HHS Public Access

Author manuscript

Curr Obes Rep. Author manuscript; available in PMC 2021 September 01.

Published in final edited form as:

Curr Obes Rep. 2020 September ; 9(3): 272–279. doi:10.1007/s13679-020-00398-7.

Socioeconomics of Obesity

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Abstract

Purpose of Review—The purpose of this review is to evaluate and emphasize important findings in the recent literature regarding the socioeconomics of obesity. It is important to evaluate trends of this global epidemic and elucidate its impact on different demographic groups and across socioeconomic strata.

Recent Findings—Obesity rates continue to increase domestically and globally which is associated with a concomitant rise in medical and economic costs. There are disparities in obesity rates based on race/ethnicity, sex, gender and sexual identity, and socioeconomic status, yet these disparities are not explained fully by health behaviors, socioeconomic position or cumulative stress alone – community and societal environmental factors have a significant role in the obesity epidemic.

Summary—Socioeconomic factors contribute to obesity on an individual and community level, and any viable approach to sustainably addressing the obesity epidemic must take these factors into account.

Keywords

Obesity; socioeconomic status; body mass index; race; gender; minority

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Conflict of Interest Chika Vera Anekwe, Amber R. Jarrell, Matthew J. Townsend, Gabriela I. Gaudier and Julia M. Hiserodt declare that they have no conflict of interest. Fatima Cody Stanford serves on the advisory board of Novo Nordisk

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

Ethics Committee Approval: This viewpoint was considered IRB exempt.

Introduction

Obesity is a chronic disease with significant medical, social and economic consequences both domestically and globally. Obesity is determined by an individual's body mass index (BMI), defined as weight in kilograms divided by height in meters squared. For adults, the overweight BMI range is 25 kg/m^2 to less than 30 kg/m^2, and the obesity BMI range is 30 kg/m^2 and higher [1]. The prevalence of obesity in the United States is high and continues to increase [2]. In 2011–2012 16.9% of children and 34.9% of adults were affected by obesity [3]; in 2015–2016, prevalence rose to18.5% in children and in 2017–2018 prevalence reached 42.4% in adults [4]. Predictive modeling suggests the prevalence of obesity in U.S. adults will be 48.9% by the year 2030 [5]. This epidemic has the greatest prevalence among socially disadvantaged groups and under-represented persons (ethnic/racial minorities, women, and individuals from lower socioeconomic backgrounds) [2].

Obesity affects different racial and ethnic groups at various rates. According to the National Center for Health Statistics in 2017–2018, black women had the greatest prevalence of obesity at 56.9% among U.S. adults. The prevalence of obesity among Hispanic women was 43.7%. The prevalence of obesity among men was quite similar among black and white males at 41.1% and 44.7%, respectively. Non-Hispanic Asian men and women had the lowest prevalence of obesity compared to any other race/ethnicity [4].

Sexual minority populations, such as lesbian, gay, or bisexual groups, are at risk of obesity due to consequences of homophobia, prejudice, and increased levels of stress [6, 7]. Lesbian and bisexual females have an increased prevalence of obesity when compared with straight females. However, gay males have a lower prevalence of obesity when compared to straight males [6, 7]. Gender minority populations include transgender and individuals who do not conform to societal norms of sexual orientation, gender identity, and/or gender expression. Gender nonconforming birth-assigned females were found to have higher BMIs than gender conforming females, while gender nonconforming birth-assigned males had a lower BMI than their conforming counterparts [7]. Outpatient data of adolescents between the ages of 14–25 diagnosed with gender dysphoria or taking gender affirming hormones in 2008–2014 were analyzed retrospectively. Affirmed males (female to male) experienced a significant increase in BMI (presumably due to exogenous testosterone), while affirmed females (male to female) did not experience any significant weight change throughout their course of hormone administration [8].

Obesity in children (classified as ages 2–11) and adolescents (ages 12–21) is based on age and sex-specific percentiles using the CDC's BMI-for-age growth charts [9, 10]. The overweight category ranges from 85^{th} to less than the 95^{th} percentiles. Obesity is defined as at or above the 95^{th} percentile [11]. Like adults, the prevalence of obesity in youth varies by race/ethnicity and gender. In 2011 – 2014, increased prevalence of obesity was seen in Hispanic children and adolescents when compared to white, black, or Asian youths. The lowest prevalence of obesity was among Asian children and adolescents [12]. Adolescents with overweight have a 70% chance of becoming an adult with overweight or obesity [9].

Socioeconomic status (SES) is an important factor associated with obesity. SES can be determined using variables such as education, income, and occupation, with education considered to be the most stable variable over time [2]. A study of data collected in the National Health and Nutrition Examination Survey (NHANES) from 1971–1974, 1976–1980, 1988–1994, and 1999–2000 of adults between the ages of 20–60 identified trends in obesity rates among SES levels. Education levels were classified as low (less than high school, 9^{th} grade or below), medium (high school, 10^{th} to 12^{th} grade), and high (college or higher). Over the past 3 decades, the prevalence of obesity increased among low SES groups, while increasing significantly among high SES groups, thus leading to a reduction in disparities in obesity rates across different SES groups [2]. This trend was consistent across ethnic/racial and gender categories. Although low SES is an established risk factor for obesity [13], its impact may be mediated in part by psychosocial stress [14]. A study examining the effects of neighborhood poverty and psychosocial stress on central adiposity demonstrated that people living in neighborhoods with increased poverty and unfair treatment were at an increased risk of central adiposity [15]. These findings indicate that increased stress exposure among blacks and US born Hispanics as compared with whites and non US born Hispanics, may play a role in disparities in obesity rates among these group [14, 15].

Consideration of Obesity as a Disadvantaged Status

Obesity may be viewed as a form of socioeconomic disadvantage. Multiple longitudinal studies have demonstrated that childhood and/or adolescent obesity is associated with persistent or widened socio-economic disadvantage in adulthood [16, 17]. In addition, midlife obesity is associated with multiple indicators of socio-economic disadvantage in midlife and later adulthood, as measured by both subjective and objective measures [18].

Individuals with obesity encounter bias in multiple settings, with reported rates of weight discrimination approaching those due to gender and race/ethnicity [19–22]. In the workplace, employees with obesity are perceived as having lower supervisory potential, lower self-discipline, and worse personal hygiene; as less likely to be seen as suitable for public-facing sales positions; and as having lower promotion prospects compared to average-weight peers [19]. Data from the National Longitudinal Survey of Youth (NLSY) obtained annually from 1979 through 1994 and biennially from 1994 through 1998, suggest the existence of a wage penalty for obesity, after controlling for sociodemographic, economic, and health variables, ranging from 0.7–3.4% for men and 2.3–6.1% for women [23]. These wage penalties appear stronger for women than men as a whole, and may accumulate over time [24].

Weight stigma also pervades medical practice. Physicians may perceive patients with higher BMI to be less adherent to medications, even after adjusting for patient demographic factors, patient-reported adherence, literacy level, and blood pressure control [25]. Weight stigma has also been observed among nurses, medical students, psychologists, and dietitians [21]. These biases may affect medical practice and health care utilization. Patients with obesity are less likely to complete recommended cancer screenings and more likely to avoid care [21]. It has also been suggested that the activation of pathophysiologic stress pathways

triggered by weight stigma may act as an intermediary between obesity and poor health outcomes [26]. Indeed, as a consequences of external weight bias, those with obesity develop internalized weight bias which leads to both physical and mental health impairment [27, 28]. In these several ways, obesity may drive disadvantage in ways not captured by classical measures of socioeconomic status.

In considering obesity as a disadvantaged status, we must also address the overlapping concepts of food insecurity and the built environment. 11.8% of U.S. households were food insecure at some time in 2017 [29]. Persistent household food insecurity, in particular when present without hunger, has been associated with a 22% increased odds of childhood obesity versus children who are food secure throughout childhood [30]. Adults with food insecurity similarly have a higher prevalence of obesity compared to adults who are food secure [31]. While studies reveal differing associations by race/ethnicity, age, and gender, the most consistently reported association between food insecurity and obesity is among women [31, 32]. The built environment, including housing, transportation, workspaces, and recreational infrastructure, has a strong influence on obesogenic status. The presence of a neighborhood conducive to physical activity or active commuting [33] and healthy food environments, as characterized by a lower percentage of limited-service restaurants [33] or convenience stores [34], higher density of supermarkets [35], and perceived availability of healthy foods [36] have each been associated with lower BMIs.

Socioeconomically disadvantaged groups face unique obesity treatment challenges. In addition to having increased baseline risk and burden of obesity, black, Hispanic, and low-income individuals are underrepresented in existing treatment literature; the few published trials have demonstrated drawbacks such as high attrition rates and weight loss outcomes lower than expected [37, 38]. Harvey and Ogden suggest several potential solutions including material incentives and telecommunications technologies via Internet or mobile phone to reduce barriers to accessing treatment, such as transportation, costs, and childcare concerns [37]. One promising 24-month randomized effectiveness trial employed a behavioral weight loss approach including skills training, community health educators, and eHealth tools for self-monitoring progress and real-time feedback, demonstrating 6-month weight losses sustained at study conclusion (24 months) in a population with 71.2% black and 13.1% Hispanic individuals, as well as 32.9% who did not complete high school [39]. While such trials offer some potential solutions, more studies are needed to better meet the disproportionate burden of obesity among disadvantaged groups.

Ethnic/Racial Burden of Obesity

Racial and ethnic disparities are apparent not only in obesity rates but also in the rates of co-morbidities associated with obesity such as hypertension, diabetes, and arthritis [40]. Over a lifetime, cardiovascular conditions are increased in patients with obesity, particularly in black and Hispanic-Americans. Metabolic syndrome, made up of a constellation of metabolic abnormalities such as hypertriglyceridemia and low high density lipoprotein (HDL) cholesterol, is increased in patients with obesity, specifically Mexican-Americans followed by black women, black men and finally Caucasians [41]. Similar ethnic/racial trends are seen in the rates of diabetes; however, this association persists after controlling for

BMI, indicating that BMI alone does not account for the ethnic/racial disparities. These trends are different among those with hypertension – Mexican-Americans have the lowest rates while blacks have the highest. In terms of mortality, whites with obesity have a higher risk of death than blacks [42, 43], though the risk of stroke and coronary heart disease are increased in the latter [40].

There are several mechanisms that may explain the disparities in obesity rates between majority and minority populations. The role of health behaviors is one mechanism. Racial and ethnic minorities have been shown to generally consume fewer fruits and vegetables and engage in less physical activity than whites [14, 44]. Poor dietary quality is highly correlated with food insecurity, more commonly seen in Hispanics, blacks and low SES populations [45]. Another factor that may lead to increased food intake and insulin resistance is psychosocial stress, which is found at a higher proportion in racial/ethnic minorities [14]. There is also evidence to support that decreased sleep duration can lead to increased body mass [46]. Reduced sleep duration is associated with longer work hours, low SES, and lower education, all of which occur more often in racial/ethnic minorities, specifically in black men; however the overall association between sleep and BMI can vary by race/ethnicity, gender and age [45].

Interplay of Gender and Obesity

Dietary intake is the predominant factor affecting gender differences in obesity. Women tend to eat more calorie dense foods even though they report the desire to eat healthier more than men [47]. Alternatively, men experience weight gain in response to increased alcohol intake compared to women, though this may vary based on type and frequency of alcohol consumed [47]. An individual’s social network may affect obesity, more in men than women. Males with friends with obesity increase their personal risk of obesity. Additionally, some developed countries consider men with obesity as having higher social status while attributing thin body habitus in women as more desirable. Female obesity (but not male obesity) can be trended based on the economic status of the country, with most countries showing a positive correlation between SES status and obesity in women [47, 48]. Changes in labor needs and unemployment rates have dramatically reduced physical activity levels for both men and women [47]. Moreover, regional cultural beliefs have led to disparities in female weight such as restricted public physical activity for women in some Arab countries and emphasis on excess weight as a sign of fertility in some Asian and African countries [47]. Education seems to play a role in obesity rates predominantly in women, for whom increased education is highly correlated to less risk for obesity in many countries [49].

Socioeconomic status affects the relationship between gender and obesity in myriad ways. In males, lower income jobs often include manual labor or more physical work than many jobs women at the same SES level may obtain [13, 47]. The prevalence of obesity in men tends to be comparable across SES classes as defined by education level, though it is still greatly affected by race/ethnicity. For example, highly educated white men had a lower risk of obesity in comparison to highly educated black men [2]. However when income or occupation are considered, men at the lowest SES levels have nearly double the risk of obesity [49]. Women in the U.S. have a much clearer trend across SES levels than men with

significant increases in rates of obesity as SES status decreases [50]. A long-term consequence of obesity in lower SES women is a higher risk of their children developing obesity [49].

Indeed, the predominant risk factor for obesity in children is parental or familial obesity regardless of gender, though particular parental behaviors may lead to weight gain in female adolescents more than males [51]. Obesity trends vary based on ethnicity within all age groups in a similar pattern as adult trends, but more variation is seen in female youths than males [51]. As children transition into their teenage years, males develop more fat-free mass leading to a higher total energy expenditure compared to females. Conversely, menstruation can lead to cravings in young females, particularly for fat and carbohydrate rich foods. Additionally, physical activity is an important factor affecting obesity in children. Females generally tend to engage in less physical activity than males of the same age, but sedentary behavior regardless of gender is a contributing influence on obesity [51].

Economic Impact of Obesity

Medical costs of obesity and obesity-related diseases

Obesity is a risk factor for multiple chronic diseases and accounts for a significant portion of costs associated with these diseases. The relative risk of developing many chronic diseases is increased in those with overweight and obesity, including end-stage renal disease, congestive heart failure, and many cancers such as breast, endometrial and gallbladder cancer [52]. Type 2 diabetes is increased in those with obesity by a factor of 7 [13, 53], while 6% of cancers diagnosed in 2007 were attributed to obesity [13, 54]. There is also an increased risk of infection and major complications during hospitalizations in individuals with obesity [13, 55]. For those with obesity, there is a twofold increase in the risk of hypertension [56], and an almost 3.5-fold increase for diabetes and twofold increase for diabetes and hyperlipidemia, respectively [57, 58].

The economic burden of these chronic conditions has been estimated by many groups and ranges widely. Waters and Graf did an extensive review of obesity-related diseases, and analyzed the costs of these diseases that can be directly attributed to obesity by calculating the population attributable risk, or the percent of cases that can be directly attributed to obesity, and multiplying those percentages by the total healthcare costs for each chronic disease in 2016. The direct medical costs of overweight and obesity was determined to be $480.7 billion for 2016 alone [52]. Hruby and Hu estimated that for men and women with obesity, respectively, there was an additional $1,152 per year and $3,613 per year in medical spending, with a total of $190 billion nationally going to the treatment of obesity and obesity-related diseases [13].

Work absenteeism

The economic costs of obesity reach outside of healthcare as well. Multiple studies have found positive and statistically significant correlations between obesity and absenteeism, likely related to the increased risk of chronic disease as described above. Kleinman and colleagues analyzed four categories of absenteeism, including total absence days, sick-leave

days, disability days, and workers' compensation days, and found that employees with obesity (BMI ≥ 30) had 1.43 more sick days and 3.08 more total absences, had a 70% increase in short-term disability days, and had a 281% difference in workers' compensation days compared to employees with BMI < 27 kg/m^2 [59]. Other studies report increased absence rates ranging from 25% to almost 200% more absence days in employees with obesity compared to those without obesity [57, 59]. These increased absences from the workforce account for significant economic costs, with one study estimating that losses from absenteeism range from $3.38 billion to $6.38 billion nationally per year, and another study estimating the total cost to be as high as $11.2 billion per year [57, 60].

Lower work productivity

Studies have shown that even when present at work, employees with obesity have decreased productivity compared to those with standard weight (defined here as BMI between 18.5 – 25 kg/m^2)[57]. It is unclear what the cause of this decreased productivity is, but it is hypothesized to be either a result of the increased medical comorbidities found in those with obesity and/or factors that may contribute to having both obesity and decreased productivity in an individual [57].

This decrease in productivity comes at a cost to employers. A systematic review by Goettler and colleagues found that the cost from decreased productivity of individuals with obesity ranged between $11 and $4175 per individual per year [61]. Another study by Ricci and Chee analyzed the amount of lost productive time between individuals with standard weight, overweight, and obesity, and found that although there were no differences in productivity costs between employees with standard weight and overweight, those with obesity had an excess cost of $11.7 billion per year in lost productivity [62].

Premature death

Premature death also contributes to the economic costs of obesity. Obesity is a significant risk factor for the development of chronic diseases such as cardiovascular disease, diabetes, and cancer, and these increased comorbidities have led to a decreased life expectancy for those with obesity. One study estimates that obesity contributed to a total of 4 to 7 years lost per individual, while others have reported between 6 and 14 years of life lost [13, 63, 64]. The monetary cost of these years lost is currently unreported, and more work still needs to be done to determine the economic impact of this decreased life expectancy.

Health insurance and disability insurance costs

Although less studied than other economic costs of obesity, it is thought that there are increased costs from the public health insurance structure in relation to obesity. As described above, obesity accrues large excess medical costs via increased chronic conditions and these increased medical costs are shared among the larger population within our public health insurance structure, rather than burdening the one individual. One study has argued that this public sharing of medical costs transfers the cost away from those with obesity, removing monetary incentive for those with obesity to improve their weight status and overall health [57]. The estimated cost of this externality is about $150 per individual [57].

Transportation costs

Transportation costs have also increased with the rising incidence of obesity. As weight increases, so does the amount of fuel required to transport an individual any given distance. In the airline industry between 1990 and 2000, increases in weight required an additional 350 million gallons of jet fuel per year, accounting for an additional $275 million in jet fuel costs in the year 2000 alone [65]. For non-commercial highway vehicles, increases in average weight since the 1960s have accounted for an additional 1 billion gallons of fuel used per year, which accounts for about $2.7 billion a year [57, 66, 67].

Educational attainment

Educational attainment has been studied as another potential area of economic impact of obesity. The relationship between educational attainment and obesity is currently debated, although studies have begun to point to an overall negative relationship between educational attainment and excess weight [57, 68–70]. A study conducted by Hagman and colleagues compared Swedish adolescents with obesity to a matched cohort with standard weight and analyzed the percentage of students who completed at least 12 years of school. They found that 55.4% of adolescents with obesity completed at least 12 years of school, compared to 76.2% of adolescents with standard weight status [69]. French and colleagues found that girls with obesity were less likely to attain a Bachelor's degree and were also less likely to earn more than $50,000 annually, although they did not find a significant difference in boys with obesity, while Black and colleagues found that boys with obesity had significantly lower scores on national math and literacy assessments, with no difference for girls when sociodemographic factors were taken into account [68]. The economic impact of this decrease in educational attainment has yet to be quantified.

Quality of Life (QoL)

QoL is another important measure of the impact of obesity and is likely related to many of the above factors, including medical comorbidities, absenteeism, productivity, and educational attainment. Individuals with obesity have been shown to have poorer QoL in multiple categories compared to standard weight individuals, with physical QoL measures more closely associated with BMI than mental/psychological measures [71, 72]. These effects were consistent across gender and age groups. Importantly, certain aspects of QoL have been shown to improve with weight loss, especially in individuals who undergo bariatric surgery, likely because of the increased percentage of weight lost with surgical interventions compared to other interventions [72].

Global economic impact

The rising economic impact of obesity is a global phenomenon. The worldwide prevalence of overweight and obesity increased from 921 million to 2.1 billion people from 1980 to 2013, while total population rose from 4.4 billion to 7.2 billion during the same time period; this represents an increased prevalence of 27.5% for adults and 47.1% for children [73]. A 2014 McKinsey Global Institute analysis estimated the global economic cost of obesity to be approximately $2.0 trillion or 2.8% of global gross domestic product (GDP), close to the total economic impact from tobacco or armed conflict [74]. Within these staggering

aggregate statistics, there is significant variation by country, age, and sex. For example, higher rates of overweight and obesity exist among women than men in developing countries, contrasted with higher rates among men than women in developed countries [73].

Gaps remain in our understanding of the true global economic impact of obesity. Systematic reviews of the costs of obesity based solely on English-language studies inevitably leave low- and middle-income countries underrepresented in the literature [75, 76]. Additionally, the available literature displays significant heterogeneity in methods, such as the inclusion of direct versus indirect costs, variability in which comorbidities of obesity are considered, and how future economic costs are discounted [75].

Conclusion and Future Directions

The growing national and global impact of obesity is undeniable. Data projections show that by the year 2030 the prevalence of adult obesity and severe obesity in the United States will rise to 48.9% and 24.2%, respectively, and severe obesity will be the most common BMI category nationwide among women, black adults and low-income adults [5]. Current global trends predict 38% of the world's adults will have overweight while 20% will be affected with obesity by 2030 [13, 77]. Excess body weight is estimated to affect two billion people worldwide as of 2015, and accounts for approximately four million deaths (which represents 5% of all global deaths) and 120 million disability-adjusted life years [74, 78, 79]. The global economic impact of obesity is estimated to be approximately $2.0 trillion [74, 79]. Clearly obesity poses substantial health and economic burdens on society and is a major public health challenge of national and global importance.

The sequalae of obesity include health-related, social, psychological and economic consequences on both the individual and societal levels [13]. Contributors to obesity, or obesogenic factors, include industrialization, mechanized transportation, urbanization, technology, and an increasingly abundant supply of inexpensive energy-dense food [13, 74]. Heritable factors such as genetics, family history, race, ethnicity, as well as socioeconomic and sociocultural environment also interact in order to determine an individual's susceptibility to obesity [13]. Our collective approach to treating obesity must be as multi-faceted as its etiology. Similarly broad approaches and strategies have been, and continue to be employed to face other daunting public health challenges such as smoking, alcohol use and armed violence [13, 74].

The impact of various obesity treatment interventions has been analyzed, with findings suggesting that key areas for promoting behavioral change include informing, enabling, motivation and influencing individuals to change their routine and habits [74]. Informing the public is key to approaching any public health concern, with the effectiveness of the information depending on how, when, where and to whom it is delivered. Enabling choice is critical for behavioral change, particularly if poor choices are made more difficult to access. Motivation to change habits through personal goals and incentives can play a role, although the impact in this area can vary. Finally, influencing behavior via choice architecture, priming and social norms has been shown to have a powerful effect [74]. Within this framework, some specific interventions that have been proposed include increasing active

transport, increasing healthcare payor incentives, improving access to and affordability of healthy foods, limiting availability and media marketing of high-calorie foods, improving food labeling, reformulating food products to be more healthful, and increasing access to weight management programs and bariatric surgery [33, 74]. These approaches can be implemented at the level of government, school systems, employers, health-care systems, restaurants, food retailers, manufacturers and foodservice providers [74, 78].

Obesity is known to arise as a result of positive energy balance – that is, an excess of calories consumed in relation to calories expended, which gives rise to the storage of excess energy as body fat [13]. While on the surface, the implication may be that individual behavioral change can reverse the balance, personal behavior occurs largely in response to complex environmental, socioeconomic and genetic factors [2, 13]. Thus, there is a great need for population-based, community-level, and environmental approaches for the prevention and management of obesity [2, 33]. Ideally, these approaches should target multiple population-level risk factors and be tailored to the specific gender-based, socioeconomic, and geographic needs of vulnerable target populations [13, 33, 74, 78, 80].

Funding Information:

National Institutes of Health and Massachusetts General Hospital Executive Committee on Research (ECOR)(FCS), National Institutes of Health NIDDK P30 DK040561 (FCS) and L30 DK118710 (FCS)

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