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The Epidemic of Obesity

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As the obesity epidemic spreads, concern about the significant health and economic consequences has also grown. Obesity has been linked to a variety of chronic diseases, almost 300,000 deaths each year, and $117 billion in direct and indirect annual costs in the United States alone. In this article we review the recent trends in overweight and obesity, summarize the lifestyle factors that influence the increasing prevalence of obesity, and discuss the health and economic impact of the obesity epidemic. (*J Clin Endocrinol Metab* 89: 2522–2525, 2004)

THE UNITED STATES is experiencing an epidemic of overweight and obesity. The prevalence of excess weight is increasing rapidly across the country, and today close to 65% of the adult population is overweight or obese (1). Comparing the period 1976–1980 (2) with 1999–2000 (1), the prevalence of overweight [body mass index (BMI) $\geq$ 25 kg/m^2] has increased by 40% (from 46.0% to 64.5%) and the prevalence of obesity (BMI $\geq$ 30 kg/m^2) has risen by 110% (from 14.5% to 30.5%).

We are also witnessing an alarming increase in weight among our youth. More than 10% of 2- to 5-yr-olds and 15% of 6- to 19-yr-olds are overweight (BMI $\geq$ 95th percentile for age and gender) (3). This represents a near-doubling of overweight children and a near-tripling of overweight adolescents over the last two decades (4). Whereas some segments of the population are more likely to be overweight or obese than others, people of all ages, races, ethnicities, socioeconomic levels, and geographic areas are experiencing a substantial increase in weight (4).

International data indicate that the epidemic is not isolated to the United States but is in fact a global health problem (5, 6). The prevalence of obesity is rising in other developed and affluent countries and is now spreading to less affluent countries (6).

Lifestyle trends

Overweight and obesity result from the interaction of many factors, including genetic, metabolic, behavioral, and environmental influences. The rapidity with which obesity is increasing suggests that behavioral and environmental influences, rather than biological changes, have fueled the epidemic. Increasing energy consumption, decreasing energy expenditure, or a combination of both has led to a positive energy balance and a marked increase in weight in our society.

Over time, changes in our eating habits and activity levels have occurred, but the specific details of these complex behavior changes are not well understood. In evaluating caloric intake, the data from large national surveys have shown mixed results (7). For example, data from the National Health and Nutrition Examination Survey suggest that average energy intake increased between 1971 and 2000 (8). However, Popkin *et al.* (9) analyzed data from the Nationwide Food Consumption Survey (1965 and 1977–1978) and the Continuing Survey of Food Intake by Individuals (1989–1991 and 1994–1996) and did not find a large difference in caloric intake in 1994–1996 compared to 1965.

Outside national surveys, ecological data seem to support the idea that energy intake has increased (7). Despite the fact that there has been an increase in availability and consumption of lower-fat food items over time, a number of trends have been described that could contribute to an increased energy balance and the observed rise in obesity: higher per capita energy availability (10), increased percentage of food consumed outside the home including fast foods (7, 11), greater consumption of soft drinks (11–13), and larger portion sizes (7, 13).

The inconsistent data on energy intake suggest that rising levels of obesity may be more closely related to changes in energy expenditure. As with energy intake, competing influences exist. For example, the number of health clubs, recreational facilities, and homes with exercise equipment has grown (14). However, sedentary activities, such as television watching and videogame playing, have also increased. Of note, television viewing is associated with greater weight in children and adults (15), but it is unclear whether this relationship is due more to a corresponding increase in food consumption or a decrease in physical activity (14). Overall, it appears that levels of leisure-time activity have not changed significantly (16).

What seems to have changed, however, is the level of activity required for work and daily living (17), although this has not yet been well documented. With advances in technology, there has been a greatly reduced dependence on walking and cycling for transportation. Household physical activity has likely decreased due to labor-saving devices. Occupational energy requirements have also dropped as mechanized labor aids have become available, and in general, jobs have become more sedentary.

Today 60% of the U.S. population does not participate in

Abbreviations: BMI, Body mass index; CVD, cardiovascular disease.

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regular physical activity, and 25% are almost entirely sedentary (18). In addition, physical activity in schools has declined, and almost half of young Americans between the ages of 12 and 21 yr are not vigorously active on a routine basis (18).

Although the complexities of this relationship are not yet fully understood, the end result is quite clear: the imbalance of energy intake and energy expenditure has resulted in an epidemic of overweight and obesity across the United States.

Measuring overweight and obesity

As the prevalence of overweight and obesity continues to increase, efforts have been made to quantify this weight change in individuals and in the population. Because fat is stored throughout the body, it cannot be measured directly. Body weight itself can provide an indication of fat stores, but because body build and composition are extremely variable, there is no ideal body weight. Instead, other measurements are often used to estimate body fat and better quantify health risk. These include BMI, waist circumference, waist/hip ratio, skin-fold thickness, and bioimpedance. Although these measurements cannot capture all the variables that impact risk, they can be used as tools to estimate risk.

The measurement used most often to quantify body fat is BMI. It is relatively easy to calculate (weight in kilograms divided by the square of the height in meters); it has defined risk categories (overweight, BMI $\geq 25\ kg/m^2$; and obese, BMI $\geq 30\ kg/m^2$), and it is closely correlated with body fat in most people. It is not a perfect measure, however. BMI does not distinguish between fat mass and lean mass and, therefore, does not provide an accurate indication of body fat in extremely muscular individuals or people who have lost significant muscle mass. In addition, BMI may not be a sensitive indicator of the health risks associated with moderate weight gain (10–20 lb) in individuals that fall within the normal BMI range. Despite these limitations, BMI can be a reliable and valid measure for identifying adults at increased risk of overweight- and obesity-related morbidity and mortality (19).

Health consequences

Even small increases in weight across a population can have a devastating impact on public health. Close to 300,000 deaths each year in the United States may be attributable to obesity (20), making obesity the second leading cause of preventable death in this country (21). Excess weight increases the risk of multiple conditions, including cardiovascular disease, type 2 diabetes, cancer, and premature death (4). The adverse health consequences occur not only in individuals who are in the overweight and obese categories, but disease risk also starts to increase even for those at the upper end of the normal range (BMI 22.0–24.9) (22).

Although there are a multitude of negative consequences associated with excess weight, many may be reversible with weight loss. For example, randomized trials have shown that weight loss leads to a reduction in blood pressure, better glucose tolerance, and an improved lipid profile (21). The U.S. Preventive Services Task Force has concluded that these improvements in intermediate outcomes provide indirect evidence of the health benefits achievable with modest weight reduction (19).

Heart disease

A large variety of studies have linked obesity to an increased risk of heart disease, and it has been estimated that 20–30% of cardiovascular disease (CVD) mortality may be attributable to excess body weight (23). This is especially significant given that heart disease is the most common cause of death in the United States, killing more than 700,000 Americans each year (24). Men and women who are overweight or obese may be 2 to 3 times more likely than their leaner peers to develop CVD (25, 26), and they are also more likely to die from it (23). Moreover, excess weight early in life is predictive of coronary heart disease mortality. Overweight adolescents may be more than twice as likely as their lean peers to die from coronary heart disease during adulthood (27).

Hypertension

Among men and women, hypertension is one of the most common conditions related to overweight and obesity (28). The diagnosis and treatment of hypertension come with enormous personal and financial costs, and complications include an increased risk of CVD, aortic dissection, renal damage, and cerebrovascular disease. In terms of its association with excess weight, there is a strong linear relation between BMI and blood pressure, and both weight (29–31) and weight gain (32, 33) are positively associated with the development of hypertension. For example, compared with leaner women, overweight women may be almost 3 times more likely and obese women nearly 6 times more likely to develop hypertension (29).

Diabetes

More than 18 million people in the United States have type 2 diabetes (34), which is the sixth leading cause of death in this country (24). Complications of diabetes include blindness, kidney disease, heart disease, stroke, peripheral vascular disease, and neuropathy. Using data from the Nurses Health Study (35), it was estimated that as much as 80% of type 2 diabetes could be attributed to the combined effect of inactivity and overweight/obesity (personal communication, Hu F.B., January 2001). There is a strong linear relationship between BMI and risk of type 2 diabetes mellitus, and obese individuals have almost 10 times the risk of diabetes, compared with their nonobese peers (36, 37). Independent of BMI, weight gain, waist circumference, and waist/hip ratio also strongly correlate with diabetes risk (38–42).

Cancer

Excess weight has been linked to a variety of cancers. The International Agency for Research on Cancer has estimated that overweight and obesity cause 9% of postmenopausal breast cancer, 11% of colon cancer, 25% of renal cancer, 37% of esophageal cancer, and 39% of endometrial cancer (5). Calle *et al.* found that obesity was associated with a higher risk of death from 14 cancers (esophagus, colon and rectum, liver, gallbladder, pancreas, kidney, non-Hodgkin lymphoma, multiple myeloma, stomach, prostate, breast, uterus, cervix, and ovary), and it was estimated that overweight and obesity may account for 14% of all cancer deaths in men and 20% in women (42a).

Cerebrovascular disease

Stroke is the third leading cause of death in the United States (24) and a leading cause of significant, long-term disability. Various measures of obesity have been associated with an increased risk of cerebrovascular disease in men and women. For example, Rexrode *et al.* (43) reported that the risk of ischemic stroke increased with BMI, and obese women had approximately twice the risk as lean women. In men, associations between stroke and both BMI (22) and waist/hip ratio (43a) have been reported.

Gallstones

Gallstones are fairly common, and whereas many are asymptomatic, they can cause pain and inflammation and often lead to treatment with laparoscopic cholecystectomy. Although gallstones do form in lean adults, the relationship between weight and gallstone formation is very strong. Compared with women in the healthy weight range, overweight women have close to twice the risk of developing gallstones, and obese women have 2.5–3 times the risk. Gallstones are more common in women; however, similar trends of increased risk with higher BMI have also been seen in men (22).

Osteoarthritis

More than 20 million people in the United States have osteoarthritis (44). This condition, characterized by the degeneration of the joint cartilage, can cause severe pain and functional limitations. It is a leading cause of disability and also the most common reason for joint replacement surgery. Compared with their leaner peers, overweight adults are at increased risk of developing osteoarthritis of the knee (45) and are more than twice as likely to develop osteoarthritis in the hip (45). Overweight and obesity are also associated with an increased risk of knee and hip replacement surgery (46).

Additional consequences

In addition to the diseases discussed above, overweight and obesity also increase the risk of a large variety of other conditions, including dyslipidemia, sleep apnea, asthma (4), cataracts (47–49), benign prostatic hypertrophy (50), menstrual irregularities, pregnancy complications, depression, and social discrimination (4). Obesity also negatively affects physical functioning, vitality (51), and general quality of life (52).

Economic impact

Excess weight not only causes widespread health effects, but it also results in a tremendous economic burden. Assessing this economic cost is an additional method of summarizing the broad impact of the epidemic on society. It is estimated that obesity costs the United States $117 billion each year (4). This estimate includes both direct costs (related to diagnosis and treatment of illness, including doctor visits, medications, hospitalizations, and nursing home stays) and indirect costs (resulting from lost wages and productivity due to illness or premature death) (4, 53).

The true cost of the current epidemic of overweight and obesity, however, is likely much higher than the $117 billion estimate. The estimate is based on the costs of obesity and does not fully address the costs related to those who are overweight but not obese. It also does not take into account other significant and costly conditions associated with obesity, such as reduced physical functioning, sleep apnea, pregnancy complications, and cataracts. Using a conservative approach, Thompson *et al.* (54) estimated that the excess health care costs linked to obesity were nearly as high as those associated with smoking.

Conclusions

The prevention and treatment of excess weight is critical for the health of both individuals and our society. Health care providers can play an important role in monitoring patients' weight and assisting with diet and physical activity counseling. The U.S. Preventive Services Task Force recommends that clinicians screen patients for obesity and offer intensive counseling and behavioral interventions (19). All patients should be encouraged to maintain a healthy weight by eating a nutritious diet and exercising regularly to balance energy intake and energy expenditure. Individuals who are overweight should be assisted in losing weight gradually with a focus on long-term weight loss and maintenance. A variety of approaches can be effective in treating excess weight, and detailed guidelines have been created for providers to help patients with weight management (21).

Lifestyle interventions have proven effective in preventing and treating obesity (21, 55) and its health consequences (56). However, to be most successful and sustain positive change over time, individuals' efforts must be facilitated and supported by the larger physical environment. With this aim, a variety of resources have been developed to address the issues of overweight and obesity at the community and population levels (57, 58). Multilevel interventions are needed if we are to stem the epidemic and prevent the growing negative consequences of overweight and obesity.

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