

Overweight and Obesity: Prevalence, Consequences, and Causes of a Growing Public Health Problem

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ABSTRACT: This paper provides an overview of the evidence on the current epidemic of obesity in the United States. The prevalence of overweight and obesity now exceeds 60% among US adults, and the rate is rapidly increasing among children and adolescents. Dismal medical, social, and economic consequences are already apparent and likely to worsen without multipronged intervention. Increased rates of hypertension, diabetes, and dyslipidemia, among other medical conditions, threaten to shorten the longevity of the American populace by as much as 5 years. The incidence of depression is increasing

and experts suggest this is linked with the increased prevalence of obesity. The cost of obesity-related medical care has increased astronomically since 1987, in addition to lost productivity and income. Novel multidisciplinary, preventive, and therapeutic approaches, and social changes are needed that address the complex interplay of biologic, genetic, and social factors that have created the current obesity epidemic. **KEY INDEXING TERMS:** Overweight; Obesity; Prevalence; Economics. [*Am J Med Sci* 2006; 331(4):166–174.]

Obesity is rapidly becoming the number one health problem in the country, with concomitant increases in social, medical, and public health costs. Although it remains unclear whether morbidity is increased, it is clear that since the 1970s the United States has experienced substantial increases in the number of people who are overweight or obese. The data from the National Center for Health Statistics (NCHS) indicate that about 30% of adults over the age of 20 years, or 60 million adults, are obese. These statistics have generated much interest on the part of governmental agencies and professional organizations,^{1–3} yet primary care clinicians provide weight loss advice to less than half of patients identified as obese.^{4–6} The US Surgeon General has issued a call to action regarding the obesity epidemic and offered guidelines and strategies for addressing this public health challenge.⁷ The National Heart, Lung, and Blood Institute (NHLBI) Working Group on the Pathophysiology of Obesity-Associated Cardiovascular Disease has recom-

mended high priority areas for human and animal research to identify basic mechanisms.⁸

This article summarizes current evidence on the scope of the obesity problem; its medical, social, and economic consequences; and potential causes as a background for considering lifestyle, pharmacotherapeutic, and surgical approaches to treating this epidemic.

Scope of the Obesity and Overweight Problem

Identifying Persons Who Are Overweight and Obese

Overweight and obesity are characterized by an increase in body fat. The NHLBI guidelines classify overweight and obesity based on body mass index (BMI), calculated as weight in kilograms divided by the square of height in meters. Using this classification, a healthy or desirable BMI is between 18.9 and 24.9.² A person is considered overweight if the BMI is between 25.0 to 29.9 and obese if the BMI is greater than or equal to 30.0. Persons who are obese can be further classified into stage I (BMI 30.0–34.9), stage II (BMI 35.0–39.9), or stage III (BMI \geq 40.0). Although the term *morbid obesity* is still used for International Classification of Diseases, Ninth Revision, Clinical Modification (ICD9-CM) coding purposes, the NHLBI recommends the use of other descriptive terms, such as stage III, extreme obesity, or clinically severe obesity, which are more aesthetically pleasing.⁴

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Using BMI as the standard measure of body fat is not without controversy. While it is inexpensive and easily calculated, it is an indirect measure that assumes independence of such factors as age, gender, body composition, level of physical activity, and race or ethnicity, which can also influence the percentage of body fat.^{9,10} Gallagher and associates¹⁰ investigated the relationship between BMI and the percentage of body fat among groups based on age, gender, and ethnicity. The BMI was highly correlated with body fat percentage for people of both genders among African Americans and whites. However, gender and age had a significant effect on the relationship of BMI and the percentage of body fat. Females and older adults had a higher percentage of body fat for a given BMI compared with males and younger adults.

Racial differences in BMI have been offered as an explanation for racial disparities in morbidity and mortality. Gallagher and associates¹⁰ found no statistically significant racial difference between African American and white adults in the percentage of body fat for a given BMI. However, Deurenberg, Yap, and van Straveren⁹ performed a meta analysis of 32 studies to determine the relationship of BMI and percentage of body fat in adults. For African Americans, the BMI overestimated the percentage of body fat compared to whites with the same BMI. In spite of these age, gender, and racial differences in the relationship of BMI to body fat, most researchers and policy makers assert that the BMI is a reasonable measure to use to assess morbidity and mortality risk associated with overweight and obesity.¹⁰

Other, more direct measures of body fat are available, including underwater weighing (hydrodensitometry), dual energy x-ray absorptiometry, bioimpedance analysis, deuterium oxide dilution, and skinfold thickness.⁹ These direct measures of body fat can be expensive to obtain and often are not easily accessible to the primary care clinician. However, they should be used in combination with the BMI to assess risk and monitor the progress of therapeutic interventions.¹¹

Skinfold thickness is an anthropometric measure of body fat that is based on the assumption that subcutaneous fat reflects the total fat content of the body.¹¹ Calipers are used to obtain skin fold measurements over several areas of the body, and these measures are used to calculate the percentage of body fat. These measures, while seemingly simple to obtain, are prone to significant measurement errors.

Underwater weighing is the earliest and most commonly used method of measuring body density.¹² Using this method, the person is submerged under water while the volume of water displaced and the underwater weight are measured. The body density is used to estimate the percentage of body fat. This method is prone to errors due to variations in hy-

dration, lung volume, muscle mass, and mineral content of the body.

With the exception of anthropometric measurements, bioelectrical impedance, also called bioimpedance analysis (BIA), is perhaps the most accessible and inexpensive noninvasive method of estimating the percentage of body fat for use in a clinical setting. In recent years, inexpensive bedside BIA instruments have become available that detect the bioelectrical conductivity of body components with high water concentrations, such as skeletal muscle and lean tissue and other components such as fat, which have low water concentrations.¹³ The fat composition of the body can be calculated by entering the resistance data from the BIA into regression equations that take into account the person's weight, limb length, and other factors such as age, gender, and ethnicity. The BIA method of estimating fat composition is population specific, and an equation must be developed that is specific to the population for which the measure is being used.¹³

Bioimpedance analysis has good correlations with dual energy x-ray absorptiometry (DEXA),¹⁴ which, though most often used as a measure of bone mass density, is also used to measure total body and regional fat mass. This measurement is obtained by performing an x-ray scan of the whole or parts of the body exposing the patient to a small amount of radiation. DEXA is considered an accurate and precise method of determining body composition that is often used as a standard for judging the accuracy of BIA.^{11,14} Similar measures can be obtained by magnetic resonance imaging or computed tomography, but DEXA exposes the person to less radiation and is less expensive.¹⁵

Prevalence of Obesity and Overweight

The two most common data sources used to report the prevalence of overweight and obesity are the Behavioral Risk Factor Surveillance Survey (BRFSS),¹⁶ a national telephone survey conducted annually by the Centers for Disease Control and Prevention (CDC) in which height and weight are self-reported, and the National Health and Nutrition Examination Survey (NHANES),¹ which includes objective measures of BMI. The use of these two data sources accounts for the variations in reports of the prevalence of obesity. The most recent data from the 2002 BRFSS indicate that about 59.2% percent of adults are overweight or obese.¹⁷ The NCHS uses NHANES to report the prevalence of overweight and obesity in adults. The most recent data from the NCHS indicate a slightly higher rate of 65.2% of adults in the United States who are overweight or obese. Of these, approximately 4.9% are extremely obese (BMI > 40).¹⁸

Data from both sources indicate that the prevalence of overweight and obesity is increasing, with higher prevalence when direct measures are included. As shown in Tables 1 and 2, the prevalence

Obesity Prevalence, Consequences, and Causes

Table 1. Prevalence of Overweight in Adults Aged 20 Years and Older^a

	1976–80	1988–94	1999–2002
Both sexes	47.4	56	65.2
Male	52.9	61	68.8
Female	42	51.2	61.7
Race			
White male	53.8	61.6	69.5
White female	38.7	47.2	57
Black male	51.3	58.2	62
Black female	62.6	68.5	77.5
Hispanic male	61.6	69.4	74.1
Hispanic female	61.7	69.6	71.4
Male			
20–34 years	41.2	47.5	57.4
35–44 years	57.2	65.5	70.5
45–54 years	60.2	66.1	75.7
55–64 years	60.2	70.5	75.4
65–74 years	54.2	68.5	76.2
75 years and over		56.5	67.4
Female			
20–34 years	27.9	37.0	52.8
35–44 years	40.7	49.6	60.6
45–54 years	48.7	60.3	65.1
55–64 years	53.7	66.3	72.2
65–74 years	59.5	60.3	70.9
75 years and over		52.3	59.9

^aData from National Center for Health Statistics at <http://www.cdc.gov/nchs/data/hus/04trend.pdf#069>.¹⁸

of obesity in adults has increased by about 50% per decade over the past 20 years from 15.1% in the period of 1976 to 1980, to 23.3% in 1988 to 1994, to

Table 2. Prevalence of Obesity in Adults Aged 20 Years and Older^a

	1976–80	1988–94	1999–2002
Both sexes	15.1	23.3	31.1
Male	12.8	20.6	28.1
Female	17.1	26.0	34.0
Race			
White male	12.4	20.7	28.7
White female	15.4	23.3	31.3
Black male	16.5	21.3	27.9
Black female	31.0	39.1	49.6
Hispanic male	15.7	24.4	29.0
Hispanic female	26.6	36.1	38.9
Male			
20–34 years	8.9	14.1	21.7
35–44 years	13.5	21.5	28.5
45–54 years	16.7	23.2	30.6
55–64 years	14.1	27.2	35.5
65–74 years	13.2	24.1	31.9
75 years and over		13.2	18.0
Female			
20–34 years	11.0	18.5	28.4
35–44 years	17.8	25.5	32.1
45–54 years	19.6	32.4	36.9
55–64 years	22.9	33.7	42.1
65–74 years	21.5	26.9	39.3
75 years and over		19.2	23.6

^aData from National Center for Health Statistics at <http://www.cdc.gov/nchs/data/04trend.pdf#069>.¹⁸

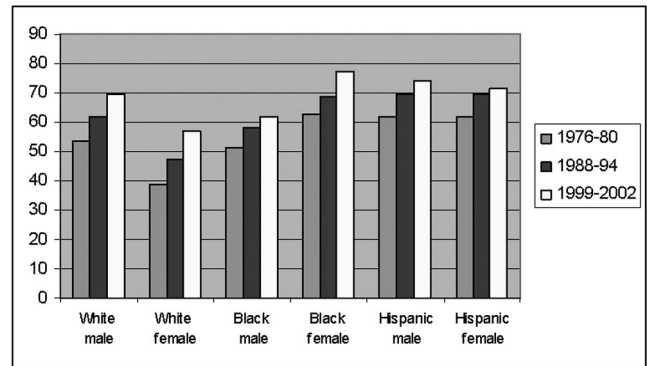


Figure 1. Prevalence of obesity in adults by race and gender. (Data from the National Center for Health Statistics.¹⁸)

the current rate in 1999 to 2002.¹⁹ This increase in prevalence has been seen in all regions of the nation, among all racial and ethnic groups, in both genders, among all educational levels, and among children, adolescent, and adult age groups. However, some groups consistently experience higher rates of overweight and obesity compared to the general population. States in the southeastern region have the highest prevalence of obesity and overweight having the dual disadvantage of high obesity rates and low per capita income. The prevalence of obesity and overweight decreases as educational level increases. The prevalence of obesity is higher in women compared to men and among African and Hispanic Americans compared to whites. Most of the racial disparities in the prevalence of obesity and overweight are related to gender (Figures 1 and 2). A higher percentage of African American women are obese compared to white women. However, there are no ethnic or racial differences in the prevalence of obesity among men.¹⁸

Among adults, the prevalence of obesity increases with age (Table 2). As people age, they become more sedentary. After 65 years, this relationship reverses so that those over the age of 75 years are among the

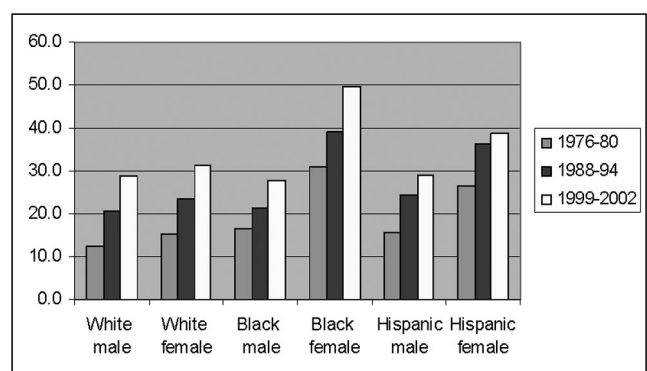


Figure 2. Prevalence of overweight in children aged 6 to 11 years by race and gender. (Data from the National Center for Health Statistics.¹⁸)

Table 3. Prevalence of Overweight for Children 6 to 11 Years Old^a

	1976–80	1988–94	1999–2002
Both sexes	6.5	11.3	15.8
Male	6.6	11.6	16.9
Female	6.4	11.0	14.7
Race			
White male	6.1	10.7	14.0
White female	5.2	*9.8	13.1
Black male	6.8	12.3	17.0
Black female	11.2	17.0	22.8
Hispanic male	13.3	17.5	26.5
Hispanic female	9.8	15.3	17.1

^aData from National Center for Health Statistics at <http://www.cdc.gov/nchs/data/hus/hus04trend.pdf#069>.¹⁸

*Relative standard error of > 20–30%.

least likely to be overweight or obese. This finding may be due to the fact that persons in this age group are those who survived to this age because they avoided the adverse health consequences of being overweight or obese.²⁰

The high prevalence of overweight and obesity is not limited to adults. According to the CDC, approximately 14% of children (Table 3) and 12% of adolescents (Table 4) are overweight. The prevalence of overweight in children has tripled between 1980 and 2000 and parallels the increase seen in adults over the same period (Figures 3 and 4).²¹ The growing rate of overweight and obesity in children and adolescents is of particular concern because children and adolescents who are overweight and obese are likely to carry the condition into adulthood,²² thus foretelling significant personal and social health consequences for many years to come if action is not taken to reverse these trends.

Consequences of Overweight and Obesity

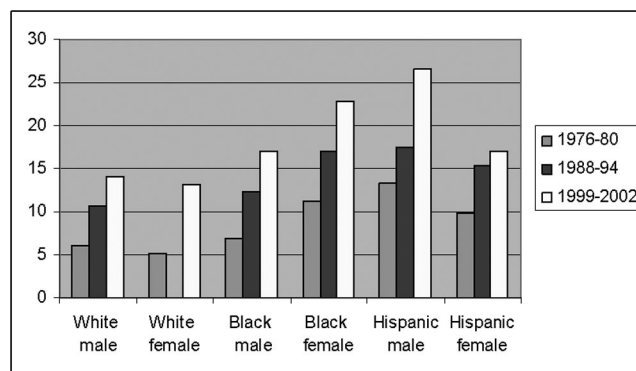
The high prevalence of overweight and obesity has an adverse effect on the health of the population,

Table 4. Prevalence of Overweight for Adolescents 12 to 19 Years Old^a

	1976–80	1988–94	1999–2002
Both sexes	5.0	10.5	16.1
Male	4.8	11.3	16.7
Female	5.3	9.7	15.4
Race			
White male	3.8	11.6	14.6
White female	4.6	8.9	12.7
Black male	6.1	10.7	18.7
Black female	10.7	16.3	23.6
Hispanic male	7.7	14.1	24.7
Hispanic female	8.8	*13.4	19.6

^aData from National Center for Health Statistics at <http://www.cdc.gov/nchs/data/hus/hus04trend.pdf#069>.¹⁸

*Relative standard error of > 20–30%.

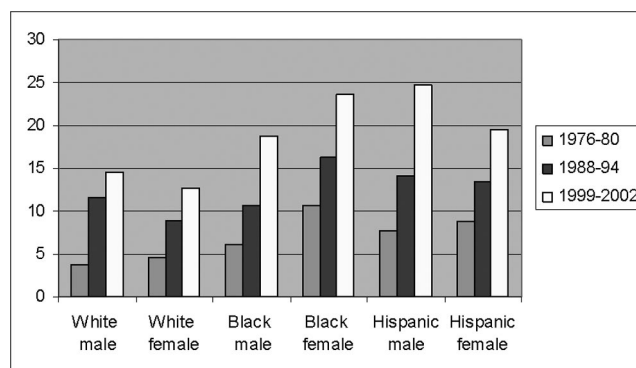
**Figure 3.** Prevalence of overweight in children aged 12 to 19 years by race and gender. (Data from the National Center for Health Statistics.¹⁸)

psychosocial functioning, and quality of life for individuals and families, and the economic stability of the nation.

Medical Consequences

Researchers have consistently found associations between overweight and obesity and increased morbidity and mortality involving nine body systems, many of which are interdependent.²³ Overweight and obesity have been linked to cardiovascular disease, hypertension, diabetes, dyslipidemia, metabolic syndrome, gallstones, osteoarthritis, sleep apnea, and certain forms of cancer.^{7,24,25} The risk of these comorbid conditions is positively correlated with the BMI. The amount of abdominal or visceral fat is of particular concern. Excess abdominal fat or central adiposity is an independent risk factor for morbidity associated with overweight and obesity.²

Field and associates²⁶ followed women in the Nurses Health Study and men in the Health Professionals Follow-Up Study over a 10-year period to determine the relationship of overweight and the development of several common chronic illnesses. Compared to their same-sex peers who were in the healthy BMI range of 18.9 to 24.9, participants whose BMI was 35 or greater

**Figure 4.** Prevalence of overweight in adults by race and gender. (Data from the National Center for Health Statistics.¹⁸)

were about 20 times more likely to develop diabetes, two times more likely to develop heart disease or stroke, 2.5 times more likely to develop hypertension, three times more likely to develop gall stones, and 1.5 times more likely to develop colon cancer.

Furthermore, overweight and obesity have been shown to have a negative effect on longevity. Overall mortality increases when the BMI reaches 25 or greater and even more dramatic increases in mortality are noted when BMI exceeds 30.² Several researchers have investigated the impact of overweight and obesity on life expectancy. Olshansky and associates¹⁹ estimated a reduction in life expectancy at birth of one-third to three-fourths of a year. This reduction in life expectancy, though small, is greater than the negative effects of accidental deaths. Peeters and colleagues²⁰ estimated a decrease in life expectancy of 6 to 7 years at age 40 years among overweight participants in the Framingham Heart Study.

Fontaine and associates²⁷ estimated the years of life lost (YLL) due to obesity over the lifetime of adults aged 18 to 85 years. These investigators found differences between African Americans and whites in the YLL over a range of BMI values corresponding to overweight and obesity (BMI 25-45). Among whites, the YLL increased as BMI increased. For white men, this increase was noted in all age ranges, but was especially high in the 20-, 30-, and 40-year age groups. For white women, an increase was noted but there was little variation among age groups until BMI exceeded 40. Among African American men and women, a consistent increased YLL did not occur until the BMI reached 37 to 38 in African American women and 32 to 33 in African American men. Consistent with the results noted in whites, younger adults in the 20- to 30-year age groups experienced higher YLL compared to their counterparts who were in the 40- to 60-year age groups. Unlike whites, however, African American men and women aged 70 and older experienced a decrease in YLL over all BMI ranges. In other words, obesity seems to have a protective effect for elderly African Americans.

While the association between overweight and obesity is fairly consistent for the increased risk of death and disease, the actual number of American lives lost to obesity has been somewhat controversial. Estimates of the annual number of deaths attributable to overweight and obesity have ranged from 110,000 to 400,000 annually.^{19,28} This variation in estimates is due to the different methods used to create the estimates. Regardless of methods, the number of deaths due to obesity and overweight is impressive and warrants attention.

Psychosocial Consequences

Overweight and obesity also adversely affect the quality of life. Overweight and obesity carry a social stigma that may contribute to higher rates of anxi-

ety, depression, and low self-esteem.^{1,29,30} Persons who are overweight and obese report episodes in which they were ridiculed in public settings. Jokes and derogatory portrayals are common in the popular media.³¹ Adolescents who are overweight are less likely to marry, complete fewer years of education, and have a lower household income in adulthood.²²

Puhl and Brownell³¹ described anecdotal and empirical evidence that adults who are overweight and obese experience discrimination in employment, education, and healthcare. Especially worrisome were the negative attitudes expressed by some health care professionals. Physicians, nurses, dietitians, students, and health care professionals specializing in nutrition reported associating obesity and overweight with poor hygiene, dishonesty, family problems, a lack of intelligence, inactivity, and a lack of will power. Furthermore, these professionals indicated they preferred not to treat or touch these patients and were repulsed by them. The extent to which these negative attitudes influence treatment decisions and the care provided to patients who are obese awaits future investigation.

In addition to the concerns about negative social consequences of obesity and the potential impact on individual's mental health, researchers have recently shown increasing interest in the question of whether there may be some link between the increasing prevalence of obesity and an observed increase in the prevalence of depression in the population. McElroy and associates³² conducted an extensive review of literature from the past 35 years to examine reasons for the comorbidity of obesity with mood disorders. These reviewers found evidence for variability in the co-occurrence of obesity in persons with diagnosed mood disorders such that some types of mood disorders seem to be associated with obesity but other subtypes are associated with being underweight. Subtypes associated with obesity include major depressive disorder with childhood or adolescent onset, major depressive disorder with atypical features, and major depressive disorder with hypercortisolemia, which is associated with visceral fat deposition. After examining studies of the prevalence of mood disorders in clinical populations, the reviewers concluded that, although most obese persons in the community do not have mood disorders, mood disorders may be two to three times more prevalent (20% to 30% vs. 10%) in persons seeking treatment, especially those with morbid obesity, compared with community control subjects.

Obesity is also associated with other mental disorders. Depression and other mental illnesses most likely contribute to obesity through their association with poor eating habits, lack of physical activity, and poor adherence to medications and recommended lifestyle modifications.³³ However, cross-sectional studies in several countries have found increased prevalence of greater abdominal (visceral) fat and metabolic syndrome in patients with schizophrenia and bipolar disorder independent of medications.³⁴

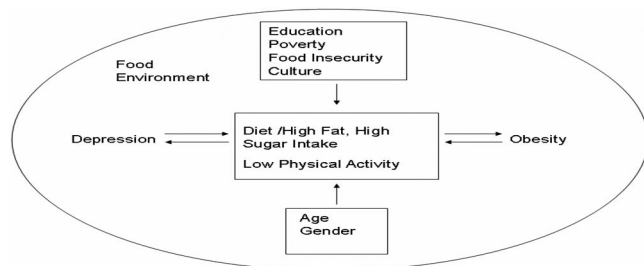


Figure 5. Hypothesized relationships between obesity and psychosocial factors.

In addition, many medications used in the treatment of mental illness tend to cause weight gain.^{35–37} As a result, health care providers are advised to routinely monitor weight for patients in mental health clinics.

Figure 5 summarizes some of the hypothesized relationships between obesity and psychosocial factors discussed in this section. Within the current environment, an increasing number of people are developing both obesity and depression. There are plausible mechanisms by which depression may contribute to weight gain and obesity, and also mechanisms by which obesity may contribute to depressed mood. Lower levels of education, poverty, food insecurity, and certain cultural beliefs seem to be consistently associated with obesity, and these may serve as moderators of the eating and physical activity behaviors that can contribute both to depression and to weight gain. The relationship of these factors is made even more complex by differences observed by gender and age. To help unravel the causes, consequences, and potential interventions for obesity, the complex relationships among all these variables require additional study.

Economic Impact

In addition to the adverse effects on health, the high prevalence of persons who are overweight and obese has an adverse effect on the economy. Overweight- and obesity-related conditions are among the most expensive health care problems, because treatment of these comorbid conditions is associated with greater use and cost of health services.³⁸ Increases in the treatment of and expenditures for diseases associated with obesity have occurred because of increases in the prevalence of overweight and obesity, increases in the number of comorbid conditions being treated for these persons, and changes in the clinical treatment guidelines for persons who do not have symptoms.³⁹

It is estimated that treatment of obesity-related conditions accounts for \$92.6 to \$117 billion, which is approximately 5.7% to 9.1% of the total US health care expenditures.⁴⁰ More than half of these costs are paid with public funds through Medicare and Medicaid.³⁸ However, the amount paid by private insurance is estimated at about \$36.5 billion.³⁹

Wee and associates⁴¹ examined age and racial differences in obesity-related health care expenses among adult participants in the 1998 Medical Expenditure Panel Survey. The mean per capita total health care expenses was \$2970 for adults with healthy weights, \$3038 for adults who are overweight, and \$4333 for adults who were obese. Annual health care expenses increased with rising BMI in all age groups over 35 years. This increase was most dramatic for adults older than 55 years. Among white adults, there was a dramatic increase in total health care expenses as the BMI increased. Among Hispanic adults, total health care expenditures did not increase until the BMI rose above 30. The relationship between BMI and total health care expenses was not statistically significant for African American adults.

Thorpe and associates³⁹ examined how the prevalence and expenditures for treatment of 10 chronic illnesses associated with overweight and obesity (i.e., arthritis, asthma, back problems, diabetes, heart disease, hyperlipidemia, hypertension, mental disorders, other pulmonary conditions, upper gastrointestinal conditions) has changed between 1987 and 2002 for privately insured adults. In 1987, the prevalence of treatment for seven of these conditions was higher among persons who were obese compared with their counterparts who had healthy weights. In 2002, there was an increase in the prevalence of treatment for most of the conditions regardless of weight. However, the prevalence of treatment for persons who were obese was higher for all 10 conditions compared with their counterparts who had healthy weights. Similar increases in the prevalence of treatment were noted among persons who were overweight compared to those with healthy weights. Increased prevalence of treatment was noted in five of the 10 conditions in 1987 and in seven in 2002. The researchers estimated that the share of private health care spending rose during this period from 2% to 11.6% or from \$3.6 billion to \$36.5 billion.

In addition to the direct costs of treating obesity-related conditions, there are indirect costs associated with the value of income lost through decreased productivity, absenteeism, and premature death. Furthermore, the government, employers, and businesses pass the high health care costs to taxpayers, employees, and consumers in the form of higher taxes, cost of goods, and fewer raises in earnings.³⁸ All sectors of the economy experience a decrease in disposable income as a result of high health care expenses. This decrease in disposable income results in a decrease in voluntary contributions to charities, denial of requests for charity care, and a decreased demand for manufactured goods, luxury items, and leisure activities.³⁰

Potential Causes of Overweight and Obesity

Understanding the causes of overweight and obesity is one of the first steps in halting the epidemic. Weight gain is the normal physiologic response that occurs when energy intake exceeds energy expenditure.⁴² Overweight and obesity will result when this energy imbalance persists.

Eating is the primary method of energy gain. However, eating serves a social and emotional function in addition to the biologic function.^{43,44} Hunger, satiety, and thought influence the amount of food a person will eat.⁴⁴ Any condition that adversely affects these factors will influence the amount eaten.

More than 60% of adults who are overweight or obese report using physical activities to lose weight.⁴⁵ However, only 20% of these adults are meeting the physical activity guidelines. Variations in energy expenditure are dependent on resting metabolic rate, increased energy expenditures that occur after eating, as well as energy expended in physical activity.^{43,44}

The general public and many health care professionals attribute overweight and obesity to misbehavior on the part of the persons affected.⁴⁴ For this reason, a plethora of guidelines have been published that provide the public with education for maintaining a healthy weight. However, most adults understand the basics of healthy eating and they know that exercise promotes good health. The problem of overweight and obesity cannot be completely explained by this seemingly simple relationship. Overweight and obesity involve a complex interplay of biologic, genetic, environmental, and psychosocial factors that influence the efficiency with which some people store food and mobilize fat stores.⁴⁶

Biologic Causes

Little is known about the basic biologic causes of obesity. The role of proteins and receptors in the regulation energy balance is an important focus of research. Receptors and neurotransmitters have recently been identified that play a role in the regulation of fasting and feeding. Uncoupling proteins have been identified that may cause obesity through their effect on metabolic rate.⁴²

Other lines of research have explored biologic correlates of food choices and disordered eating associated with negative moods. Chronically elevated levels of glucocorticoids increase the salience of pleasurable activities such as drinking sweet solutions and abdominal fat deposition in rats and probably stimulate intake of high carbohydrate/high fat foods and abdominal obesity in humans as well.²⁹ Thus, women, men and women with abdominal obesity, and people with childhood- or adult-onset depression, or those living with chronic stress may be more vulnerable to depression and obesity.

Genetic Causes

Genetic predisposition increases susceptibility for weight gain and sets the parameters for body size but is rarely the sole cause of obesity.⁴⁴ More than 20 genes have been discovered that may be linked to body fat in humans and chromosomal sites of genes responsible for rare familial obesity syndromes have been identified.⁴² However, the exact mechanism by which these genes exert their pathophysiologic effects and their interaction with other environmental factors is unknown. The identification of these genes and exploration of candidate genes is an important avenue for future research regarding overweight and obesity.

Cultural Factors

Cultural differences in body size preference and the acceptance of overweight figures have been offered as one explanation for racial/ethnic differences in the prevalence of obesity.⁴⁷ Researchers have often found that, compared with white women, African American women are heavier but express less dissatisfaction with their bodies and weight and have body size ideals that are less thin and more congruent with their current perceived size. African American women have high overall self-esteem and perceive themselves to be thinner than their actual size.

Few studies of body size preference have controlled for other factors that may help explain observed ethnic differences, however. Cachelin and associates⁴⁷ examined body image and body size assessments in a multiethnic group of 1229 men and women from the Los Angeles area. These researchers controlled for age, body weight, and educational level as a proxy for socioeconomic status. Compared with men, women were more likely to want to lose weight, chose a thinner female figure as attractive, and believed that men would rate as attractive a thinner figure than the men actually chose. For an attractive male figure, there were no gender differences.⁴⁷ Notably, when BMI, education, and age were controlled, there were no racial/ethnic differences in perceptions of attractive and acceptable figures among men and few differences among women. The researchers concluded that differences in acceptable body size or tolerance for larger size by African and Hispanic Americans may not exist or may be largely explained by other factors. Further studies are needed to improve understanding of body size preferences and their relationships to weight status and weight management efforts.

Social and Environmental Factors

The association between industrialization and increasing body weight has been noted among people residing on the continent of Africa, in Latin America, and in Haiti.⁴⁴ This association has been offered as one explanation for increasing rates of overweight and obesity in the United States. Americans are consum-

ing more calories and expending less energy in physical activity. The opportunity for physical activity has diminished dramatically. More people have sedentary jobs, energy-saving devices that decrease physical demands are more prevalent, and fewer people are biking or walking to work and for leisure activities. Television, computers, and central air-conditioning and heat have increased the appeal of staying inside for leisure activity. Physical education programs have been eliminated from many school systems because of budget constraints. In some neighborhoods, the infrastructure as well as perceived or real danger discourages people to engage in outdoor activities such as walking the dog, pushing strollers, jogging, and playing ball.⁴⁸

While energy expenditures have been decreasing over the past century, access to good-tasting, inexpensive food that requires little or no preparation has increased. The US culture promotes the heavy consumption of foods that are high in calories, sugar, and fat. The food industry spends about \$11 billion annually on advertising and \$22 billion on consumer promotions. Much of this advertisement and promotion is targeted toward children.⁴⁸ The industry encourages unhealthy eating habits by promoting the taste, accessibility, convenience, and cost of unhealthy foods to the detriment of healthy foods that require more effort for preparation and are more likely to be perishable. Unhealthy foods can be found in restaurants, convenience stores, vending machines, gas stations, bookstores, museums, and even in hospitals.⁴⁴ As a result of these factors, some data indicate the average caloric intake has risen from 1826 kilocalories per day (kcal/d) in the period of 1977 to 1980 to 2002 kcal/d in 1994 to 1999.⁴⁸

With so many biologic and social contributing factors, the economics of dietary choices that promote obesity may too easily be underestimated. A person can purchase 1500 calories for \$5 at a fast food restaurant and even less at a grocery store. Government programs provide assistance to persons at risk for inadequate nutrition; however, there is as yet little evidence about the effects of these programs on food purchases and healthy diet choices. Although food is relatively inexpensive in the United States, low-income families still have to spend a greater proportion of their resources on food.⁴⁹ On a per unit of food energy basis, the cost of potato chips is only about 20% the cost of raw carrots. Studies indicate that the quality of diets improves with higher household income, and food purchases by wealthier households include more higher quality meats, fish and seafood, and more fruit and vegetables.⁵⁰ Purchasing low-cost, high-fat, and high-sugar food products instead of more costly raw fruits and vegetables may be rewarding not only because these foods are highly palatable and easy to prepare, but also because saving money on food may allow purchase of other products and entertainment desired by the family.

Summary

The current “epidemic” of overweight and obesity threatens to overtake the nation like a tsunami, wreaking havoc on medical, social, and economic health of the United States. More than 60% of adults and the highest percentage of children and adolescents in history are overweight or obese. Although obesity is increasing for all sociodemographic groups, there do appear to be important subgroup differences, particularly among women and African Americans. These differences seem to be associated with biologic, behavioral, and societal differences. Epidemiologic, clinical, and physiologic studies have demonstrated that overweight and obesity are causally related to multiple serious health conditions, notably cardiovascular disease, the nation’s number one cause of morbidity and mortality. Also, serious psychosocial sequelae, including reduced overall quality of life and depression, are associated with increasing weight. Economic consequences are astronomical with nearly 10% of the health care budget now going to the treatment of obesity and its associated risk factors and conditions.⁴⁰ Answers are needed that elucidate the multifactorial risk factors and causes of this epidemic. Also, novel multidisciplinary preventive and therapeutic approaches, and social and economic changes will be required to address the complex interplay of biologic, genetic, and social factors that have created the current obesity epidemic.

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