Childhood Obesity — The Shape of Things to Come

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Related articles, pages 2329 and 2371

Last week, I met with the G. family in the Optimal Weight for Life (OWL) clinic at my hospital. One of the parents was overweight, and the other was obese. The five children were more severely obese and had numerous weight-related complications — one had evidence of fatty liver, one had high blood pressure, two had gastroesophageal reflux, two had orthopedic problems, three had marked insulin resistance, four had dyslipidemia, and all had emotional problems related to their weight.

Sadly, this family might be a microcosm of 21st-century America: if we don't take steps to reverse course, the children of each successive generation seem destined to be fatter and sicker than their parents. How will obesity affect the physical and psychological well-being of children in coming decades? What effects will childhood obesity have on life expectancy, the national economy, and our society? To explore these questions, one might view the obesity epidemic as consisting of four overlapping phases.

Phase 1 began in the early 1970s and is ongoing: average weight is progressively increasing among children from all socioeconomic levels, racial and ethnic groups, and regions of the country. Today, about one in three children and adolescents is overweight (with a body-mass index, or BMI, in the 85th to 95th percentile for age and sex) or obese (BMI above the 95th percentile), and the proportion approaches one in two in certain minority groups.[1] Though it has attracted much attention from the medical profession and the public, childhood obesity during this phase has actually had little effect on public health, because an obese child may remain relatively healthy for years.

Phase 2, which we are now entering, is characterized by the emergence of serious weight-related problems.[2] The incidence of type 2 diabetes among adolescents, though still not high, has increased by a factor of more than 10 in the past two decades and may now exceed that of type 1 diabetes among black and Hispanic adolescents. Fatty liver associated with excessive weight, unrecognized in the pediatric literature before 1980, today occurs in about one in three obese children. Other obesity-related complications affecting virtually every organ — ranging from crippling orthopedic problems to sleep apnea — are being diagnosed with increasing frequency in children (see table). There is also a heavy psychosocial toll: obese children tend to be socially isolated and have high rates of disordered eating, anxiety, and depression. When they reach adulthood, they are less likely than their thinner counterparts to complete college and are more likely to live in poverty.

It may take many years to reach phase 3 of the epidemic, in which the medical complications of obesity lead to life-threatening disease. As Baker et al. (pages 2329–2337) and Bibbins-Domingo et al. (pages 2371–2379) report in this issue of the *Journal*, overweight or obesity in childhood or adolescence increases the risk of coronary heart disease (CHD) in adulthood; by 2035, Bibbins-Domingo et al. predict, the prevalence of CHD will have increased by 5 to 16%, with more than 100,000 excess cases attributable to increased obesity among today's adolescents. Preliminary data from Canada suggest that adolescents with type 2 diabetes will be at high risk for limb amputation, kidney failure requiring dialysis, and premature death. In some, fatty liver will progress to hepatitis and cirrhosis, which may remain asymptomatic until irreversible organ damage has occurred. Poverty and social isolation would complicate the timely identification and management of such problems. Shockingly, the risk of dying by middle age is already two to three times as high among obese adolescent girls as it is among those of normal weight, even after other lifestyle factors are taken into account.[3] My colleagues and I have predicted that pediatric obesity may shorten life expectancy in the United States by 2 to 5 years by midcentury — an effect equal to that of all cancers combined.[4]

Without effective intervention, phase 4 of the epidemic will entail an acceleration of the obesity

Complications of Childhood Obesity.

Psychosocial	Poor self-esteem Anxiety Depression Eating disorders Social isolation Lower educational attainment
Neurologic	Pseudotumor cerebri
Endocrine	Insulin resistance Type 2 diabetes Precocious puberty Polycystic ovaries (girls) Hypogonadism (boys)
Cardiovascular	Dyslipidemia Hypertension Coagulopathy Chronic inflammation Endothelial dysfunction
Pulmonary	Sleep apnea Asthma Exercise intolerance
Gastrointestinal	Gastroesophageal reflux Steatohepatitis Gallstones Constipation
Renal	Glomerulosclerosis
Musculoskeletal	Slipped capital femoral epiphysis Blount's disease* Forearm fracture Back pain Flat feet

* Blount's disease is a growth disorder of the tibia that causes the lower leg to angle inward (tibia vara).

rate through transgenerational mechanisms. Obese children tend to be heavy in adulthood, in part because obesity-promoting habits persist. In addition, carrying excessive weight early in life may elicit irreversible biologic changes in hormonal pathways, fat cells, and the brain that increase hunger and adversely affect metabolism. Furthermore, adult obesity and its complications appear to increase the risk of obesity and its complications in offspring through nongenetic influences, a phenomenon termed perinatal programming. For example, a recent study found that maternal hyperglycemia during pregnancy strongly predicted BMI in offspring at 5 to 7 years of age, after adjustment for maternal weight gain and birth weight.[5]

Currently, the economic costs of pediatric obesity in the United States are relatively small — probably several hundred million dollars annually. Without effective intervention, the costs of obesity might well become catastrophic, arising not only from escalating medical expenses but also from diminished worker productivity, caused by physical and psychological disabilities. Future economic losses could mean the difference between solvency and bankruptcy for Medicare, between expanding and shrinking health care coverage, and between investment in and neglect of our social infrastructure, with profound implications for our international competitiveness. The human costs would be incalculable.

Like global warming, the obesity epidemic is a looming crisis that requires action before all the scientific evidence is in. And as with climate change, some have questioned experts' forecasts, doubting the far-reaching impact of obesity, though skepticism is gradually being overcome by accumulating data. Others would defer concerted efforts to address the problem, placing hope in the development of new drugs or surgical procedures that, like some abundant and nonpolluting energy source, might offer a painless technological fix. Or they argue that the costs of action are too great, not recognizing that our survival depends on solving the problem. But I believe that obesity differs in one important respect from global warming: simple solutions are available, and with a comprehensive national strategy, we may be able to implement them without great sacrifice.

Certainly, we have much to learn about the regulation of body weight. Low-fat diets have yielded disappointing results, and very-low-carbohydrate diets appear to be more effective only in the short term. Novel approaches that focus on the quality rather than the ratio of macronutrients appear promising, and other areas warrant study, including the effects of sleep deprivation, stress, infectious agents, and endocrine-disrupting environmental toxins on weight. Unfortunately, the U.S. government has thus far invested only a fraction of a cent in research for every dollar that obesity costs society. And although broad consensus exists regarding the dietary and lifestyle habits needed to prevent and treat childhood obesity, we lack anything resembling a comprehensive strategy for encouraging children to eat a healthful diet and engage in physical activity. Such a strategy would include legislation that regulates junk-food advertising, provides adequate funding for decent lunches and regular physical activities at school, restructures the farm-subsidies program to favor nutrient-dense rather than

calorie-dense produce, and mandates insurance coverage for preventing and treating pediatric obesity.

Parents must take responsibility for their children's welfare by providing high-quality food, limiting television viewing, and modeling a healthful lifestyle. But why should Mr. and Ms. G.'s efforts to protect their children from life-threatening illness be undermined by massive marketing campaigns from the manufacturers of junk food? Why are their children subjected to the temptation of such food in the school cafeteria and vending machines? Why don't they have the opportunity to exercise their bodies during the school day? And why must Mr. and Ms. G. fight with their insurance company for reimbursement to cover the costs of their children's care at the OWL clinic? Fortunately, with the exercise of both personal and social responsibility, we have the power to choose the shape of things to come.

An interview with Dr. Ludwig can be heard at www.nejm.org.

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