9 Race/Ethnic and Socioeconomic Disparities in Obesity

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Introduction

Race/ethnic and socioeconomic status (SES) disparities in obesity have important implications for the health and wellbeing of the U.S. population. Obesity is associated with adverse outcomes including discrimination in the workplace and health care settings, elevated levels of disability and morbidity, reduced earnings, increased risks of death, and limited access to health care. Thus, efforts to close race/ethnic and SES disparities in obesity may reduce disparities in other important outcomes. Our chapter describes current disparities in obesity, reviews evidence about the mechanisms that likely give rise to disparities in obesity, and considers the major policy and intervention frameworks that may support efforts to shift disparities in obesity in the U.S. population.

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Surveillance and Measurement

Disparities

Race/ethnic and SES disparities in obesity are substantial. Among adults in 2017–2018, 42% of non-Hispanic whites were obese (BMI $\geq$ 30.0), compared to 50% of non-Hispanic blacks, 45% of Hispanics, and just 17% of non-Hispanic Asians (Hales et al., 2020). Although the prevalence of obesity is lower among Asians than among other race/ethnic groups, evidence suggests that Asian subpopulations may experience health risks at a lower BMI than other race/ethnic groups (Jih et al., 2014). Among children in 2017–2018, 16% of non-Hispanic whites were obese (BMI $\geq$ 95th percentile on growth charts), compared to 24% of non-Hispanic blacks, 26% of Hispanics, and 9% of Asians (Fryar et al., 2020). Important disparities by SES are also present. The prevalence of obesity is 12 percentage points lower among those who have a college degree than among those who have a high school degree or less education, and is 8 percentage points lower among those who are >350% of the federal poverty line than among those who are $\leq$130% of the federal poverty line (Ogden et al., 2018).

Notably, growth in the burden of obesity is not shared equally by all. Demographic and epidemiologic research finds increasing obesity across most groups in the U.S. in recent decades, with the fastest increases among blacks and Mexican

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Americans, and slower increases among Asians of Indian descent, immigrants, and those with higher income or education (Ford et al., 2011; Krueger et al., 2014; Ogden et al., 2018). Drawing on age-period-cohort models, demographers find that birth cohorts play a central role in driving the increases in obesity over time (Masters et al., 2013; Reither et al., 2009; Yang et al., 2021). Within cohorts, blacks tend to have higher body masses than whites, in addition to persistent disadvantages across age groups. Body mass also increases across birth cohorts for all education groups. These findings emphasize that cohorts may be more important than period effects for driving disparities in our population, suggesting the need to identify the early life factors that drive obesity.

Self-Reports Versus Objective Measures

Demographers rely on population samples to study obesity, and some of those samples rely on self-reported heights and weights (the measures used to calculate body mass and obesity). However, self-reported heights and weights may be biased due to social desirability, lack of knowledge, or rounding errors. Individuals tend to report taller heights and lower weights than observed with objective measures, leading to under-estimates of obesity (Gorber et al., 2007). One study finds that only 57% of adults who are underweight (i.e., BMI < 18.5), based on objectively measured heights and weights, are classified as underweight when using self-reported heights and weights. Similarly, only 72% of those who are extremely obese (i.e., BMI > 40), based on objective measures, fall into that same group when relying on self-reported heights and weights (Stommel & Schoenborn, 2009).

The accuracy of self-reported heights and weights varies across race/ethnic groups and by SES, potentially confounding efforts to understand the magnitude, determinants, or consequences of disparities in body mass that are measured from self-reports. Among adults, blacks and some Hispanic groups tend to overestimate their self-reported heights relative to whites, and those with college degrees tend to underestimate their weight relative to those with less than a high school education (Stommel & Schoenborn, 2009). These differences do not always translate into significant differences in average body masses from objectively measured and self-reported measures, although college-educated individuals do have significantly lower body masses when using self-reported heights and weights rather than objective measures (Stommel & Schoenborn, 2009). Among adolescents, correlations between observed and self-reported heights, weights, and body masses range from 0.79 to 0.95, and the correlation between self-reported and observed body masses is significantly smaller for blacks than for whites (Strauss, 1999). Notably, errors in self-reported measures and observed measures appear constant across time for all race/ethnic groups (Hattori & Sturm, 2013).

Although understanding the impact of misreported heights and weights on mean levels of body mass is important, errors in self-reports may have a larger impact on understanding disparities at either end of the body mass distribution. This is especially problematic given that race/ethnic differences in average body mass understate the vast over-representation of blacks and Native Americans among the most obese, and Asian Americans among the underweight (Denney et al., 2004). To our knowledge, no comparable work has examined whether the shape of the body mass distribution differs across levels of SES, suggesting a direction for future research. For example, lower SES individuals may have divergent experiences and be concentrated at the tails of the body mass distribution (e.g., very obese and underweight), whereas lower SES individuals may be more likely to gravitate to the normal weight or overweight points in body mass distribution.

Population surveys increasingly include objective measures of height and weight (e.g., National Health and Nutrition Examination Survey, National Longitudinal Study of Adolescent Health, Health, and Retirement Study). Measured heights and weights may be especially important during adolescence and at older ages, when body mass can change rapidly, with important implications for race/ethnic and SES disparities.

Incidence and Prevalence

Most research on obesity focuses on prevalence—the obesity status of individuals at the time of measurement. Prevalence measures are useful for describing race/ethnic or socioeconomic disparities in body mass at a given moment in time, or for tracking disparities over time. Fewer studies examine rates of new cases of obesity, or rates of recovery from obesity. Demographers, however, have methodological tools for examining rates of incidence and recovery (e.g., survival models) and the time spent in specific states (e.g., life tables). These tools are useful for identifying factors that are associated with transitions to higher or lower body masses in the population, and to understand which groups are likely to spend more or less time at specific body masses.

A handful of studies show that the incidence of obesity is higher among black and Hispanic children than among whites, and is higher among children in lower income families than in higher-income families (Cunningham et al., 2014; Gordon-Larsen et al., 2004; Strauss & Knight, 1999; Tran et al., 2016). Further, among children, transitions from obese or overweight statuses to normal weight are relatively common (Gordon-Larsen et al., 2004; Tran et al., 2016). Multistate life tables show that children who are obese at age 3 can expect to live 3.1 of the next 13 years in the normal weight status if they are white, 1.9 years in the normal weight status if they are Asian, 1.4 years in the normal weight status if they are black, and just 0.9 years in the normal weight status if they are Hispanic (Tran et al., 2016). Blacks and Hispanics are especially unlikely, relative to whites or Asians, to transition to lower body masses throughout childhood.

Studies of incidence and recovery require longitudinal data with repeated measures of height and weight ideally focused at stages of the life course (e.g., childhood, old age) where body masses may change frequently. Studies like these could allow us to advance research on body mass disparities in several ways. First, researchers could examine how often individuals in the population lose weight, in the absence of major interventions, and how that weight loss varies across race/ethnic and SES groups. Second, researchers could examine whether the factors that drive disparities in new cases of obesity differ from the factors that drive disparities in recovery to lower body masses. Third, researchers could examine the duration of time spent in normal weight, overweight, or obese statuses over some span of time, allowing them to consider the impact of cumulative exposures to a given body mass status to health outcomes among race/ethnic and SES groups.

Mechanisms

Numerous studies have examined the mechanisms that drive race/ethnic and SES disparities in obesity. We review studies that consider the behavioral, biological, neighborhood, and social mechanisms that could plausibly have population-level impacts. The diversity of mechanisms considered reflects the failure of simple behavioral interventions to reverse the tide of the obesity pandemic, and the breadth of factors that give rise to disparities in obesity. Throughout, we note areas where additional research might advance the literature.

Behaviors

Diet and Physical Activity Diet (caloric intake) and physical activity (energy output) together create energy balance—when caloric intake exceeds energy output, then individuals gain weight. Current trends in caloric intake and physical activity suggest that the prevalence of obesity will increase in the future, and racial and SES disparities will continue to widen (Basu et al., 2014). Modest changes in caloric intake and physical activity could reduce the prevalence of obesity in the coming decades, but those changes would have to be larger among non-whites and low-SES groups to close those disparities. For example, even if blacks reduced their caloric intake by over 500-kilocalories per day, black-white disparities in obesity would persist into the future, due to metabolic constraints in how fast individuals can lose weight. Further, individuals with lower SES would need to reduce caloric intake by 72 kilocalories per day, or increase physical activity by 14 minutes per day, to achieve the same prevalence of obesity as the middle-income population (Basu et al., 2014).

The consumption of calorically dense foods varies across race/ethnic and SES groups, and may partially explain disparities in obesity. For example, the frequency of eating fast food is higher among blacks than among whites, and among those with 12 years of schooling than among those with college degrees (Kant et al., 2015). Similarly, the consumption of sugar-sweetened beverages is higher among black, Mexican American, and non-Mexican Hispanic populations than among whites, and higher among those with less education or income than among those with higher SES (Bleich et al., 2018; Han & Powell, 2013). Low water consumption is associated with higher consumption of sugar-sweetened beverages (Rosinger et al., 2019). Remarkably, one-fifth of the U.S. population reports no water consumption on a given day. Tap water consumption is lower among blacks and Hispanics relative to whites, and among those with less education than among those with more education (Rosinger et al., 2018).

Overall diet quality also varies across race/ethnic and SES groups. Compared to white children, Hispanic children are more likely to eat greens, beans, seafood, and plant proteins, whereas black children are less likely to eat whole fruits or dairy (Thomson et al., 2018). Among adults, poor quality diets (based on standards from the American Heart Association) are more common among blacks and Hispanics, relative to whites, and among less educated adults compared to those with more education (Rehm et al., 2016).

Research on Mexican immigrants to the U.S. shows that diet quality decreases with each successive generation in the U.S. Notably, a decline in diet quality is greatest among migrants from low-SES backgrounds, which is consistent with segmented assimilation theory (Martin et al., 2015). Further, higher levels of linguistic acculturation (e.g., being more fluent in English and speaking English in more contexts) among migrants are associated with lower consumption of fruits and vegetables (Creighton et al., 2012). Although concepts including acculturation and assimilation have been criticized due to poor conceptualization and measurement, more rigorous approaches drawn from anthropology might more directly measure how norms, values, and beliefs change in diverse ways as immigrants spend time in the U.S. (Broesch & Hadley, 2012).

Food insecurity—wherein households have limited or uncertain access to healthy foods—may also partially account for disparities in obesity. Households that are food insecure may look for foods that are affordable, calorically dense, and comforting; unfortunately, that results in poorer quality diets. Some research finds that lower income food insecure adults consumed lower quality diets compared with their lower income food secure counterparts (Leung et al., 2014), suggesting that food insecurity is associated with poorer diets independent of poverty. However, other research finds that food insecurity is not associated with poorer diets or overweight among children, after adjusting for poverty (Bhattacharya et al., 2004). When focusing on race/ethnic disparities, research shows that food insecurity is associated with poorer quality diets among non-Hispanic whites and Asians, but not among blacks or Hispanics (Leung & Tester, 2019). Looking across studies, food insecurity is important in its own right, but its role in driving disparities in obesity is unclear.

Physical activity has declined over time in the U.S., and those declines are associated with increasing obesity (Church et al., 2011). Disparities in leisure-time, work-related, and active transportation-related physical activity may help to explain race/ethnic and SES disparities in obesity. Education is positively associated with leisure-time physical activity and negatively associated with work-related physical activity (Scholes & Bann, 2018). Adults with less than a high school degree are most likely to engage in active transportation-related physical activity. Further, whites have higher levels of both leisure-time and work-related physical activity compared to blacks and Hispanics, but blacks and Hispanics have higher levels of active transportation-related physical activity (Scholes & Bann, 2018). Adolescents show similar patterns; non-Hispanic whites are most likely to meet recommendations for physical activity, followed by Hispanics, non-Hispanic blacks, and Asians (Katzmarzyk et al., 2017).

Disparities in types of sports pursued may also help to explain race/ethnic and SES disparities in physical activity. More educated adults are more likely to undertake all types of leisure-time physical activity, including team sports (e.g., basketball, soccer), fitness activities (e.g., running, weight lifting), and activities that typically require specialized facilities (e.g., swimming, golf) (Saint Onge & Krueger, 2011). Compared to whites, blacks and Mexican Americans are more likely to engage in team and fitness sports, and those disparities widen with education. Disparities in types of physical activity may matter for obesity across the life course because participation in team-based sports and some fitness activities may be more difficult to maintain at the older ages when injuries and declines in cardiovascular function may be more common (Saint Onge & Krueger, 2011). Physical activity in childhood and adolescence, including participation in sports, is predictive of physical activity in early adulthood. This is vexing given that children from lower SES backgrounds are less likely to engage in sports after school than children from wealthier backgrounds, presaging future disparities in obesity (Turner et al., 2015).

Sleep Duration Short sleep duration may be linked to obesity through several pathways. First, experimental studies find that short sleep duration is associated with hormonal dysregulation, including decreases in leptin (a hormone that reduces appetite) and increases in ghrelin (a hormone that stimulates appetite) (Omisade et al., 2010; Spiegel et al., 2004). Second and relatedly, short sleep is associated with snacking more frequently and preferences for foods with more saturated fats and sugar, and less protein (Al Khatib et al., 2017). Finally, short sleep may leave individuals too fatigued to engage in physical activity, although evidence for this mechanism remains mixed (Al Khatib et al., 2017).

Short sleep and sleep disturbances vary across race/ethnicity and SES. Among adults, sleep durations of less than 6 h per night are more common among blacks, Mexican Americans, other Hispanics, and Chinese Americans than among whites (Chen et al., 2015; Krueger & Friedman, 2009). Among adolescents, more black and Asian girls sleep less than 7 h per night (compared to white girls), and more black, Hispanic, and Asian boys sleep less than 7 h (compared to white boys) (Reither et al., 2014). Evidence also shows that exposure to discrimination is associated with sleep disturbances, sleepiness, and difficulty falling asleep (Yip et al., 2020). Higher levels of education and income are associated with higher odds of sleeping 7–8 h per night, whereas lower education and income are associated with higher odds of sleeping 6 or fewer hours or 9 or more hours per night (Basner & Dinges, 2018; Krueger & Friedman, 2009). Long work hours are also associated with shorter sleep durations (Krueger & Friedman, 2009).

Evidence that sleep duration mediates race/ethnic disparities in obesity and related outcomes is uneven. Narcisse et al. (2018) demonstrate that trouble falling asleep, trouble staying asleep, and short sleep duration each explained between 1% and 16% of the association between food insecurity and obesity among whites, Hispanics, Asians, and Native Hawaiian-Pacific Islanders. Other studies, however, have found no evidence that sleep duration mediates race/ethnic disparities in obesity (Piccolo et al., 2013; Reither et al., 2014). Although theory suggests that sleep should mediate the association between SES and obesity (Van Cauter et al., 1999), empirical tests are lacking. Using longitudinal data to test whether sleep duration or sleep quality explains SES disparities in obesity could advance our understanding of the origins of disparate obesity outcomes.

Some evidence shows that the association between sleep duration and BMI varies by race/ethnicity. Data from adolescents and adults show that the association between short sleep and weight gain (Spaeth et al., 2013) or obesity (Jean-Louis et al., 2015; Reither et al., 2014) is stronger among blacks than among whites. When focusing on Hispanic subgroups, some research finds that sleep is inversely associated with body mass among Mexican Americans, but not among Cuban Americans or Puerto Ricans (Knutson, 2011). In conclusion, improved sleep quality and quantity may help to reduce obesity, but the benefits vary across groups.

Screen Time and Sedentary Behaviors - Sedentary behavior—including sitting, watching television or other electronic devices, and driving—is associated with obesity independently of the frequency of physical activity (Kim et al., 2016). Even individuals who are very active spend substantial time in sedentary activities throughout the day. Three mechanisms might link sedentary activity to obesity. First, sedentary behavior leads to metabolic dysfunction, resulting in increased total cholesterol, triglycerides, and insulin resistance (Hamburg et al., 2007). Second, sedentary behavior and screen time allows individuals an opportunity to snack and diminishes recognition of satiety. Specifically, both adults and children tend to eat fewer fruits and vegetables, and consume more calorically dense snacks, beverages, and fast foods, when engaging in screen time (Pearson & Biddle, 2011). Third, screen time can displace time spent on sleep and physical activity (Chahal et al., 2013), behaviors that can protect against obesity. As a result, evidence demonstrates that more frequent sedentary activity is associated with increased body mass and prospective weight gain (Mun et al., 2018).

Notable disparities in screen time or other sedentary activities have been observed. Children who are non-white and from lower income families tend to have more screen time than children who are white or from wealthier families, based on parent reports (Haughton et al., 2016; Tandon et al., 2012). However, those disparities disappear when using accelerometer-derived time in sedentary activities (Carson & Kuzik, 2017). Among adults, accelerometer data shows that income is associated with higher levels of moderate and vigorous activity, but also more time spent in sedentary activities (Shuval et al., 2017). These patterns suggest that sedentary behaviors may help to explain disparities in body mass, although drawing on objective measures of activity, and adjusting for time spent in moderate or vigorous activity, may be essential for future research.

Smoking Cigarette smoking is associated with obesity, and may play a role in shaping disparities in obesity. Smoking can reduce appetite, and smokers often note concerns about weight gain as a barrier to quitting smoking. Smoking is associated with obesity for several reasons (Audrain-McGovern & Benowitz, 2011). First, smoking activates neurological pathways that reduce appetite (Mineur et al., 2011). Second, smoking can increase the activity of enzymes in adipose tissue which can lead to reduced body weight (Carney & Goldberg, 1984). Third, smoking cessation can lead to an increase in snacking as a means of coping with withdrawal (Audrain-McGovern & Benowitz, 2011). Finally, smoking is associated with insulin resistance and central fat accumulation (Houston et al., 2006; Shimokata et al., 1989). As a result, current smokers are often less likely to be obese than never smokers and former smokers are more likely to be obese than never smokers (Audrain-McGovern & Benowitz, 2011). Over time, however, the lifetime consumption of cigarettes is positively associated with body mass among both current and former smokers (Dare et al., 2015).

Substantial racial/ethnic and socioeconomic disparities are present in smoking behavior. Those who have less education and lower incomes have higher rates of smoking in the U.S. (Pampel et al., 2010). Youth smoking is highest among American Indians, followed by whites, while Hispanics, blacks, and Asians have the lowest rates of current smoking. Among adults, a striking 42% of American Indians are current smokers, followed by whites and blacks at 37%, Hispanics at 23%, and Asians at 15% (Garrett et al., 2011). Some research, however, shows that smoking and obesity are especially likely to co-occur among blacks relative to whites, as well as among the less educated and those with lower family incomes (Healton et al., 2006), suggesting that smoking and obesity may be elements of a shared lifestyle. We are not aware of longitudinal studies that specifically examine whether smoking mediates race/ethnic or SES disparities in obesity. Efforts to understand the role of smoking for disparities in obesity are especially pressing, given the joint contributions of obesity and smoking to survival and other health outcomes.

Maternal smoking may also shape disparities in obesity. Maternal smoking is associated with the development of pediatric obesity. Although maternal smoking is associated with low birthweight, those low birthweight infants tend to experience faster gains in weight than normal weight infants and are more likely to become obese in childhood (Ino, 2010). Hispanic and black children are more often exposed to maternal smoking than are whites, although those differences are reduced after adjusting for SES (Taveras et al., 2010). As such, maternal smoking may play a larger role in explaining SES disparities in child obesity than in accounting for race/ethnic disparities.

Breastfeeding Breastfeeding may be an important factor in obesity prevention for both the mother and baby. Breastfeeding may help infants to regulate caloric intake and provide infants with nutrients and bioactive factors that affect their growth (Bartok & Ventura, 2009). Less than half of infants are breastfed for the first 6 months of life, and Healthy People 2020 set goals to increase the share of infants that are breastfed at 6 months and 1 year of age (U.S. Department of Health and Human Services, 2013). Indeed, the percentage of infants who are breastfed for at least 6 months is lower among blacks and Hispanics than among whites, and is lower among those with a high school degree or less than among those with some college or a college degree (Xiang et al., 2019), suggesting that encouraging breastfeeding and reducing barriers to breastfeeding may help to reduce disparities in obesity (Thompson & Bentley, 2013).

Breastfeeding is also associated with maternal obesity. Some studies suggest that exclusive breastfeeding, especially for longer durations, may be associated with weight loss among postpartum women (Neville et al., 2014). Breastfeeding, however, varies across SES and race/ethnicity. Higher levels of maternal and paternal education are associated with higher odds of mothers ever breastfeeding. Further, mothers who are white or foreign-born Latinas have among the highest odds of ever breastfeeding, whereas blacks, Asians, and U.S.-born Latinas have among the lowest odds of ever breastfeeding (Heck et al., 2006; Louis-Jacques et al., 2017). Interventions aimed at increasing breastfeeding in an effort to increase postpartum weight loss show mixed results. One study in Belarus was able to increase exclusive breastfeeding via hospital-based behavior interventions, but found no effect on postpartum weight loss (Kramer et al., 2009). A second study used a cell phone app to encourage breastfeeding among low income women in the U.S., but the app did not successfully increase breastfeeding (Lewkowitz et al., 2020). Efforts to design interventions that promote breastfeeding in diverse U.S. populations are crucial for testing the effect of breastfeeding on postpartum weight loss.

Biological Factors

Developmental Origins of Health and Disease The developmental origins of health and disease perspective emphasizes that prenatal and postnatal environments can impact birth characteristics and subsequent disease risk throughout the life course. Both observational studies of humans and experimental studies of animal models find that prenatal and perinatal exposures to poor nutrition or inadequate calories can result in physiologic changes that are adaptive to low-nutrition environments, but that may lead to subsequent increased likelihood of diabetes, hypertension, and obesity (Gluckman & Hanson, 2004). Among humans, maternal obesity, gestational weight gain, poor nutrition, and excessive nutrition are associated with subsequent child obesity via the intrauterine environment (Dabelea & Crume, 2011; Perng et al., 2019), by altering fetal metabolism, hormone production, or sensitivity to those hormones. In turn, those changes shape fetal organ development and subsequent metabolic set points (Gluckman et al., 2008).

We are aware of only one study that examines whether maternal obesity explains race/ethnic disparities in children's obesity. The researchers found that parental body mass explains almost 40% of the black/white gap in children's body mass, and almost 20% of the Hispanic/white gap in children's body mass (Taveras et al., 2013). We are not aware of any studies that examine whether maternal body mass explains SES disparities in child obesity, suggesting a useful direction for future research.

The developmental origins of health and disease perspective also suggest that prenatal environments can drive epigenetic changes that shape race/ethnic and SES disparities in obesity. Epigenetic changes can change gene activity, and can sometimes be passed from one generation to the next, but do not change the structure of DNA itself. For example, paternal obesity has been associated with hypo-methylation of the insulin-like growth factor gene (IGF2) among newborns (Soubry et al., 2013), which has been associated with obesity in children (Ács et al., 2017).

Race/ethnicity and SES may be linked to sets of exposures during developmental stages when epigenetic changes are most likely to occur. Race/ethnic minorities experience historical processes, prejudice, and discrimination that may result in epigenetic changes (Osborne-Majnik et al., 2013). Further, SES might directly impact access to resources like food. Some research shows that having a black father or a less educated mother is associated with epigenetic changes (as observed in umbilical cord blood) that are associated with low birth weight, which is linked to subsequent cardiovascular disease, diabetes, and obesity (King et al., 2015).

Genetics A large body of literature suggests that individuals are genetically predisposed to obesity. Heritability estimates show that genetic factors account for 72% of the variability in obesity among twins and 46% of the variability in obesity among families (Stryjecki et al., 2018). This provides support for the heritable nature of obesity. However, genetic factors may do little to explain race/ethnic differences in obesity. Heritability estimates do not vary across families from different ethnic backgrounds (Stryjecki et al., 2018). Further, most published twin studies have been conducted in predominantly white populations, and provide little insight into understanding the contribution of genetics to race/ethnic disparities in obesity (Harden & Koellinger, 2020).

Genome-wide association studies (GWAS) have demonstrated that obesity is heritable in more diverse populations (Domingue et al., 2014). However, genetic factors are weakly associated with observed race/ethnicity or education, suggesting that they may be poorly poised to explain disparities across groups (Harden & Koellinger, 2020). As a result, genetic factors likely have little power to explain race/ethnic or educational disparities in obesity (Boardman et al., 2010; Boardman et al., 2015).

The thrifty gene hypothesis suggests that genetic differences may predispose some race/ethnic groups differentially to obesity, given ancestral environments that are selected for those genes (Locke et al., 2015). For example, one GWAS in an isolated population of 3072 Samoans found a genetic variant that is unique to this population, predisposing them to obesity (Minster et al., 2016). When expressed, this gene plays a role in decreasing energy use and increasing fat storage. When looking across race/ethnic groups, however, the thrifty-gene hypothesis receives little support. One large study finds little support for the positive selection of single-nucleotide polymorphisms (SNPs) that are associated with obesity, and of the few that were found, five favored leanness rather than obesity (Wang & Speakman, 2016). Further, most of these mutations had occurred prior to the last 30,000 years, suggesting that they did not take place in the context of more recent shifts in agriculture or food systems. Genetic variation may contribute to obesity risk, but in diverse populations, it may do little to account for disparities in obesity.

Neighborhood Context

Neighborhoods are often the places where individuals eat at restaurants, go grocery shopping, exercise, sleep, and experience pollution—all of which may shape obesity risk (also see Chap. 13). Neighborhoods are also segregated by race/ethnicity and SES, suggesting that they may impact disparities in obesity.

Neighborhoods and Food A food desert refers to a low-income neighborhood where a large number of residents have poor access to healthy foods, based on distance from supermarkets, supercenters, or large grocery stores. The food desert literature assumes that people will purchase and consume healthy foods (e.g., fruits, vegetables, and whole grains) if they are available. However, the literature on food deserts and obesity is mixed.

In a nationally representative survey of adults in the U.S., living in a food desert was positively associated with obesity (Testa & Jackson, 2019). Other studies find a null relationship between obesity and food deserts (Cummins et al., 2014). A recent quasi-experimental study shows that opening a grocery store in a food desert leads to few dietary changes and may, in fact, increase the consumption of less healthy foods (Campbell et al., 2020). When stratified by race and ethnicity, one study finds that whites living in food deserts are more likely to be obese than blacks, even though African Americans are more likely to reside in food deserts (Walker et al., 2010). In contrast, a study on African American women with low food access shows that those living in high-poverty neighborhoods are more likely to be obese compared to their counterparts in low-poverty neighborhoods (Gailey & Bruckner, 2019).

Food swamps are neighborhoods with substantial access to unhealthy food options (Fleischhacker et al., 2011). Some research suggests that a lack of access to healthy food may have less impact on obesity than an abundance of unhealthy options (Cooksey-Stowers et al., 2017). For example, minorities and low-income communities are disproportionately targeted by advertising for fast food, snack foods, and sugary beverages (Cassady et al., 2015; Nguyen et al., 2020). Further, communities where the gap between black and white earnings is greatest have relatively more fast food access than grocery store access (Bell et al., 2019). Future research that draws on a more complete inventory of food environments—including food swamps, food deserts, access to food from personal gardens or hunting, or food sold in retail outlets that primarily sell non-food items (e.g., pharmacies)—could clarify the diverse food resources available to broad segments of the population. That research could, in turn, clarify the role of community food access and disparities in obesity.

Neighborhoods and Physical Activity Neighborhoods also offer residents different opportunities to engage in physical activity. Neighborhoods that have access to parks, green spaces, trails, or that are more walkable, are associated with greater physical activity among residents (Smith et al., 2017), and lower levels of obesity (Lee et al., 2019a). But those benefits are not shared equally. Some evidence shows that parks in high-poverty areas are utilized less than parks in more affluent areas (Park et al., 2018). Other research shows that Latinos are more likely to use neighborhood trails for walking or jogging than whites, and those with less education use fewer areas of the trail than do those who are more educated (Kraft et al., 2018). A full test of whether the physical amenities can explain disparities is limited. One example finds that amenities do little to explain race/ethnic or SES disparities. The association between amenities and obesity is stronger among low income than among high income children, but only in rural areas, and the association between amenities and obesity is weaker among Hispanic children than among whites in both urban and rural areas (Uzochukwu, 2017).

Access to outdoor amenities may have little impact on obesity if they appear unsafe or if perceptions of crime are common (Fish et al., 2010). Public spaces like parks and trails that have poor lighting, high levels of crime (or perceptions of crime), and graffiti or other vandalism, may be used less often by individuals in the area (Kraft et al., 2018). For example, parks in high-poverty or minority neighborhoods are often underutilized, due to physical disorder (e.g., graffiti, broken glass) as well as social disorder (e.g., public drinking) (Douglas et al., 2018; Park et al., 2018). Indeed, one study finds that access to safe parks is associated with lower odds of physical inactivity among adolescents who are Asian, white, or from low income families (Babey et al., 2008).

Neighborhoods and Sleep Neighborhoods may impact sleep through diverse mechanisms including concerns about safety, excess light, and noise (Hale et al., 2019). Non-whites and low income populations are more likely to live in neighborhoods with greater exposure to noise pollution due to nearby airports or highways (Muzet, 2007). Further, the housing stock in neighborhoods can affect sleep disparities. Mobile homes are common in lower income communities but are often more poorly constructed than houses or apartments, making it harder for residents to limit noise exposure and control temperature. As a result, those who live in mobile homes are more likely to experience short sleep durations, although blacks are more likely to report short sleep duration than whites even in houses or apartments (Johnson et al., 2018). Noisy neighborhoods are more strongly associated with disrupted sleep among Hispanics than among whites, and are more strongly associated with short sleep durations among both Hispanics and blacks than among whites (Koinis-Mitchell et al., 2019). Ultimately, community barriers to sleep may drive disparities in obesity.

Neighborhoods and Environmental Pollution A recent body of literature suggests that environmental pollution may contribute to obesity through mechanisms including metabolic dysregulation, elevating the risks of other chronic diseases that are associated with obesity, or by preventing individuals from being physically active (An et al., 2018). Indeed, one study shows that exposure to air pollution from automobile traffic is associated with a nearly 14% increase in body mass (Jerrett et al., 2014). Another study suggests that long-term exposure to nitrogen dioxide (a common pollutant) is associated with higher fasting blood-lipid levels, especially among those who are already obese (Kim et al., 2019). These findings are especially concerning, given that air pollution—from sources including automobile traffic, industrial pollution, landfills, or hazardous waste sites—is generally higher among low income or nonwhite populations, than among whites or those with higher household incomes (Clark et al., 2014; Gray et al., 2013). Although this research suggests that air pollution may explain disparities in obesity, empirical tests are lacking. Demographers may be well poised to do this research with access to administrative, geo-spatial, and surveillance data.

Social Connectedness

Social Networks Social networks may influence obesity if one's family, friends, or classmates support lifestyles that drive weight gain or weight loss, or support norms about body image that encourage weight gain or weight loss (Christakis & Fowler, 2007). For example, peers can support obesogenic behaviors such as fast food consumption (Fortin & Yazbeck, 2015). However, the association between social network characteristics and obesity may be spurious if individuals are more likely to befriend individuals who have a similar body mass (i.e. homophily) or if unobserved factors (e.g., school, work, or family characteristics) drive both network connections and obesity (Cohen-Cole & Fletcher, Cohen-Cole & Fletcher, 2008a, b; Zhang et al., 2018). A recent review of longitudinal studies suggests that network characteristics may drive obesity in a reciprocal manner. Individuals form connections with people who have similar risks of obesity, who then go on to share similarly obesogenic environments, and then go on to influence each other's weight related behaviors (Zhang et al., 2018).

Social network characteristics are associated with disparities in obesity. A cross-sectional study suggests that white females are more likely to be overweight if their friends are also overweight, but that association does not emerge among blacks and Hispanics (Bruening et al., 2015). That study, however, does not clarify whether peer influences determine white females' body masses, or whether white females simply choose friends who have similar levels of obesity. A longitudinal study that adjusted for school-level variables and attempted to account for reverse-causality, found that being obese is associated with having fewer friends and lower levels of social integration among white females, but not among blacks or Hispanics (Ali et al., 2012). Aside from the structure of social networks (e.g., number of friends, degree of integration), the characteristics of the people in those networks may also influence obesity. Among black and Hispanic adults, having more friends or family members who are obese is associated with viewing heavier weights as normal (Winston et al., 2015). Network size and SES are also associated with obesity. Higher SES adolescents generally have wider social networks and lower levels of obesity, but social network structure did not vary across the obesity status of adolescents (Arias et al., 2018). Thus, SES may do little to explain any associations between network characteristics and obesity. Taken together, future research could continue to examine whether social networks play a causal role in shaping disparities in obesity, and, if so, untangling the mechanisms at play.

Social Support Social support—including encouragement, accountability, and modeling of healthy behaviors from family, friends, or coworkers—can support obesity prevention and weight loss efforts (Lemstra et al., 2016; Umberson, 1992). Social support from diverse sources may inform race/ethnic and SES disparities in obesity. For example, children in low-income income families have higher body masses, but that association is weaker for children who have greater social support from grandparents (Lindberg et al., 2016). Other research shows that social support within school settings is associated with higher levels of physical activity for children across income groups, and for Hispanics and blacks, but not for whites or Asians (Babey et al., 2015). Social support from parents also matters. Compared to children of white parents, children of English-speaking Hispanic parents have 7.7 times the odds of being overweight or obese in the absence of social support, but that association is reduced by almost 80% if children of English-speaking Hispanic parents have access to social support (Watt et al., 2012). And finally, social support from family and friends is associated with increased physical activity among both white and Hispanic children (Vazquez & Schuler, 2020).

Policy and Population-Level Interventions

Efforts to reduce disparities in obesity depend, in part, on policy and intervention efforts that have population-level impacts.

Randomized Clinical Trials for Obesity Interventions

Some interventions have successfully reduced obesity and its sequelae. A recent meta-analysis of randomized controlled trials (RCTs) finds strong evidence that nutritional intervention programs conducted in obese adult populations significantly reduce the future risk of cardiovascular events and all-cause mortality (Ma et al., 2017). This same study shows that dietary interventions also reduce the subsequent risk of death from cardiovascular disease. In addition, surgical options may reduce disease incidence and extend longevity in overweight adults. A systematic review and meta-analysis of bariatric surgery found that it reduces the risk of stroke, myocardial infarction, and premature mortality by 50%, relative to overweight subjects treated with non-surgical options (Kwok et al., 2014). Recent meta-analyses also show that obesity intervention programs are effective in slowing weight gain among children (Liu et al., 2019; Scott-Sheldon et al., 2020), which could promote the primary prevention of obesity if implemented early in the life course.

This evidence is encouraging and runs counter to the narrative among some clinicians and scholars that obesity intervention programs are "futile" (Havrankova, 2012). However, existing research seldom includes disadvantaged populations. Only one of the RCTs considered by Ma et al. (2017) was conducted in a non-Hispanic Black sample of U.S. adults. Moreover, financial, cultural, and other barriers (e.g., health insurance coverage) can prohibit the widespread adoption of effective interventions, particularly in disadvantaged communities. Indeed, members of disadvantaged communities may lack the resources, knowledge, or power to benefit from any given intervention (Masters et al., 2015; Pampel et al., 2012). For example, food deserts in some areas present structural challenges to the widespread adoption of programs and policies designed to alter dietary behaviors among residents of these communities. Efforts to overcome these barriers might require broader structural shifts such as housing vouchers to move to better resourced neighborhoods (Ludwig et al., 2011).

Social Policies and Large-Scale Interventions

In addition to tailoring small-scale intervention programs to disadvantaged groups, it is important to understand how findings from relatively small intervention programs could scale into social policies that maximize population health returns on public investments (Roundtable on Population Health Improvement, 2015). Although not obesity interventions per se, nutritional assistance programs in the U.S. are currently the most influential social policies with respect to dietary options, behaviors, and related changes in body habitus. To date, evidence on these programs is mixed.

The Supplemental Nutrition Assistance Program (SNAP) is one such program. With a typical annual budget in excess of 60 billion dollars that reaches approximately 40 million households each month, SNAP—formerly known as the food stamp program—is by far the largest nutritional intervention program in the U.S. (Tiehen, 2020). SNAP targets lower income families, and eligibility depends on both income and asset criteria. Unfortunately, a considerable body of evidence suggests that, as historically configured, SNAP benefits create incentives that encourage poor diet, weight gain, and obesity. For instance, children, adolescents, and adults who receive SNAP-subsidized groceries are more likely to drink sugar-sweetened beverages than SNAP-eligible persons who do not receive benefits (Twarog et al., 2020). Perhaps in part due to sugary beverage consumption, adolescent and adult SNAP recipients are more likely to be obese and exhibit poor cardiometabolic health, relative to low income persons who do not use SNAP (Leung et al., 2017; Leung & Rimm, 2015). Moreover, the county-level prevalence of obesity is positively associated with SNAP-authorized convenience stores, suggesting that SNAP benefits are sometimes used to purchase high-calorie items of low nutritional value (Houghtaling et al., 2021).

However, it is important to acknowledge that some research indicates that SNAP benefits can support a healthy diet and body mass. For instance, analyses of data from the Panel Study of Income Dynamics found that low-income children with access to SNAP benefits have lower long-term risks of developing obesity and related conditions (e.g., diabetes) than other disadvantaged children (Hoynes et al., 2012). Similarly, a study of the National Longitudinal Survey of Youth-1979 data finds that, among SNAP recipients, access to higher levels of SNAP benefits reduced average weight and the probability of obesity (Almada & Tchernis, 2018).

Evidence suggests that health outcomes related to nutritional-support programs are malleable and dependent on specific policy provisions. To illustrate, in 2009 the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) improved recipients' food packages (e.g., by including more fruits and vegetables), which encouraged healthier overall food purchasing behaviors (e.g., buying items with less sodium and sugar) among WIC-eligible households (Ng et al., 2018). In addition, improved nutritional standards for school-lunch programs implemented in 2010 by the U.S. Department of Agriculture have resulted in healthier diets and lower odds of overweight and obesity among children and adolescents (Welker et al., 2016). Recent evidence suggests that these improved nutritional standards are associated with reduced obesity risk, especially among children in poverty (Kenney et al., 2020).

In addition to SNAP and other federally-supported nutrition programs, scholars and policymakers have begun to explore interventions that are specifically designed to limit weight gain and reduce obesity prevalence. Perhaps the clearest illustration of such policies is the implementation of soda taxes in some U.S. cities, which are levied to reduce consumption of sugar sweetened beverages (SSBs) by increasing financial costs to consumers. In 2014, Berkeley, California levied a one cent per-ounce excise tax on SSBs; after 3 years, consumption of SSBs declined significantly among Berkeley residents but remained constant in comparison cities of Oakland and San Francisco, which did not tax SSBs until 2017 and 2018, respectively (Lee et al., 2019b). A similar policy in Philadelphia, Pennsylvania, had modest effects on reducing SSB consumption, overall, but significantly reduced the intake of SSBs among African-American children and adults (Cawley et al., 2019). Although this policy had limited benefits for overall population health, it benefited a sub-population with higher obesity risk, potentially preventing further widening of obesity disparities in the future.

Finally, it is imperative to recognize that human behavior occurs within institutional and environmental contexts that constrain the choices available to individuals. One way to shift environmental contexts is to move from one neighborhood to another, leading to improvement (or deterioration) in access to well-stocked supermarkets, walkable sidewalks and/or trails, and healthcare facilities. Extant research strongly suggests but has not yet definitively shown that moving from disadvantaged neighborhoods to wealthier ones reduces obesity risks through these and other mechanisms (Drewnowski et al., 2019). Another, more subtle way to alter choice sets is to "nudge" people toward healthier options. For instance, workplaces can increase access to and improve the visibility of healthy snack options, nudging employees toward lower-calorie diets. A meta-analysis of dietary interventions designed to test behavioral nudges concluded that altering "choice architecture" is likely an effective public health strategy to reduce obesity prevalence (Arno & Thomas, 2016). An implication of these studies is that reducing obesity disparities in the U.S. will require new policies that support access to healthy choices, especially for its most disadvantaged citizens.

Conclusion

Race/ethnic and SES disparities in obesity are persistent, and may continue to widen in the future. A complex set of behavioral, biological, neighborhood, and social mechanisms contribute to these disparities, although existing research does little to systematically compare each of these sets of mechanisms. The literature also describes some policy levers or interventions that may be useful for closing disparities or reducing overall disparities, if configured appropriately. Urgent efforts to improve our understanding of disparities and to design policies and interventions to close those disparities are warranted, given the long-term consequences of obesity disparities for population health.

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