity as a composition of four fluids (blood, phlegm, yellow bile, and black bile). Any extras were considered obesity (Christopoulou-Aletra & Papavramidou, 2004)
1885	Penny scale was introduced by Germany and the US as a measurement and evaluation criteria for weight (Schwartz et al. 1986–1996)
Early 1900s	Healthy weights became the criteria for eligibility for insurance policies, termed “ideal” weights. It was linked to longevity (Medico-Actuarial Mortality Investigation, 1912)
1911–1935	Dublin and Lotha developed the first tables of “ideal” weight measurement and evaluation scale computed based on gender, height, and weight (Dublin & Lotha, 1937)
1959	The Build and Blood Pressure Study conducted by 26 insurance companies in the US replaced the term “ideal” weight with desirable weight, suggesting an association between weight and morbidity, especially cardiovascular diseases (1959)
1973	Participants at an international conference updated the desired weight table to include acceptable range of weights for particular height, which was later converted to body mass index. Men had a range of 20.1–25.0 and women 18.7–23.8 (Bray, 1975)
1980	U.S. Department of Agriculture (USDA) and the Department of Health and Human Services (HHS) classified obesity and overweight as nutritional-related disorders caused by the accumulation of extra fat. The BMI table was used, with adjustments for weights and heights (1985)
1985	The USDA and HHS issued a range of weights and heights table for men and women, which was standardized to a single measurement by 1990, where healthy BMI was less than 25, unhealthy BMI was greater or equal to 25 (1985)
1990–2000s	The World Health Organization (WHO) Expert Committee on physical status modified and reclassified the body mass index (BMI) with cut off points of 25, 30, and 40 based on weight for height squared

Source: Centers for Diseases Prevention. Accessed 21 Apr 2020 at <http://www.cdc.gov/growthcharts/>

Hippocrates linked “surplus fluids” in the body to infertility and early mortality, including the association to different health outcomes among populations. Much later, landmark studies such as the U.S. Medico-Actuarial Mortality Investigation (Association of Life Insurance Medical Directors, 1912), the Dublin and Lotha study (1937), and the Build and

Blood Pressure Study (1959) culminated in the adoption of tables listing body weights for a given height associated with better mortality outcomes, which were to be used for insurance policies in the US (Dublin & Lotha, 1937; Schwartz, 1986). Individuals with weights between 20% and 25% above the “ideal” were considered to have unhealthy weights and ineligible to enroll in insurance policies (Metropolitan Life Insurance Company (MLIC), 1942). By the late 1970s, the weight tables were replaced with the MLIC table of weights and heights using data collated over two decades on the mortality rates of insured people from 1950 to 1972 in the Build and Blood Pressure Study of 1979.

These tables were criticized during the latter part of the twentieth century because they were too prescriptive of healthy weights for particular heights, making them unrealistic for many people (Weigley, 1984). Beginning in the early 1980s, the US Department of Agriculture (USDA) and the Department of Health and Human Services (HHS) adopted a standardized body mass index (BMI) calculation to estimate excess adiposity, which has been criticized for being inaccurate for estimating body fat, particularly in people who exercise regularly and athletes (Nuttall, 2015). Other indicators of adiposity-related health risks include waist circumference, waist-to-hip ratio, and weight-to-height ratio (Maffetone & Laursen, 2020). A recent article by Park et al. proposes a new calculation to estimate cardiometabolic risk: the weight-adjusted-waist index, which these researchers believe best predicts cardiovascular disease-related mortality (2018).

Ongoing debates on overweight and obesity influences on cardiometabolic risk in global populations suggest caution in the sole reliance on BMI as an indicator (Maffetone & Laursen, 2020). Trending research seeks to develop a fail-safe index that does not underestimate risk for non-White populations such as Asians, Chinese, Africans, and Latin Americans, in which up to 40% or more of those who are normal weight according to BMI may have excess body fat (Maffetone & Laursen, 2020). Whatever the best method is for identifying obesity in individuals or populations, it is clear that the obesity problem is large and increasing.

Historically, obesity treatment programs have focused primarily on approaches that target the individual, with caloric restriction being the primary approach (Garner & Wooley, 1991; Archer et al., 2018).

However, as early as the 1970s, some rejected these approaches for their high failure rates, advocating behavior-based, non-diet approaches instead (Garner & Wooley, 1991).

As previously noted, with economic development and rising incomes, obesity has become a global health concern (Boutayeb, 2006). With this increase in global obesity, research and practice in obesity control in vulnerable populations has trended toward advocating lifestyle changes and health education awareness rather than pharmacological interventions (Roberto et al., 2015) or surgical approaches (weight loss surgery or bariatric surgery) (English & Williams, 2018), which are less available in developing country settings.

As discussed in the next section, lifestyle and education-oriented interventions involving self-monitoring of food intake, physical activity, and other behavior change hold great promise for reducing existing obesity (Heymsfield et al., 2018), when used together with prevention approaches which emphasize a healthy diet and active living (U.S. C.D.C., 2019). When implemented, these lifestyle approaches may promote weight loss of 5–10% and maintenance of that weight loss, which is closely associated with reduction in cardiometabolic risk (Heymsfield et al., 2018). In addition, lifestyle behavioral approaches for obesity control and management increasingly utilize mobile health (mHealth) technologies to provide real-time support with education, behavioral modification, interactive self-guided features, online support blogs, and other informational social interactions (Bonomi & Westerterp, 2012; see also Chap. 10, this volume). Technologies with activity monitoring capabilities support physical activity engagement, increasing the chances for sustainable obesity and metabolic conditions management.

Current research in addressing the global obesity pandemic involves newer, systems-oriented interventions, which seek to address the obesity epidemic in partnership with schools, community groups, local health authorities, and more (see also Chap. 5, this volume). A systems approach to overcoming the obesity epidemic will involve both continued research to understand the individual and societal causes of the condition as well as multidisciplinary collaboration to identify the best approaches to adopt when community-based intervention strategies are designed (The Community Guide, 2017).

Pertinent Sustainable Community Health-Oriented Approaches

Current community-level obesity and metabolic disease intervention programs include those that more traditionally seek to influence dietary intake, physical activity, or other aspects of lifestyle. In contrast to approaches focused on individuals or families, these community-based interventions may also work to change policies and practices to make adopting healthier behaviors easier. We consider current community-oriented obesity control and management practices aligned to social ecological model (SEM), policy diffusion model-based activities, and whole systems approaches (WSAs).

Social ecological models (SEMs) consider health behaviors at intrapersonal, interpersonal, organizational, community, and public policy levels that impact weight status (U.S. C.D.C., 2017a; Sallis, Owen, & Fisher, 2008). (See also Gittelsohn, Kim, He, & Pardilla, 2013; Harrison et al., 2011). These include nutrition, physical activity, and lifestyle approaches, public policy initiatives, multifactorial approaches, and creating healthier food environments within communities with the input and involvement of all parties involved; involving the media to promote healthy diets and community education on the risk factors associated with overweight; and built environment polices for obesity prevention and control.

Nutrition, Physical Activity, and Lifestyle Approaches

Both nutrition and physical activity interventions can modify risk for obesity and metabolic conditions, reducing morbidity and mortality in populations by improving dietary quality, modifying cardiometabolic risk, and promoting weight loss (Wing et al., 2011; Woodcock, Franco, Orsini, & Roberts, 2011; Schwingshackl, Missbach, Dias, König, & Hoffmann, 2014, see Chap. 5, this volume). Many such interventions aim to reduce obesity and overweight in communities through nutrition education, self-monitoring, portion control, meal planning, and social support to encourage eating healthier foods, while reducing intake of less healthy foods. The interventions focus on reducing caloric intake and

sugar-sweetened beverage (SSB) intake, improving snack quality, increasing fruit and vegetable intake, and promoting moderate exercise (NHLBI, 2015). Physical activity-oriented interventions often involve walking or other forms of exercise. Walking at a moderate pace of three miles (about 6000 steps) per hour expends sufficient energy to meet the definition of moderate-intensity physical activity (Ainsworth et al., 2000). Combined nutrition and physical activity approaches may result in greater obesity and weight reduction than using either alone (Johns, Hartmann-Boyce, Jebb, & Aveyard, 2014). A weight loss of 5% or greater is associated with lower risk for cardiovascular disease (Wing et al., 2011), while moderate physical activity of 30 minutes a session, five times a week is associated with a 19% reduction in mortality (Woodcock et al., 2011). The effects are stronger and more sustained when combined with healthy diet (Schwingshackl et al., 2014).

Yet, most community-based nutrition and physical activity interventions have been implemented with small groups rather than at the community level. Some examples include ACHIEVE (Daumit et al., 2013), STRIDE (Green et al., 2015), and IN SHAPE (Bartels et al., 2015). ACHIEVE involved a randomized controlled trial of a group weight management and physical activity program in overweight and obese patients with serious mental illness in various community rehabilitation centers (Daumit et al., 2013). It was effective in helping participants achieve and maintain a healthier weight during an 18-month period (Daumit et al., 2013). STRIDE was a six-month, randomized controlled trial in a community setting of overweight and obese patients with serious mental illness and increased risk of diabetes, who were prescribed a calorie-restricted, Dietary Approaches to Stop Hypertension (DASH) diet and physical activity (Green et al., 2015). STRIDE participants were successful at achieving and maintaining a healthier weight and better glucose control. All three of these interventions were successful and took place among a specific community of adults with serious mental illness.

Community-based, lifestyle interventions involve a combination of diet, exercise, and/or behavior modification to prevent or treat obesity (Galani & Schneider, 2007; Barte et al., 2010; Olsen & Nesbitt, 2010; Bonomi & Westerterp, 2012). Those programs incorporating a dietary component have led to significant weight loss when compared with no

treatment (Bonomi & Westerterp, 2012). Lifestyle interventions with a dietary component likely achieve their effects on weight loss by reducing intake of certain types of high-calorie foods, such as those high in saturated fat and/or by increasing physical activity. Moreover, such lifestyle interventions have improved plasma lipid concentrations, insulin sensitivity, and blood pressure, even in the absence of weight loss or body composition change, which may reflect the positive impact of improved dietary quality (higher in fruits, vegetables, and whole grains) and higher levels of physical activity (Bell et al., 2007).

As an example, Lifestyle Interventions for Expectant Moms (LIFE-Moms) (Lifestyle Interventions for Expectant Moms, n.d.; Peaceman et al., 2018) aimed to reduce excessive gestational weight gain among women. This intervention program targeted diet, physical activity, and behavioral and support strategies (weekly coaching phone calls and texts, individual counseling sessions, etc.). Pregnant women with BMI greater or equal to 25 took part in the program. Interventions significantly reduced the percent of women with excess gestational weight gain among this community of pregnant, adult women. (Peaceman et al., 2018).

Policy Diffusion Approaches

These seek to achieve obesity control and prevention through community access to recreational areas and infrastructure that provide an enabling environment to exercise and to stay active; information available to help individuals make healthy lifestyle choices; knowledge of food healthy supply chains and food markets; and more (see Research Box 16.1). They also include efforts to develop urban forests (Renner, 2019) and increase community access to healthy foods via incentive programs for retailers and requiring menu labeling at the point of decision in food markets such as chain restaurants (which has since been a law in the US since 2018) (US Food and Drug Administration (U.S. F.D.A.), 2020). Policy-oriented obesity control and management efforts also include increasing availability of potable water in public.

The US CDC partnership with the National Center for Chronic Disease Prevention and Health Promotion is an example of a policy

Research Box: 16.1

The Central California Regional Obesity Prevention Program: Changing Nutrition and Physical Activity Environments in California's Heartland. (Schwarte et al., 2010).

Background: In the US, California's Central Valley is one of the country's leading agricultural regions, but it also has high rates of poverty, hunger, overweight, obesity, and poor quality food environments. It is a region of food deserts and a large population of migrant workers, many of whom are undocumented.

Methods: The Central California Obesity Prevention Program (CCROPP) aimed to create a community-driven, whole systems approach to prevent obesity by changing the food and physical activity environments. It did this by addressing policy, partnering with community organizations and public health departments, and engaging community members actively in the process. It did this after an extensive review of the literature and by adopting a logic model that involved applying systems theory to social systems.

Results: The interventions within this large region led to establishment of new farmers markets, increased collaborations among schools, communities, health departments, farmers, and WIC. Self-sustaining walking groups were formed in some areas, one of which installed a new walking path at a local park. Other communities made structural improvements at parks, left school exercise areas open after school hours, passed breastfeeding policy changes, and created strategic plans for cities focused on health.

Conclusion and implications: The CCROPP showed that food and physical environment changes are possible even in areas of high poverty and few resources. However, further research is needed to evaluate the long-term impact of these initiatives and what additional measures are needed to prevent and reduce obesity within communities.

What Do You Think?

1. How do food markets influence community health?
2. How might communities differ in their obesity prevention, control and management approaches depending on community-specific characteristics?
3. How might policy initiatives address those potential cross-community differences while promoting equitable improvements in health?

initiative for obesity control and prevention (U.S. C.D.C., 2017a) aimed to “to increase the capacity of state health departments and their partners to work with and through communities to implement effective responses to obesity in populations that are facing health disparities” (U.S. C.D.C.,

2017a), such as supporting communities in plans for safe places for physical activity and nutrition health.

It is not likely that any single policy change would contribute significantly to reduced obesity, but when combined with multiple policy changes and other community-based efforts, change is possible.

Multifactorial Approaches

Multifactorial approaches to prevent obesity and metabolic conditions through health systems or structural reconfigurations, community-focused activity design, or targeting environmental and personal factors may help reduce health disparity and enable equity and social justice for people with obesity and metabolic conditions. For instance, community-level, multifactorial approaches may focus on healthier foods and beverages in schools or other communities, limiting access to less healthy food and beverage options in a variety of settings, promoting reduced screen time among individuals, and providing technology-supported coaching or counseling interventions for individuals (The Community Guide, 2017).

The Cherokee Choices program is an example of a community-based multifactorial approach intervention to improve the health of Cherokee Indians living in a rural area of North Carolina, USA (Bachar et al., 2006). This program involved three main components: elementary school mentoring (addressing inter- and intrapersonal factors and organizational factors within school settings); worksite wellness for adults (again, addressing inter, intrapersonal, and organizational factors within working adult communities); and a church-based health promotion program (addressing similar areas). The tribe also incorporated a social marketing program with TV ads and a documentary to support their efforts. Participants within the various programs met dietary and physical activity goals, reduced body fat, and were committed to the program. The program is important in that it follows established models, such as the SEM, but also involved community needs assessments that got stakeholder input into what was needed before the program was established, increasing its likelihood of success (Bachar et al., 2006).

The Healthy Eating Active Communities (HEAC: Samuels et al., 2010), the Community Health Initiative (CHI: Cheadle et al., 2010; Ross et al., 2010), and Tribal Health and Resilience in Vulnerable Environments (THRIVE: Jernigan et al., 2017, 2018; Jernigan, Salvatore, Williams, et al., 2019) are examples of other multifactorial approaches. The HEAC is a collaborative partnership located in six low-income communities in California, involving 11 school districts, a network of local organizations, and a coalition of state-level advocacy organizations, as well as local public health departments (Samuels et al., 2010). The HEAC is aimed to make changes in food and physical activity environments (such as changes in foods and beverages available in vending machines in various sectors, changes in neighborhood retail food offerings, and changes in equipment available in schools) while educating local authorities such as city councils on the importance of incorporating health considerations into development plans, and funding programs to educate local youth (Samuels et al., 2010). It resulted in many positive changes in the food and physical activity environments.

CHI is a program that originated in 2005 with Kaiser Permanente (an integrated health care delivery system) and involved just three sites in Colorado (Schwartz, Kelly, Cheadle, Pulver, & Solomon, 2018). It has since expanded to include 32 communities in Colorado, nine in northern California, nine in southern California, six in the Pacific Northwest, and two additional in each Maryland and Georgia, USA (Schwartz et al., 2018). Some of the CHI programs include local stores receiving more fresh fruits and vegetables; evidence-based prevention strategies such as promoting walking or biking to schools; and integrating health considerations into planning and development decisions (Cheadle et al., 2010). While changes attributed to this program have been modest overall, an analysis that evaluated the relationship between dose (intensity of the program) and results found more encouraging results (Schwartz et al., 2018).

THRIVE (Jernigan et al., 2017, 2019) was created to improve US Tribal food environments and control obesity. THRIVE used a participatory research process to increase healthy foods and reduce pricing of these foods in tribal stores. Formative research, used in step one, assessed tribal community food environments and health outcomes. The second phase,

intervention development, examined convenience stores and created healthy retail product, pricing, promotion, and placement strategies. The last phase focused on intervention implementation and evaluation of the perception of healthier stores among both the intervention and control groups of participants (Jernigan et al., 2018). Positive outcomes included higher shopping frequency of purchasing fruits, vegetables, and other healthy items (Jernigan et al., 2018).

Whole Systems Approaches (WSAs)

WSAs are attempts to track and measure the extent to which community-based programs adhere to best practices in attempting to develop healthier practices and environments (Garside, Pearson, Hunt, Moxham, & Anderson, 2010; Bagnall et al., 2019). Ten features of a WSA program to address public health problems such as obesity include:

1. **Identifying a system:** Programs should first recognize all elements of a complex, adaptive system that affects the public health issue of concern.
2. **Capacity building:** Programs should have an explicit goal to support communities and organizations in the complex system.
3. **Creativity and innovation:** Programs should develop mechanisms to support local innovation to address the public health problem.
4. **Relationships:** Programs should use appropriate methods to develop effective relationships between participating organizations.
5. **Engagement:** Programs should use appropriate methods to help individuals, organizations, and economic sectors engage everyone involved in developing and delivering programs.
6. **Communication:** Programs should develop mechanisms to support good communication between the members of each system.
7. **Embedded action and policies:** Programs should describe in a transparent way the practices that will promote public health within organizations of the system.

8. **Robust and sustainable:** Programs should develop clear strategies to provide adequate resources for existing and new projects.
9. **Facilitative leadership:** Programs should provide strong strategic support and appropriate and adequate resources for all levels of interventions.
10. **Monitoring and evaluation:** Programs should have preplanned methods for formative and process evaluations in order to enhance the effectiveness of the interventions (Bagnall et al., 2019).

The evidence on the efficacy of WSAs is emerging (Bagnall et al., 2019). The Central California Regional Obesity Prevention Project (CCROPP; Schwarte et al., 2010) is a WSA-type program in eight agricultural, Central Valley counties to create farmers' markets in food desert communities. In addition, schoolyards became open for community members after school (Schwarte et al., 2010). A similar program is the Australian Romp and Chomp, a program that targeted all children under age 5 in the City of Geelong in Australia and the borough of Queensville in Victoria, Australia (de Silva-Sanigorski et al., 2010) promoting healthy eating and healthy play, resulting in lower prevalence of obesity in the children (de Silva-Sanigorski et al., 2010). Shape Up Somerville is another WSA-style project involving three diverse communities in Massachusetts, USA. Implementation of the program aimed to prevent and control obesity in school children showed evidence of efficacy and cost-effectiveness (Coffield et al., 2019). (Economos et al., 2013; Coffield et al., 2019). The WHO European Healthy Cities Network (de Leeuw, Tsouros, Dyakova, & Green, 2014) is yet another WSA involving 100 cities in 30 countries across Europe by addressing health inequalities that would impact obesity control and management (de Leeuw et al., 2014). Thus far the evidence for WSA approaches is mixed and outcomes may vary by context and level of adherence to WSA principles. See Discussion Box 16.1: Accessing Obesity Treatment for a discussion of some of the barriers to accessing treatment that should be addressed by using WSA principles.

Discussion Box 16.1: Accessing Obesity Treatment

Multidisciplinary approaches to managing obesity among individuals within communities are a best community health practice. However, they are very limited in their feasibility and availability, especially among members of low-income communities. While programs to improve the food and physical activity environments and to educate the public on the importance of healthy diet and exercise are very important in reducing the risk for obesity, they presume implementation of community health policies, which would not be the case across various socioeconomic groups and in different environments.

What Do You Think?

1. What types of policy changes need to occur to make obesity treatment more accessible to marginalized populations and communities?
2. What would be an appropriate universal community health policy that could reduce community health disparities in weight control?

Cultural, Legislative, and Professional Issues That Impact Community Health Approaches

Cultural, legislative, and professional issues may positively or negatively impact community health approaches to address high rates of obesity and metabolic disease. Cultural issues that influence educational attainment, SES status, gender equity, and treatment of marginalized populations can perpetuate disparities in obesity and metabolic disease. Legislative and policy issues that may positively or negatively influence efforts include ease and cost of implementation, flexibility to implement policies differently in areas that differ in various respects, and other issues. Professional issues often relate to lack of communication or understanding among professions addressing the same issues.

Cultural Influences

As described in earlier sections, there are disparities in obesity in the US and globally. In the US, these disparities are present by geographic region, SES, race/ethnicity, and rural versus urban areas (U.S. C.D.C., [n.d.](#)).

Between 2011 and 2014, an analysis of obesity rates in rural versus metropolitan areas in the US showed that obesity rates for rural residents was higher by about 15%. More than 39% of adults in nonmetropolitan areas had obesity compared to 33% of those in metropolitan countries. There are also disparities in obesity prevalence by race/ethnicity. NHANES data from 2015 to 2016 showed that Hispanics and Blacks had a higher obesity rate of 50.6% and 54.8% compared to Whites with 38% in the US (Lee, Warren, Liu, Foti, & Selvin, 2019). Even among children, obesity rates were higher among Hispanics (47%) and Blacks (46.8) compared to Whites (37.9%). Some of the factors associated with higher rates of rural obesity include institutional and systemic poverty; underinvestment in community health programs; and the consequent limited resources to implement policies that address the social determinants of health (Lundeen et al., 2018). Known contributors to these community disparities in obesity prevention and control include poor awareness about nutrition information and food deserts around residential areas (American Heart Association, 2004; Moller & Kaufman, 2005).

Among the Organization for Economic Co-operation and Development countries (OECD) (a group of 37 country economic partners), disparities in obesity rates by educational attainment is higher among women compared to men. Factors driving the higher rate of obesity among women may be attributed to low education levels and effects of socioeconomic on life course (Devaux & Sassi, 2015). These ongoing disparities, which are largely driven by poverty and lack of educational attainment, have been resistant to change. Thus, it is challenging to address obesity while equal access to educational and socioeconomic tools to battle obesity in the most at-risk populations remains limited.

Legislative Influences

Many developed countries have obesity control and prevention-related policies and programs targeted to vulnerable populations like children and older adults of low socioeconomic backgrounds. Examples in the US include the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) (which serves approximately 53% of all eligible

infants) and the Child and Adult Care Food Program (CACEFP) (which serves about 3.5 million children in childcare by providing meals to one-third of all children in childcare centers). Other programs include the National School Lunch and School Breakfast programs (which provide 31 million children food twice a day, five days a week across 100,000 public and private schools) and the Supplemental Nutrition Assistance Program (SNAP) (which provides low-income individuals and families with assistance to buy healthy foods).

Policy strategies to tackle obesity in OECD countries (Finland, Belgium, and Chile) include policies that increase prices of potentially unhealthy foods, food labeling, and mandatory inclusion of physical activity in schools and primary care settings (Cecchini & Warin, 2016). In Sweden and Denmark, nutrients are listed on the front of the pack to help people make better and healthier food choices. Other interventions aimed at reducing obesity include advertisement restrictions on radio and TV, especially those enticing to children, including bans of advertisements on SSBs. Bans of ads on SSBs have also occurred in Chile, Poland, Spain, and Turkey. See Discussion Box 16.2 for a further discussion of issues related to SSBs.

Discussion Box 16.2: Sugar-Sweetened Beverage (SSB) Issues

Within developed countries, SSBs are a major contributor to excess calories. When consumed in addition to the other foods one needs, they provide excess calories without the accompanying nutrients that other foods provide and may lead to obesity. When they replace other sources of nutrition in the diet, SSB may lead to nutrient imbalances and inadequate micronutrient intake. The increasing size of SSB portions has led to front-of-package labeling or point-of-sale labeling, bans on SSB advertising, and/or SSB taxation.

What Do You Think?

1. What factors would influence a population to adopt policies to label SSBs on the front of package to mitigate risk of obesity?
2. What other food labeling would be helpful to obesity prevention and control?

However, obesity prevention and control policies are politically controversial and have not been well supported by the food industry, which has invested in its historic trade practices marketing highly processed foods, while national governments have been lukewarm regarding implementing nutrition-safe food market regulations (Lyn, Heath, & Dubhashi, 2019, see also Chap. 3, this volume). Adoption and implementation of population-wide obesity control and management policies and applying multilevel systems approaches with coordinated efforts by governments, industry, communities, and individuals would go a long way toward reducing and preventing obesity using sustainable community health approaches (Malik, Willett, & Hu, 2013).

Professional Issues

Professionals in obesity control and management (such as doctors, physician assistants, nurses, dietitians, and more) contend with fragmented health care services (Lawrence & Kisely, 2010). They also may be less well trained to treat obesity in special populations such as in those with psychiatric disabilities, who have higher rates of obesity compared to those from the general population (Jonikas et al., 2015). This lack of training in obesity management for special populations would explain why professions are less likely to advise people with developmental disabilities to adopt lifestyle changes aimed to lower their (risk for) obesity (Sciamanna, Tate, Lang, & Wing, 2000; Phelan, Nallari, Darroch, & Wing, 2009). The limitations in preparation among health care providers with people with psychiatric and developmental disabilities are suggested by the fact that intervention effects tend to be below clinically significant levels (about 5%) (Olker, Parrott, Swarbrick, & Spagnolo, 2016) with less than 40% of participants improving cardiovascular health (Bartels et al., 2013). Moreover, professionals seem less knowledgeable on sustainable resourcing of interventions with special populations (Patel, Asch, & Volpp, 2015), increasing risk for relapse to pre-intervention conditions. While professionals increasingly utilize mHealth technologies with people with or at risk for obesity (Galbraith-Emami & Lobstein, 2013), they are less familiar with community activity engagement practices for their clients to adopt and maintain healthy behavior change.

Related Disciplines Influencing Community-Oriented Health Aspects

Several disciplines work on the issue of obesity. These include, but are not limited to medicine, nutrition, kinesiology, psychology, epidemiology, biostatistics, geography, economics, political science, public health, and more. Whereas the great variety of scientists and other specialists involved means that many approaches are being discussed and tried, this variety can also lead to competitiveness and resistance to information sharing. Better coordination and understanding among disciplines will be needed if progress is to be made in reversing the obesity epidemic. Below we briefly describe the role that several disciplines have made on this important issue.

Medicine has been active in many aspects relating to obesity, including categorizing obesity as a disease (American Medical Association, 2013), thereby reducing somewhat the stigma associated with obesity and its treatment. Medical organizations are active in evaluating the evidence for clinic-based treatment, including individual and group treatment, and issuing guidelines for evidence-based treatment. For example, in 2013, the American College of Cardiology together with the American Heart Association and The Obesity Society issued guidelines for managing overweight and obesity in adults (Jensen et al., 2013). The American Association of Clinical Endocrinologists (AACE) issued its own guidelines of care in 2016 (Garvey et al., 2016). The American Academy of Pediatrics issued guidelines for pediatric weight management in 2007 (Spear et al., 2007), including guidance on when and how to incorporate the input of other health professionals such as dietitians and behavior specialists. These are just some of the guidelines that have been issued, which have included bariatric surgery guidelines and those from various international medical organizations.

The field of nutrition and dietetics has also been actively involved in obesity treatment by providing guidelines on nutrition health and safety (see Chap. 5, this volume). Professional nutrition associations such as the Academy of Nutrition and Dietetics have also issued position and practice papers to guide care (Raynor & Champagne, 2016) as well as evidence reviews for best practices in nutrition treatment for individuals

(Academy of Nutrition and Dietetics Evidence Analysis Library, 2019). They have also issued recommendations for preventing pediatric obesity particularly with emphasis on nutrition in schools and childcare settings (Hoelscher, Kirk, Ritchie, & Cunningham-Sabo, 2013).

The fields of kinesiology and exercise physiology have contributed to our understanding of how physical activity factors impact obesity risk (Donnelly et al., 2009). These professionals have also studied which forms of exercise are most helpful in combatting obesity, including recommendations that establish aerobic/cardiovascular exercise as important in preventing weight gain, promoting weight loss, and necessary to prevent regaining lost weight (Donnelly et al., 2009). Such bodies of professionals dedicated to studying physical activity as the American College of Sports Medicine (ACSM) have also published guidelines related to exercise and weight management, which aerobic exercise as the form of exercise is most likely to help those who have lost weight maintain the weight loss (Donnelly et al., 2009). This field has also been instrumental in discovering that those who have lost significant weight typically have to maintain very high levels of physical activity post weight loss to help maintain the lost weight (Donnelly et al., 2009).

Psychologists and other behavioral specialists have also been integral in obesity treatment, identifying and managing psychological comorbidities related to obesity, and raising awareness about bias related to obesity. The American Psychological Association (APA) released a Clinical Practice Guideline for the Treatment of Obesity and Overweight in Children and Adolescents in 2018, which included recommendations for family-based multicomponent interventions (consistent with recommendations of other groups) (Llabre et al., 2018). It also emphasized the need to avoid stigmatizing the condition and the people with the condition (Llabre et al., 2018).

Public health professionals have been highly active in raising the profile of obesity and disseminating information about its risks (American Public Health Association, 2007), advocating for policy changes to combat it, and developing community-based programs to address it (Blumenthal, Hendi, & Marsillo, 2002). Public health professionals often work with the most disadvantaged and marginalized populations. Therefore, they work extensively on the issue of addressing obesity disparities.

The field of epidemiology has been instrumental in helping public health professionals, physicians, policymakers, and many more understand the size and nature of the problem of obesity (Ogden, Yanovski, Carroll, & Flegal, 2007). Their work has been cited many times in this chapter (Ogden et al., 2007; Ogden, Carroll, Kit, & Flegal, 2012; Flegal et al., 2013; Hruby & Hu, 2015; Hales et al., 2017, 2020). They have studied and disseminated information regarding factors associated with increased obesity risk. They have collected and analyzed data sets within countries and globally to help track progress on addressing this epidemic. In addition, recently professionals in systems bioinformatics have begun to work together with epidemiologists and other professionals to help elucidate the underlying genetic relationships to disease, including metabolic diseases (Oulas et al., 2019).

Scientists from the social sciences have also entered the realm of research into obesity. For example, political scientists have studied how obesity has impacted policy and interest in types of policies as well as how policy has influenced health outcomes (Kersh & Monroe, 2002). They have also evaluated the unintended consequences of policies and how easily (or not) policies may be transferred from one area to another (Kersch, 2009). They have also assessed equity issues with regard to policies and their implementation (Fox & Horowitz, 2013). Even economists have been actively involved in obesity research, evaluating the cost of obesity and its comorbidities on various levels of economies (Ananthapavan, Sacks, Moodie, & Carter, 2014). They have also evaluated the cost-effectiveness of interventions that touch policy or that are implemented within communities. Geographers have also been involved as mapping of obesity trends and food deserts have become important to understand the problem (Science X: Phys.org, 2013).

Issues for Research and Other Forms of Scholarship

This discussion of obesity and metabolic disease, including its etiology, prevention, treatment (including community-based approaches), and barriers to progress, has made plain that several areas of research need to be addressed to reverse this epidemic. Among these needs include the

need for better data; a systems approach to understand the data; and targeted interventions, including community-level and policy-level interventions that address the needs of marginalized populations. Moreover, there is need for a better understanding of how obesity control policy recommendations may affect individuals and communities. Another major research need is for high-quality studies of long-term interventions at the individual and community levels.

Further research is needed to unpack the social determinants of obesity in community populations with vulnerability (Roth, Foraker, Payne, & Embi, 2014). The evidence would enable the design and implementation of targeted interventions for sustainable obesity prevention and control based on the specific community health disparities. A one-size-fits-all approach to obesity prevention and control would be wasteful and unproductive.

An example of efforts to map factors that relate to both poverty and obesity for targeted interventions include the US Interactive Food Access Research Atlas (USDA Economic Research Service, 2019). This online map allows better identification at a granular level of specific areas where low income, low vehicle access, and low grocery store access exist, thereby reducing access to affordable, nutritious food. Indonesia has a similar project to map and track food insecurity (World Food Programme, 2015). However, many countries lack such good quality data and certainly do not have it mapped. Without mapping these areas in detail, it is not possible to know where the greatest resources are needed. Thus, we need more community-level epidemiological data for the design and implementation of sustainable community health addressing known and emerging risks for obesity.

Wider use of community health informatics approaches may help identify the data tools with the most yield by community characteristics (Gittner, Kilbourne, Vadapalli, Khan, & Langston, 2017; see also Chap. 10, this volume). Data types and sources are not equal in their ability to guide community-level policy interventions for obesity prevention and control. For instance, data that sample interconnected social and economic deprivation, such as lack of community infrastructure, heat stress, and higher levels of pollution and food insecurity may suggest a community setting-specific approach to obesity prevention and control (Gittner

et al., 2017). As these type of data accrue globally, it would be possible to model interventions for adoption by governments, community organizations, and communities in their efforts to address the difficult, complex issues affecting obesity. Health systems-level studies are also needed to better understand the settings in which specific obesity prevention and control would be most effective. For instance, there is evidence to suggest that local programs may be most successful if they are multi-pronged and if the strategies at every level reinforce each other: identifying intervention targets or policy goals, engaging community members in identifying causes of obesity locally, as well as designing policies or interventions that appeal to groups outside of public health (Vitaliano et al., 2005; Barnhill et al., 2018). Thus, there is need to think globally and act locally in efforts to combat risks for obesity at the community level. Other, marginalized populations at higher risk of obesity and its comorbidities include people with neurodevelopmental, psychiatric, and musculoskeletal disorders (Lawrence & Kisely, 2010). Finally, most obesity interventions in the past have been short term and have targeted the individual. As discussed in the section on multifactorial interventions and WSAs, there are more community-based interventions and those that use WSAs today than ever before. However, we need more studies that adhere to the WSA features, that measure change rigorously and consistently, that evaluate cost-effectiveness and sustainability of the solutions, and that endure for longer periods of time.

Summary and Conclusion

Obesity is a critical public health issue in nearly every corner of the world. Throughout the world, even in areas of high deprivation, obesity now coexists with undernutrition. Obesity currently exceeds malnutrition (undernutrition) throughout the world. Sustainable ways to prevent and treat obesity and reduce its complications at the community level should prioritize policy approaches for creating healthy community and neighborhood environments, multilevel approaches to address obesity both at the community and individual levels, those that promote healthy food environments, health care systems, school environments, physical

activity communities, and foodservice programs. Cultural, professional, and/or legislative dispensations influence the practice evidence on community-level interventions to reduce obesity and its related metabolic issues. Despite much hand-wringing, discussion, exhortation, and blaming, few efforts have been made by national governments to address overweight and obesity risk in a sustainable way. Research should focus on customizing obesity prevention and control interventions to local communities, while drawing from the available and emerging global scholarship.

Self-Check Questions

1. Define obesity and metabolic conditions and outline their prevalence in the US and globally.
2. Outline the landmark studies and practices in obesity and metabolic conditions management in the last half century, highlighting their significance.
3. What are the leading approaches to community-level interventions for managing obesity, and the strength of evidence for them?
4. How have cultural, professional, and legal issues influenced the management of obesity and metabolic conditions globally?
5. What are the roles of various disciplines in addressing obesity and metabolic conditions?
6. Identify research and practice gaps in managing obesity and metabolic conditions and suggests ways to address those gaps in knowledge.

Discussion Questions

1. Think about the issue of obesity and metabolic disease disparities in the world. Based on the content in this chapter, what types of policies would be most effective for obesity prevention and control at the community level?
2. Think about a community that has high levels of obesity and few resources. Where do you think obesity treatment would have to be offered to make it accessible? What are the barriers to access? (Time? Transportation? Cost? Values? What else?). How would you remove some of the barriers to access? Are there cultural factors that you would need to take into account?
3. To what extent are lifestyle approaches translatable across communities for addressing disparities in obesity prevention and control?
4. What are some of the ways by which professionals could be prepared to work with diverse populations for obesity prevention and control?

Field-Based Experiential Learning Activity

1. One way of better understanding how to implement obesity prevention and control at the community level is to interact with individuals in communities that have higher rates of obesity. Even when individuals are not overweight or obese, dietary quality may be poor. Consider becoming a volunteer for Cooking Matters, or a similar organization in your country. <https://cookingmatters.org/volunteer-with-programming>

Consider the following based on your experience:

- 1.1 How would you provide Cooking Matters at the community level? With what resources and what benefits?
- 1.2 How would you win various community constituents' interest in participating in Cooking Matters?
2. Access the USDA's interactive food atlas: <https://www.ers.usda.gov/data-products/food-environment-atlas/go-to-the-atlas/> Search in your area. Make note of several of the factors in your area, such as socioeconomic status, access and proximity to grocery stores, restaurant availability, and at least two others. If you do not live in the US, search for data in your country online.
 - 2.1 How would you rate your local food environment where you live? How easy is it to attain healthy foods because of geographic/proximity issues? How about economic resources of people in your area to buy these foods?
 - 2.2 What do you think needs to be improved in your area?
 - 2.3 Are there policies that your area could adopt to help improve this issue? Is anyone or any group currently working on this issue that you are able to find?
 - 2.4 If you were to design a community-level obesity intervention using the WSA described in this chapter, what would be important to do first? Which stakeholders would you include? What issues would you try to address?

Key Online Resources

- Medicine Net—Metabolic syndrome quiz: Test your medical IQ. https://www.medicinenet.com/metabolic_syndrome_quiz/quiz.htm
- Quizlet Inc. (2020) Metabolic Syndrome. <https://quizlet.com/37068287/chapter-10-metabolic-syndrome-flash-cards/>
- Mayo Clinic Patient Care and Health Diagnosis. <https://www.mayoclinic.org/diseases-conditions/obesity/diagnosis-treatment/drc-20375749>
- Kids Health from Nemours—Metabolic Syndrome. <https://kidshealth.org/en/parents/metabolic-syndrome.html>
- MERCK Manual Consumer version—Obesity. <https://www.merckmanuals.com/home/disorders-of-nutrition/obesity-and-the-metabolic-syndrome/obesity>
- National Cancer Institute—Obesity and cancer. <https://www.cancer.gov/about-cancer/causes-prevention/risk/obesity/obesity-fact-sheet>
- Medical News Today. What is metabolically healthy obesity? <https://www.medicalnewstoday.com/articles/265405#1>

References

- Academy of Nutrition and Dietetics Evidence Analysis Library. (2019). *Adult weight management scoping review*. Retrieved April 30, 2020, from <https://www.andeal.org/topic.cfm?menu=5276&cat=4690>
- Ainsworth, B. E., Haskell, W. L., Whitt, M. C., Irwin, M. L., Swartz, A. M., Strath, S. J., ... Jacobs, D. R. (2000). Compendium of physical activities: An update of activity codes and MET intensities. *Medicine & Science in Sports & Exercise*, 32(9), S498–S516.
- American Heart Association. (2004). *Exercise and acute cardiovascular events: placing the risks into perspective: A scientific statement from the American Heart Association Council on Nutrition, Physical*. Retrieved from <https://www.aha-journals.org/doi/abs/10.1161/circulationaha.107.181485>
- American Medical Association (AMA). (2013). *Report of the council on science and public health: Is obesity a disease* (Resolution 115-A-12). Retrieved April 30, 2020, from <https://www.ama-assn.org/sites/ama-assn.org/files/corp/media-browser/public/about-ama/councils/Council%20Reports/council-on-science-public-health/a13caph3.pdf>
- American Public Health Association. (2007). *Addressing obesity and health disparities through federal nutrition and agricultural policy*. Retrieved April 30, 2020, from <https://www.apha.org/policies-and-advocacy/public-health-pol->

- [icity-statements/policy-database/2014/07/24/15/56/addressing-obesity-and-health-disparities-through-federal-nutrition-and-agricultural-policy](#)
- Ananthapavan, J., Sacks, G., Moodie, M., & Carter, R. (2014). Economics of obesity—Learning from the past to contribute to a better future. *International Journal of Environmental Research and Public Health*, *11*, 4007–4025.
- Archer, E., Lavie, C. J., & Hill, J. O. (2018). The contributions of ‘diet’, ‘genes’, and physical activity to the etiology of obesity: Contrary evidence and consilience. *Progress in Cardiovascular Diseases*, *61*(2), 89–102.
- Association of Life Insurance Medical Directors. (1912). The Actuarial Society of America. *Medico-Actuarial Mortality Investigation*, vol. 1. New York, NY.
- Bachar, J. J., Lefler, L. J., Reed, L., McCoy, T., Bailey, R., & Bell, R. (2006). Cherokee choices: A diabetes prevention program for American Indians. *Preventing Chronic Disease*, *3*(3), A103.
- Bagnall, A.-M., Radley, D., Jones, R., Gately, P., Nobles, J., Van Dijk, M., ... Sahota, P. (2019). Whole systems approaches to obesity and other complex public health challenges: A systematic review. *BMC Public Health*, *19*(8), 1–14.
- Barkowski, R. S., & Frishman, W. H. (2008). HDL metabolism and CETP inhibition. *Cardiology in Review*, *16*(3), 154–162.
- Barnhill, A., Palmer, A., Weston, C. M., Brownell, K. D., Clancy, K., Economos, C. D., ... Bennett, W. L. (2018). Grappling with complex Food systems to reduce obesity: A US public health challenge. *Public Health Reports*, *133*(S1), 44S–53S.
- Barte, J. C. M., Ter Bogt, N. C. W., Bogers, R. P., Teixeira, P. J., Blissmer, B., Mori, T. A., & Bemelmans, W. J. E. (2010). Maintenance of weight loss after lifestyle interventions for overweight and obesity, a systematic review. *Obesity Reviews*, *11*(12), 899–906.
- Bartels, S. J., Pratt, S. I., Aschbrenner, K. A., Barre, L. K., Jue, K., Wolfe, R. S., ... Naslund, J. A. (2013). Clinically significant improved fitness and weight loss among overweight persons with serious mental illness. *Psychiatric Services*, *64*(8), 729–736.
- Bartels, S. J., Pratt, S. I., Aschbrenner, K. A., Barre, L. K., Naslund, J. A., Wolfe, R., ... Feldman, J. (2015). Pragmatic replication trial of health promotion coaching for obesity in serious mental illness and maintenance of outcomes. *American Journal of Psychiatry*, *172*(4), 344–352.
- Bell, L. M., Watts, K., Siafarikas, A., Thompson, A., Ratnam, N., Bulsara, M., ... Davis, E. A. (2007). Exercise alone reduces insulin resistance in obese

- children independently of changes in body composition. *The Journal of Clinical Endocrinology & Metabolism*, 92(11), 4230–4235.
- Bhurosy, T., & Jeewon, R. (2014). Overweight and obesity epidemic in developing countries: A problem with diet, physical activity, or socioeconomic status? *The Scientific World Journal*. <https://doi.org/10.1155/2014/964236>
- Blumenthal, S. J., Hendi, J. M., & Marsillo, L. (2002). A public health approach to decreasing obesity. *Journal of the American Medical Association*, 288(17), 2178.
- Bonomi, A. G., & Westterterp, K. R. (2012). Advances in physical activity monitoring and lifestyle interventions in obesity: A review. *International Journal of Obesity*, 36(2), 167–177.
- Boutayeb, A. (2006). The double burden of communicable and non-communicable diseases in developing countries. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 100(3), 191–199.
- Bray, G. E. (1975). *Obesity in Perspective: A Conference, Part 1*. John E. Fogarty International Center for Advanced Study in the Health Sciences. U.S. Government Printing Office.
- Build and Blood Pressure Study*. (1959). vol. 1, Society of Actuaries, Chicago, IL.
- Cecchini, M., & Warin, L. (2016). Impact of Food labelling systems on Food choices and eating behaviors: A systematic review and meta-analysis of randomized studies. *Obesity Reviews*, 17(3), 201–210.
- Cheadle, A., Schwartz, P. M., Rauzon, S., Beery, W. L., Gee, S., & Solomon, L. (2010). The Kaiser Permanente community health initiative: Overview and evaluation design. *American Journal of Public Health*, 100(11), 2111–2113.
- Christakis, N. A., & Fowler, J. H. (2007). The spread of obesity in a large social network over 32 years. *The New England Journal of Medicine*, 357(4), 370–379.
- Christopoulou-Aletra, H., & Papavramidou, N. (2004). Methods used by the Hippocratic physicians for weight reduction. *World Journal of Surgery*, 28(5), 513–517.
- Coffield, E., Nihiser, A., Carlson, S., Collins, J., Cawley, J., Lee, S., & Economos, C. (2019). Shape up Somerville's return on investment: Multi-group exposure generates net-benefits in a child obesity intervention. *Preventive Medicine Reports*, 16, 100954.
- Daumit, G. L., Dickerson, F. B., Wang, N. Y., Dalcin, A., Jerome, G. J., Anderson, C. A., ... Oefinger, M. (2013). A behavioral weight-loss intervention in persons with serious mental illness. *New England Journal of Medicine*, 368(17), 1594–1602.

- de Leeuw, E., Tsouros, A.D., Dyakova, M., & Green, G. (2014). *Healthy cities: Promoting health and equity: Evidence for local policy and practice, summary evaluation of phase V. of the WHO European healthy cities network*. World Health Organization. Retrieved April 29, 2020, from http://www.euro.who.int/__data/assets/pdf_file/0007/262492/Healthy-Cities-promoting-health-and-equity.pdf
- de Silva-Sanigorski, A. M., Bell, A. C., Kremer, P., Nichols, M., Crellin, M., Smith, M., ... Swinburn, B. A. (2010). Reducing obesity in early childhood: Results from Romp & Chomp, an Australian community-wide intervention program. *The American Journal of Clinical Nutrition*, *91*, 831–840.
- DeHenauw, S., Huybrechts, I., De Beourdeaudhuij, I., Bammann, K., Barba, G., Marild, S., ... Ahrens, W. (2015). Effects of a community-oriented obesity prevention programme on indicators of body fatness in preschool and primary school children. *Main Results from the IDEFICS Study*, *16*(2), 16–29.
- DeVaux, M., & Sassi, F. (2015). *The labour market impacts of obesity, smoking, alcohol use and related chronic diseases*. OECD health working papers, No. 86, OECD Publishing, Paris. <https://doi.org/10.1787/5jrqn5fvp0v-en>.
- Development Initiatives Poverty Research, Ltd. (2019). *Global nutrition report*. Retrieved April 27, 2020, from <https://globalnutritionreport.org/media/profiles/v2.1.1/pdfs/global.pdf>
- Donnelly, J. E., Blair, S. N., Jakicic, J., Manore, M. M., Rankin, J. W., & Smith, B. K. (2009). Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. *Medicine and Science in Sports and Exercise*, *41*(2), 459–471.
- Dublin, L. I., & Lotha, A. J. (1937). *Twenty-five years of health Progress: A study of the mortality experience among the industrial policyholders of the Metropolitan Life Insurance Company, 1911 to 1935*. New York, NY: Metropolitan Life Insurance Co..
- Economos, C. D., Hyatt, R. R., Must, A., Goldberg, J. P., Kuder, J., Naumova, E. N., ... Nelson, M. E. (2013). Shape up Somerville two-year results: A community-based environmental change intervention sustains weight reduction in children. *Preventive Medicine*, *57*(4), 322–327.
- English, W. J., & Williams, D. B. (2018). Metabolic and bariatric surgery: An effective treatment option for obesity and cardiovascular disease. *Progress in Cardiovascular Diseases*, *61*(2), 253–269.
- Flegal, K. M., Kit, B. K., Orpana, H., et al. (2013). Association of all-cause mortality with overweight and obesity using standard body mass index categories: A systematic review and Meta-analysis. *JAMA*, *309*(1), 71–82.

- Fox, A. M., & Horowitz, C. R. (2013). Best practices in policy approaches to obesity prevention. *Journal of Health Care for the Poor and Underserved, 24*(20), 168–192.
- Galani, C., & Schneider, H. (2007). Prevention and treatment of obesity with lifestyle interventions: Review and meta-analysis. *International Journal of Public Health, 52*(6), 348–359.
- Galbraith-Emami, S., & Lobstein, T. (2013). The impact of initiatives to limit the advertising of Food and beverage products to children: A systematic review. *Obesity Reviews, 14*(12), 960–974.
- Garner, D. M., & Wooley, S. C. (1991). Confronting the failure of behavioral and Dietary treatments for obesity. *Clinical Psychology Review, 11*, 729–780.
- Garside, R., Pearson, M., Hunt, H., Moxham, T., & Anderson, R. (2010). *Identifying the key elements and interactions of a whole system approach to obesity prevention*. Exeter, UK: Peninsula Technology Assessment Group (PenTAG).
- Garvey, W. T., Mechanick, J. I., Brett, E. M., Garber, A. J., Hurley, D. L., Jastreboff, A. M., ... Plodkowski, R. (2016). American association of clinical endocrinologists and American college of endocrinology comprehensive clinical practice guidelines for the medical care of patients with obesity. *Endocrine Practice, 22*(S3), 1–203.
- Gittelsohn, J., Kim, E. M., He, S., & Pardilla, M. (2013). A Food store-based environmental intervention is associated with reduced BMI and improved psychosocial factors and Food-related behaviors on the Navajo nation. *The Journal of Nutrition, 143*(9), 1494–1500. <https://doi.org/10.3945/jn.112.165266>
- Gittner, L. S., Kilbourne, B. J., Vadapalli, R., Khan, H. M. K., & Langston, M. A. (2017). A multifactorial obesity model developed from nationwide health exosome data and modern computational analyses. *Obesity Research & Clinical Practice, 11*(5), 522–533.
- Green, C. A., Yarborough, B. J. H., Leo, M. C., Yarborough, M. T., Stumbo, S. P., Janoff, S. L., ... Stevens, V. J. (2015). The STRIDE weight loss and lifestyle intervention for individuals taking antipsychotic medications: A randomized trial. *American Journal of Psychiatry, 172*(1), 71–81.
- Greenberg, J. A. (2013). Obesity and early mortality in the United States. *Obesity, 21*(2), 405–412.
- Haidar, Y. M., & Cosman, B. C. (2011). Obesity epidemiology. *Clinics in Colon and Rectal Surgery, 24*(4), 205.

- Hales, C. M., Carroll, M.D., Fryar C. D., & Ogden C. L. (2017). *Prevalence of obesity among adults and youth: United States, 2015–2016*. NCHS Data Brief, 288. <https://www.cdc.gov/nchs/data/databriefs/db288.pdf>. Accessed 23 Apr 2020.
- Hales, C.M., Carroll, M.D., Fryar, C.D., Ogden, C.L. (2020). *Prevalence of obesity and severe obesity among adults: United States 2017–2018*. NCHS Data Brief 360. Retrieved April 30, 2020, from <https://www.cdc.gov/nchs/products/databriefs/db360.htm>
- Harrison, K., Bost, K. K., McBride, B. A., Donovan, S. M., Grigsby-Toussaint, D. S., Kim, J., ... Jacobsohn, G. C. (2011). Toward a developmental conceptualization of contributors to overweight and obesity in childhood: The six-Cs model. *Child Development Perspectives*, 5(1), 50–58.
- Heymsfield, S., Aronne, L. J., Eneli, I., Kumar, R. B., Michalsky, M., Walker, E., Wolfe, B. M., Woolford, S. J., & Yanovski, S. (2018). *Clinical perspectives on obesity treatment: challenges, gaps, and promising opportunities*. Retrieved April 28, 2020, from <https://nam.edu/clinical-perspectives-on-obesity-treatment-challenges-gaps-and-promising-opportunities/>
- Hoelscher, D. M., Kirk, S., Ritchie, L., & Cunningham-Sabo, L. (2013). Position of the academy of nutrition and dietetics: Interventions for the prevention of pediatric overweight and obesity. *Journal of the Academy of Nutrition and Dietetics*, 113(10), 1375–1394.
- Hruby, A., & Hu, F. B. (2015). The epidemiology of obesity: A big picture. *Pharmacoeconomics*, 33(7), 673–689.
- Huang, P. L. (2009). A comprehensive definition for metabolic syndrome. *Disease Models & Mechanisms*, 2, 231–237.
- Jensen, M. D., Ryan, D. H., Apovian, C. M., Ard, J. D., Comuzzie, A. G., Donato, K. A., ... Yanovski, S. Z. (2013). 2013 AHA/ACC/TOS guideline for the management of overweight and obesity in adults. *Circulation*, 129(25 S2), S102–S138.
- Jernigan, V. B., Salvatore, A. L., Wetherill, M., et al. (2018). Using community-based participatory research to develop healthy retail strategies in native American-owned convenience stores: The THRIVE study. *Preventive Medicine Reports*, 11, 148–153.
- Jernigan, V. B., Salvatore, A. L., Williams, M., Wetherill, M., et al. (2019). A healthy retail intervention in native American convenience stores: The THRIVE community-based participatory Research study. *American Journal of Public Health*, 109(1), 132–139.

- Jernigan, V. B. B., Wetherill, M., Hearod, J., Jacob, T., Salvatore, A. L., Cannady, T., ... Wiley, A. (2017). Cardiovascular disease risk factors and health outcomes among American Indians in Oklahoma: The THRIVE study. *Journal of Racial and Ethnic Health Disparities*, 4(6), 1061–1068.
- Johns, D. J., Hartmann-Boyce, J., Jebb, S. A., Aveyard, P., & Group, B. W. M. R. (2014). Diet or exercise interventions vs combined behavioral weight management programs: A systematic review and meta-analysis of direct comparisons. *Journal of the Academy of Nutrition and Dietetics*, 114(10), 1557–1568.
- Jonikas, J. A., Cook, J. A., et al. (2015). Associations Between Gender and Obesity Among Adults with Mental Illnesses in a Community Health Screening Study. *Community Ment Health J.*, 52(4), 406–415.
- Kelly, T., Yang, W., Chen, C. S., Reynolds, K., & He, J. (2008). Global burden of obesity in 2005 and projections to 2030. *International Journal of Obesity*, 32(9), 1431–1437. <https://doi.org/10.1038/ijo.2008.102>
- Kersch, R. (2009). The politics of obesity: A current assessment and look ahead. *The Millbank Quarterly*, 87(1), 295–316.
- Kersh, R., & Monroe, J. (2002). The politics of obesity: Seven steps to government action. *Health Affairs*, 21(6). Retrieved April 30, 2020, from <https://www.healthaffairs.org/doi/full/10.1377/hlthaff.21.6.142>
- Lawrence, D., & Kisely, S. (2010). Inequalities in healthcare provision for people with severe mental illness. *Journal of Psychopharmacology* (Oxford, England). <https://doi.org/10.1177/1359786810382058>
- Lee, A. K., Warren, B., Liu, C., Foti, K., & Selvin, E. (2019). Number and characteristics of US adults meeting prediabetes criteria for diabetes prevention programs: NHANES 2007–2016. *Journal of General Internal Medicine*, 34(8), 1400–1402.
- Lifestyle Interventions for Expectant Moms. (n.d.). Welcome Page. Retrieved October 27, 2020, from <https://lifemoms.bsc.gwu.edu/>
- Llabre, M. M., Ard, J. D., Bennett, G., Brantley, P. J., Fiese, B., Gray, J., ... Wilfley, D. (2018). *Clinical practice guideline for multicomponent behavioral treatment of obesity and overweight in children and adolescents*. American Psychological Association. Retrieved April 30, 2020, from <https://www.apa.org/obesity-guideline/clinical-practice-guideline.pdf>
- Loring, B., & Robertson, A. (2014). *Obesity and inequities: Guidance for addressing inequities in overweight and obesity*. World Health Organization Regional Office for Europe. Retrieved April 30, 2020, from http://www.euro.who.int/__data/assets/pdf_file/0003/247638/obesity-090514.pdf

- Lundeen, E. A., Park, S., Pan, L., O'Toole, T., Matthews, K., Blanck, H. M. (2018). Obesity Prevalence Among Adults Living in Metropolitan and Nonmetropolitan Counties — United States, 2016. *MMWR Morb Mortal Wkly Rep*, 67, 653–658. <https://doi.org/10.15585/mmwr.mm6723a1externalicon>
- Lyn, R., Heath, E., & Dubhashi, J. (2019). Global implementation of obesity prevention policies: A review of progress, politics, and the path forward. *Current Obesity Reports*, 8(4), 504–516.
- Mackenbach, J. D., Rutter, H., Compernelle, S., Glonti, K., Oppert, J.-M., Charreire, H., ... Lakerveld, J. (2014). Obesogenic environments: A systematic review of the association between the physical environment and adult weight status: The SPOTLIGHT project. *BMC Public Health*, 14(233).
- Maffetone, P. B., & Laursen, P. B. (2020). *Revisiting the global overfat pandemic*, 8(51). Retrieved April 28, 2020 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7052125/>
- Malik, V. S., Willett, W. C., & Hu, F. B. (2013). Global obesity: Trends, risk factors and policy implications. *Nature Reviews Endocrinology*, 9(1), 13–27.
- McKinsey Global Institute. (2014). *Overcoming obesity: an initial economic analysis*. Retrieved April 27, 2020 from https://www.mckinsey.com/-/media/McKinsey/Business%20Functions/Economic%20Studies%20TEMP/Our%20Insights/How%20the%20world%20could%20better%20fight%20obesity/MGI_Overcoming_obesity_Full_report.ashx
- Metropolitan Life Insurance Company. (1942). New weight standards for men and women. *Statistical Bulletin—Metropolitan Life Insurance Company*, 23, 6–8.
- Micciole, R., Di Francesco, V., Fantin, F., Canal, L., Harris, T. B., Bosello, O., & Zamboni, M. (2010). Prevalence of overweight and obesity in Italy (2001-2008): Is there a rising obesity epidemic? *Annals of Epidemiology*, 20(4), 258–264. <https://doi.org/10.1016/j.annepidem.2010.01.006>
- Moller, D. E., & Kaufman, K. D. (2005). Metabolic syndrome: A clinical and molecular perspective. *Annual Review of Medicine*, 56(1), 45–62. <https://doi.org/10.1146/annurev.med.56.082103.104751>
- National Heart, Lung, and Blood Institute (NHLBI). (2015). *In brief: Your guide to lowering your blood pressure with DASH* (NIH publication no. 06–5834). Bethesda, MD.
- NHLBI. (2016). *What is metabolic syndrome?* Retrieved April 12, 2020 from <https://www.nhlbi.nih.gov/health/health-topics/topics/ms>
- Nuttall, F. Q. (2015). Body mass index, obesity, BMI, and health: A critical review. 50(3):117–128. Retrieved April 28, 2020 from https://journals.lww.com/nutritiontodayonline/Fulltext/2015/05000/Body_Mass_Index__Obesity,_BMI,_and_Health_A.5.aspx

- Obesity Medicine Association. (2020). *What is Obesity Medicine?* Retrieved October 27, 2020, from <https://obesitymedicine.org/>
- Ogden, C. L., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2012). Prevalence of obesity and trends in body mass index among US children and adolescents, 1999-2010. *JAMA*, *307*(5), 483-490.
- Ogden, C. L., Yanovski, S. Z., Carroll, M. D., & Flegal, K. M. (2007). The epidemiology of obesity. *Gastroenterology*, *132*, 2087-2102.
- Olker, S. J., Parrott, J. S., Swarbrick, M. A., & Spagnolo, A. B. (2016). Weight management interventions in adults with a serious mental illness: A meta-analytic review. *American Journal of Psychiatric Rehabilitation*, *19*(4), 370-393.
- Olsen, J. M., & Nesbitt, B. J. (2010). Health coaching to improve healthy lifestyle behaviors: An integrative review. *American Journal of Health Promotion*, *25*(1), e1-e12.
- Omran, A. R. (2005). The epidemiologic transition: A theory of the epidemiology of population change. *The Millbank Quarterly*, *83*(4), 731-757.
- Oulas, A., Minadakis, G., Zachariou, M., Sokratous, K., Bourdakou, M. M., & Spyrou, G. M. (2019). Systems bioinformatics: Increasing precision of computational diagnostics and therapeutics through network-based approaches. *Briefings in Bioinformatics*, *80*(3), 806-824.
- Park, Y., Kim, N. H., Kwon, T. Y., & Kim, S. G. (2018). A novel adiposity index as an integrated predictor of cardiometabolic disease morbidity and mortality. *Scientific Reports*, *8*(16753), 1-8. Retrieved April 28, 2020, from <https://www.nature.com/articles/s41598-018-35073-4.pdf>
- Patel, M. S., Asch, D. A., & Volpp, K. G. (2015). Wearable devices as facilitators, not drivers, of health behavior change. *JAMA*, *313*(5), 459-460.
- Peaceman, A. M., Clifton, R. G., Phelan, S., Gallagher, D., Evans, M., Redman, L. M., ... Cahill, A. G. (2018). Lifestyle interventions limit gestational weight gain in women with overweight or obesity: LIFE-moms prospective Meta-analysis. *Obesity*, *26*(9), 1396-1404. <https://doi.org/10.1002/oby.22250>
- Petersen, R., Pan, L., & Blanck, H. M. (2019). Racial and ethnic disparities in adult obesity in the United States: CDC's tracking to inform local and state action. *Preventing Chronic Disease: Public Health Research, Practice, & Policy*, *16*. Retrieved April 30, 2020, from https://www.cdc.gov/pcd/issues/2019/18_0579.htm
- Phelan, S., Nallari, M., Darroch, F. E., & Wing, R. R. (2009). What do physicians recommend to their overweight and obese patients. *The Journal of the American Board of Family Medicine*, *22*(2), 115-122.

- Puhl, R., & Brownell, K. D. (2001). Bias, discrimination, and obesity. *Obesity Research*, 9(788), 805.
- Punthakee, Z., Goldenberg, R., & Katz, P. (2018). Definition, classification and diagnosis of diabetes, prediabetes and metabolic syndrome. *Canadian Journal of Diabetes*, 42, S10–S15.
- Raynor, H. A., & Champagne, C. M. (2016). Position of the academy of nutrition and dietetics: Interventions for the treatment of overweight and obesity in adults. *Journal of the Academy of Nutrition and Dietetics*, 116(1), 129–147.
- Renner, R. (2019). Atlanta's Food Forest will provide fresh fruit, nuts, and herbs to forage. *City Lab*. Retrieved November 11, 2019 from <https://www.citylab.com/environment/2019/06/urban-food-forest-local-agriculture-atlanta-fresh-produce/590869/>
- Roberto, C. A., Swinburn, B., Hawkes, C., Huang, T. T. K., Costa, S. A., Ashe, M., ... Brownell, K. D. (2015). Patchy progress on obesity prevention: Emerging examples, entrenched barriers, and new thinking. *The Lancet*. Lancet Publishing Group. [https://doi.org/10.1016/S0140-6736\(14\)61744-X](https://doi.org/10.1016/S0140-6736(14)61744-X)
- Rogers, J. M., Ferrari, M., Mosely, K., Lang, C. P., & Brennan, L. (2017). Mindfulness-based interventions for adults who are overweight or obese: A meta-analysis of physical and psychological health outcomes. *Obesity Reviews*, 18(1), 51–67.
- Ross, R. K., Standish, M., Flores, G. R., Jhavar, M. K., Baxter, R. J., Solomon, L. S., ... Schwartz, P. M. (2010, November 1). Community approaches to preventing obesity in California. *American Journal of Public Health*, 100(11), 2023–2025. <https://doi.org/10.2105/AJPH.2010.198820>
- Roth, C., Foraker, R. E., Payne, P. R., & Embi, P. J. (2014). Community-level determinants of obesity: Harnessing the power of electronic health records for retrospective data analysis. *BMC Medical Informatics and Decision Making*, 14(36) Retrieved April 29, 2020, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4024096/>
- Sallis, J. F., Owen, N., & Fisher, E. B. (2008). Ecological models of health behavior. In Glanz et al. (Eds.), *Health Behavior and Health Education*. San Francisco, CA: Wiley and Sons.
- Samuels, S. E., Craypo, L., Boyle, M., Crawford, P. B., Yancey, A., & Flores, G. (2010). The California Endowment's healthy eating, active communities program: A midpoint review. *American Journal of Public Health*, 100(11), 2114–2123.
- Sassi, F., Devaux, M., Cecchini, M., & Rusticelli, E. (2009). The obesity epidemic: Analysis of past and projected future trends in selected OECD countries. *OECD Health Working Papers*, 45, 1–81.

- Schwarte, L., Samuels, S. E., Capitman, J., Ruwe, M., Boyle, M., & Flores, G. (2010). The Central California regional obesity prevention program: Changing nutrition and physical activity environments in California's heartland. *American Journal of Public Health, 100*(11), 2124–2128.
- Schwartz, H. (1986). *Never satisfied: A cultural history of diets, fantasies, and fat*. New York, NY: The Free Press.
- Schwartz, P. M., Kelly, C., Cheadle, A., Pulver, A., & Solomon, L. (2018). The Kaiser Permanente Community health initiative: A decade of implementing and evaluating community change. *American Journal of Preventive Medicine, 54*(5 S2), S105–S109.
- Schwingshackl, L., & Hoffmann, G. (2015). Diet quality as assessed by the healthy eating index, the alternate healthy eating index, the dietary approaches to stop hypertension score, and health outcomes: A systematic review and meta-analysis of cohort studies. *Journal of the Academy of Nutrition and Dietetics, 115*(5), 780–800.
- Schwingshackl, L., Missbach, B., Dias, S., König, J., & Hoffmann, G. (2014). Impact of different training modalities on glycaemia control and blood lipids in patients with type 2 diabetes: A systematic review and network meta-analysis. *Systems Reviews, 3*, 130.
- Sciamanna, C. N., Tate, D. F., Lang, W., & Wing, R. R. (2000). Who reports receiving advice to lose weight: Results from a multistate survey. *Archives of Internal Medicine, 160*(15), 2334–2339.
- Science X: Phys.org. (2013). *Mapping food deserts*. Retrieved April 30, 2020, from <https://phys.org/news/2011-03-food.html>
- Seidell, J. C., & Halberstadt, J. (2015). The global burden of obesity and the challenges of prevention. *Annals of Nutrition and Metabolism, 66*, 7–12. <https://doi.org/10.1159/000375143>
- Shipan, C. R., & Volden, C. (2008). The mechanisms of policy diffusion. *American Journal of Political Science, 52*(4), 840–857.
- Sicat, J. (2018). Defining Obesity's interplay among environment, behavior, and genetics. *Obesity Medicine*. Retrieved April 27, 2020, from <https://obesity-medicine.org/obesity-and-genetics/>
- Spear, B. A., Barlow, S. E., Ervin, C., Ludwig, D. S., Saelens, B. E., Schetzina, K. E., & Taveras, E. M. (2007). Recommendations for treatment of child and Adolescent overweight and obesity. *Pediatrics, 120*(S4), S254–S288.
- Templin, T., Hashiguchi, T. C. O., Thomson, B., Dieleman, J., & Bendavid, E. (2019). The overweight and obesity transition from the wealthy to the poor in low- and middle-income countries: A survey of household data from 103 countries. *PLoS Medicine*. Retrieved April 30, 2020, from <https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1002968>

- The Community Guide (2017). *What works: Obesity prevention and control*. Retrieved from: <https://www.thecommunityguide.org/sites/default/files/assets/What-Works-Factsheet-Obesity.pdf>
- U.S. C.D.C. (2015). National Center for Health Statistics. *Health, United States, 2015, Table 58*. National Health and Nutrition Examination Survey. <https://www.cdc.gov/nchs/data/hus/2015/058.pdf>. Accessed 22 Apr 2020.
- U.S. C.D.C. (2017a). *Health equity resource toolkit for state practitioners addressing obesity disparities*. <https://www.cdc.gov/nccdphp/dnpao/state-local-programs/health-equity/pdf/toolkit.pdf>
- U.S. C.D.C. (2017b). *CDC's childhood obesity research demonstration (CORD) project 2.0*. Centers for Disease Control and Prevention, April 1, 2017. <https://www.cdc.gov/obesity/strategies/healthcare/cord2.html>. Accessed 23 Apr 2020.
- U.S. C.D.C. (2018). *Overweight & obesity*. CDC, April 2018. <https://www.cdc.gov/obesity/>
- U.S. C.D.C. (2019, October 23). *Strategies to prevent and manage obesity*. Retrieved April 28, 2020 from <https://www.cdc.gov/obesity/strategies/index.html>
- U.S. C.D.C. (2020). *Healthy weight: The health effects of overweight and obesity*. Retrieved April 27, 2020, from <https://www.cdc.gov/healthyweight/effects/index.html>
- U.S. C.D.C. (n.d.). *Data & statistics | Overweight & obesity*. Retrieved January 15, 2020, from <https://www.cdc.gov/obesity/data/index.html>
- U.S. Department of Agriculture and U.S. Department of Health and Human Services. (1985). *Nutrition and your health: Dietary guidelines for Americans*. Home and garden bulletin no. 232, US Government Printing Office, Washington, DC.
- U.S. Food and Drug Administration (F.D.A.). (2020). *Menu labeling requirements*. Retrieved April 30, 2020, from <https://www.fda.gov/food/food-labeling-nutrition/menu-labeling-requirements>
- U.S.D.A. Economic Research Service. (2019). *Food environment atlas*. Retrieved April 14, 2020, from <https://www.ers.usda.gov/data-products/food-environment-atlas/go-to-the-atlas/>
- Vitaliano, P. P., Yi, J., Phillips, P. E. M., Echeverria, D., Young, H., & Siegler, I. C. (2005). Psychophysiological mediators of caregiver stress and differential cognitive decline. *Psychology and Aging*, 20(3), 402–411. <https://doi.org/10.1037/0882-7974.20.3.402>

- W.H.O. (2018). *Obesity and overweight: Fact sheet world health organization*, Geneva, Switzerland. Retrieved April 12, 2020 from <http://www.who.int/mediacentre/factsheets/fs311/cn/>
- W.H.O. | Controlling the global obesity epidemic. (n.d.). Retrieved January 15, 2020, from <https://www.who.int/nutrition/topics/obesity/en/>
- W.H.O. Expert Consultation. (2004). Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *The Lancet*, 363(9403), 157–163.
- Weigley, E. S. (1984). Average? ideal? desirable? A brief of overview of height-weight tables in the United States. *Journal of the American Dietetic Association*, 84(4), 417–423.
- Wing, R. R., Lang, W., Wadden, T. A., Safford, M., Knowler, W. C., Bertoni, A. G., ... Look AHEAD Research Group. (2011). Benefits of modest weight loss in improving cardiovascular risk factors in overweight and obese individuals with type 2 diabetes. *Diabetes Care*, 34(7), 1481–1486.
- Woodcock, J., Franco, O. H., Orsini, N., & Roberts, I. (2011). Non-vigorous physical activity and all-cause mortality: Systematic review and meta-analysis of cohort studies. *International Journal of Epidemiology*, 40(1), 121–138.
- World Food Programme. (2015). *Indonesia-food security and vulnerability atlas 2015*. Retrieved April 19, 2020, from <https://www.wfp.org/publications/indonesia-food-security-and-vulnerability-atlas-2015>.
- World Health Organization. (2020a). *Health topics: Obesity*. Retrieved April 27, 2020, from <https://www.who.int/topics/obesity/en/>
- World Health Organization (WHO). (2020b). *Health topics fact sheets: Overweight and obesity*. Retrieved April 27, 2020, from <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>
- World Health Organization. (2020c). *Facts in Pictures*. Retrieved October 27, 2020, from <https://www.who.int/news-room/facts-in-pictures/detail/6-facts-on-obesity>
- Zimmet, P., Magliano, D., Matsuzawa, Y., Alberti, G., & Shaw, J. (2005). The metabolic syndrome: A global public health problem and a new definition. *Journal of Atherosclerosis and Thrombosis*, 12(6), 295–300.
- Zukiewicz-Sobczak, W., Wróblewska, P., Zwolinski, J., Chmielewska-Badora, J., Adamczuk, P., Krasowska, E., ... Silny, W. (2014). Obesity and poverty paradox in developed countries. *Annals of Agricultural and Environmental Medicine*, 21(3), 590–594.