

Obesity

Obesity is weight that endangers health because of its high body fat relative to lean body mass. It is highly prevalent in societies in the developed world and is linked to very high rates of chronic illnesses, higher than living in poverty, and much higher than smoking or drinking.³⁴³ Physical inactivity and poor diet are stated to be the most important contributors to obesity, although other contributing factors play an important role as well.³⁴⁴ Weight gain during teen years may worsen adult heart health^{345 346} while excess body weight during midlife is associated with an increased risk of death.³⁴⁷ And, in comparison to men, women suffer a disproportionate burden of disease attributable to overweight and obesity.³⁴⁸

Persons are classified as underweight, normal weight, overweight, and obese using the body mass index (BMI), expressed as weight/height² (kg/m²); obese is subdivided into obese and morbidly obese (about 100 lb overweight or BMI ≥ 40). Although it is recognized that these distinctions are imperfect and somewhat arbitrary, this method of classification is standard.³⁴⁹ Other terminology such as “at risk of overweight” and “overweight” for children have been used by the Centers for Disease Control and Prevention (CDC) and are recommended to be replaced by “overweight” and “obese” (www.amednews.com 7/9/07); those recommendations will be followed in this report.

Prevalence

Obesity has increased at an alarming rate in the US over the past three decades.³⁵⁰ The prevalence of morbidly obese is increasing faster in the US than the prevalence of moderately obese (BMI ≥ 30 to < 40).³⁵¹ In addition, it is believed that the obesity epidemic among children will lead to a large

³⁴³ Sturm R, Wells KB. Does obesity contribute as much to morbidity as poverty or smoking? *Public Health Rep* 2001;115:229-295.

³⁴⁴ Keith SW et al. Putative contributors to the secular increase in obesity: exploring the roads less traveled. *Int J Obes* 2006;30:1585-1594.

³⁴⁵ Baker JL et al. Childhood body-mass index and the risk of coronary heart disease in adulthood. *N Engl J Med* 2007;357:2329-2337.

³⁴⁶ Bibbins-Domingo K et al. Adolescent overweight and future adult coronary heart disease. *N Engl J Med* 2007;357:2371-2379.

³⁴⁷ Adams KF et al. Overweight, obesity, and mortality in a large prospective cohort of persons 50 to 71 years old. *N Engl J Med* 2006;355:763-778.

³⁴⁸ Muennig P et al. Gender and the burden of disease attributable to obesity. *Am J Public Health* 2006;96:1662-1668.

³⁴⁹ Cole TJ et al. Body mass index cut offs to define thinness in children and adolescents: international survey. *Brit Med J* 2007;335:194.

³⁵⁰ Wang Y, Beydoun MA. The obesity epidemic in the United States – gender, age, socioeconomic, racial/ethnic, and geographic characteristics: a systematic review and meta-regression analysis. *Epidemiol Rev* 2007;29:6-28.

³⁵¹ Sturm R. Increases in morbid obesity in the USA:2000-2005. *Public Health* 2007;121:492-496.

number of younger adults with type 2 diabetes.³⁵²

Estimates of obesity in the population can be derived from the National Health and Nutrition Examination Surveys (NHANES) and the Behavioral Risk Factor Surveillance System (BRFSS), however, it is believed that the BRFSS under estimates the actual prevalence of overweight and obesity.^{353 354} This is because women of all ages under estimate their weight while young and middle-aged men often over report their height; these behaviors then lead to faulty BMI calculations.

Based on NHANES data, currently, 66% of adults are overweight or obese; 34% of children are overweight and 16% are obese, and 11.5% of children 6-23 m old are obese (www.cdc.gov/nchs). Further, it is estimated that 21.4% of aged Medicare beneficiaries and 39.3% of disabled beneficiaries are obese.³⁵⁵ There are some indications that levels of obesity may be leveling off in children, adolescents and adults.^{356 357}

Significant differences in obesity exist by race/ethnicity and by age. Approximately 30% of non-Hispanic white adults are obese compared to 45% of non-Hispanic blacks and 36.7% of Hispanics. Non-Hispanic black and Hispanic children are much more likely to be overweight than non-Hispanic white children. Non-Hispanic black females and Hispanic males have the highest prevalences of being overweight among children and adolescents.³⁵⁸ BMI, as it is currently employed, however, may misdiagnose Asians, many of whom experience metabolic risks such as hypertension and diabetes at a much lower threshold than is associated with other racial/ethnic groups. Poor children with a sedentary lifestyle are 3.7 times more likely to be obese than their active, affluent counterparts.³⁵⁹ Race, socioeconomic status, and behavioral factors are independently related to childhood and adolescent obesity.

Interestingly, NHANES data also found that adults who slept <6 hours a night had the highest

³⁵² Lee JM. Why young adults hold the key to assessing the obesity epidemic in children. *Arch Pediatr Adolesc Med* 2008;162:682-687.

³⁵³ Yun S et al. A comparison of national estimates of obesity prevalence from behavioral risk factor surveillance system and the national health and nutrition examination survey. *Int J Obes* 2006;30:164-170.

³⁵⁴ Ezzati M et al. Trends in national and state-level obesity in the USA after correction for self-report bias: analysis of health surveys. *J Royal Soc Med* 2006;99:250-257.

³⁵⁵ Doshi JA et al. Prevalence and trends in obesity among aged and disabled US Medicare beneficiaries, 1997-2002. *Health Aff* 2007;26:1111-1117.

³⁵⁶ Ogden CL et al. Obesity among adults in the United States – no changes since 2003-2004. *NCHS Data Brief* 2007; No. 1. www.cdc.gov/nchs

³⁵⁷ Ogden CL et al. High body mass index for age among US children and adolescents, 2003-2006. *J Am Med Ass* 2008;299:2401-2405.

³⁵⁸ Kimbro RT et al. Racial and ethnic differentials in overweight and obesity among 3-year old children. *Am J Public Health* 2007;97:298-305.

³⁵⁹ Singh GK et al. Racial/ethnic, socioeconomic, and behavioral determinants of childhood and adolescent obesity in the United States: analyzing independent and joint associations. *Ann Epidemiol* 2008;18:682-695.

rate obesity (33%) while those who slept 7-8 hours had the lowest (22%).³⁶⁰ This pattern was found for both men and women and across all age groups and most race/ethnicity groups. The association between sleep and obesity was less striking among adult ≥ 65 years old than among younger adults. Similarly, the highest rates for physical inactivity were among those individuals who slept < 6 hours or ≥ 9 hours.

While NHANES focuses on national level data, BRFSS can provide estimates of obesity at national, state and local levels. In 2007, state aggregated BRFSS yielded an estimate of 25.6% for adult obesity³⁶¹ while Missouri's 2007 BRFSS data found that 35.1% of adults were overweight (41.7% males; 28.8% of females) and 28.2% were obese (28.5% for males; 27.9% for females).³⁶² The 2007 Missouri County-Level Survey data recorded adult prevalences of 37.7% for overweight and 29.1% for obesity (www.dhss.mo.gov/CommunityDataProfiles). For Clay County, the prevalence rates were 32.3% overweight and 29.2% obese, for Jackson County, the rates were 34.8% overweight and 28.3% obese, and for Platte County, 39.3% overweight and 22.4% obese. With the exception of the obesity prevalence in Platte County, which was statistically lower than the statewide rate, all of the other rates were not different from the rates for Missouri overall. In 2003, 12.1% of high school students in the state were obese.

BRFSS data for the bi-state Kansas City metropolitan area, in 2006, found that of those ≥ 18 years old, 36.2% were overweight and 27.2% were obese.³⁶³ The BRFSS rate for obesity among Kansas Citians was > 2.5 times higher than the rate found in a 2004 telephone survey commissioned by the Kansas City Health Department; That survey reported an obesity rate of 12.9%.³⁶⁴

Overweight is associated with decreased cognitive functioning among school-age children and adolescents.³⁶⁵ This raises serious concerns for academic success and one's life course. Yet, the only local information regarding overweight and obesity comes from the Kansas City University of Medicine and Biosciences' *Score 1 for Health* initiative. That project found, during 2005-2006, that Hispanic students in grades K-5 had the highest prevalence of being overweight/obese (Figure 98).³⁶⁶ While levels of being overweight were similar across grade levels, the prevalence of obesity was higher in later

³⁶⁰ Schoenborn CA, Adams PF. Sleep duration as a correlate of smoking, alcohol use, leisure-time physical inactivity, and obesity among adults: United States, 2004-2006. *NCHS Health E-Stats*, May 2008. www.cdc.gov/nchs

³⁶¹ Galuska A et al. State specific prevalence of obesity among adults – United States, 2007. *MMWR Morb Mortal Wkly Rep* 2008;57:765-768.

³⁶² Missouri Department of Health and Senior Services. *2007 Behavioral Risk Factor Surveillance System*. www.dhss.mo.gov/BRFSS

³⁶³ Kilmer G et al. Surveillance of certain health behaviors and conditions among states and selected local areas – Behavioral Risk Factor Surveillance System (BRFSS), United States, 2006. *MMWR Surv Summ* 2008;57:SS-7.

³⁶⁴ Kansas City Health Department. *2004 Health Assessment Survey*. www.kcmo.org/health.

³⁶⁵ Yangfen L et al. Overweight is associated with decreased cognitive functioning among school-age children and adolescents. *Obesity* 2008;16:1809-1815.

³⁶⁶ Campbell A, Sterling TK. *Score 1 for Health. 2007 Community Report*. www.kcumb.edu/Score1CommunityReport/

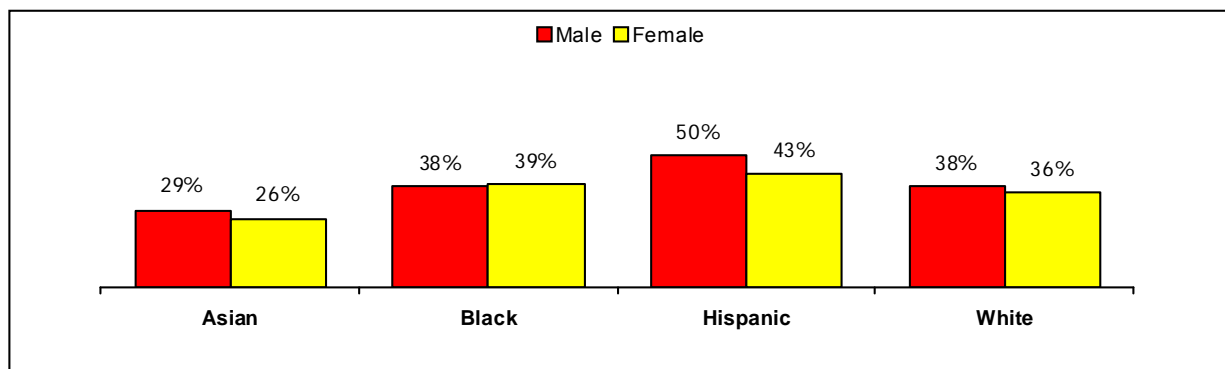
grades. The prevalence of being overweight/obese was higher in white students at lower socioeconomic status schools compared to higher socioeconomic status schools; the reverse was true to black students.

America's 2006 *Obesity Report Card* awarded Missouri a grade of B overall and for childhood obesity (www.ubalt.edu/experts/obesity). And, Trust for America's Health's report, *F as in Fat: How Obesity Policies are Failing in America, 2007*, ranked Missouri as having the 12th highest rate of adult obesity (<http://healthyamericans.org/reports/obesity2007/>). According to CDC, Mississippi had the highest obesity rate at 30.6%.

Health consequences

Being overweight or obese contributes to many health and safety issues ranging from increased risk of breast cancer, complications of pregnancy, increased risk of birth defects, impotence in males, and ability to receive certain diagnostic imaging procedures, to motor vehicle crash injury and death. It also has led to an increase in gastric bypass surgeries as a method of weight loss. The only positive health benefit to being obese (aka obesity paradox) is that these individuals have a lower risk of death from cardiovascular problems than lean persons.^{367 368}

Figure 98 Percent of school-aged children in grades K-5 who were overweight/obese, 2005-2006, Kansas City, Mo, metropolitan area (source: *Score 1 for Health 2007 Community Report, Kansas City University of Medicine and Biosciences*)



³⁶⁷ Fonarow GC et al. An obesity paradox in acute heart failure analysis of body mass index and inhospital mortality for 108,927 patients in the Acute Decompensated Heart Failure National Registry. *Am Heart J* 2007;153:74-81.

³⁶⁸ Uretsky S et al. Obesity paradox in patients with hypertension and coronary artery disease. *Am J Med* 2007;120:863-870.

Obesity, particularly higher levels of obesity, is associated with increased mortality relative to persons of normal weight.³⁶⁹ And, overweight and obese women have lower mortality rates than males up until age 45, after which women's mortality rates are much higher than men's.³⁷⁰ While the impact of obesity on mortality may be decreasing over time, perhaps due to improvements in public health and health care, obesity remains the 2nd leading actual cause of death in the US.³⁷¹ Obesity appears to lessen life expectancy markedly, especially among younger adults.³⁷² Nationally, children and adolescents who are severely obese experience a health-related quality of life as low as that reported by young cancer patients.³⁷³ According to the *Obesity Reduction Survey*, obese Missourians are 3.5 and 2.43 times more likely to develop type 2 diabetes mellitus and hypertension.³⁷⁴

Besides the association of obesity with chronic health conditions, weight also has a dramatic effect on people's ability to manage five basic activities of daily living: bathing, eating, dressing, walking across a room, and getting in or out of bed.³⁷⁵ While men with moderate obesity have a 50% increased probability of having limitations on these abilities; severe obesity is associated with a 300% increased probability. The effects are even larger for women. These differences underscore the need to distinguish between moderate and more severe levels of obesity.

Both chronic health conditions and limitations on the abilities to perform basic activities of daily living contribute to increased levels of disability among obese individuals.³⁷⁶ Disability rates are increasing among the non-elderly and the increases cut across all demographic and economic groups. Although mental health is one of the most important causes of disability among the non-elderly, the fastest growing causes are diabetes³⁷⁷ and musculoskeletal problems,³⁷⁸ conditions that are associated with obesity. Disability is projected to increase 1% per year in 50-69 year olds if there were no further gains in weight.³⁷⁹

³⁶⁹ Flegal KM et al. Excess deaths associated with underweight, overweight, and obesity. *J Am Med Ass* 2005;293:1861-1867.

³⁷⁰ Muennig P et al. Gender and the burden of disease attributable to obesity. *Am J Public Health* 2006;96:1662-1668.

³⁷¹ Mokdad AH et al. Correction: Actual causes of death in the United States, 2000. *J Am Med Ass* 2005;293:293-294.

³⁷² Fontaine KR et al. 2003. Years of life lost due to obesity. *J Am Med Ass* 2005;289:187-193.

³⁷³ Schwimmer JB et al. Health quality of life of severely obese children and adolescents. 2003. *J Am Med Ass* 2003;289:1813-1819.

³⁷⁴ Majid N. The obesity epidemic: lessons from the war on smoking. *Missouri Med* 2005;102:550-554.

³⁷⁵ McDowell MA et al. Health characteristics of US adults by body mass index category: results from NHANES 1999-2002. *Public Health Rep* 2006;121:67-73.

³⁷⁶ Lakdawalla E et al. Are the young becoming more disabled? Rates of disability appear to be on the rise among people age eighteen to fifty-nine, fueled by a growing obesity epidemic. *Health Aff* 23: 2004;168-176.

³⁷⁷ Hannon TS et al. Childhood obesity and type 2 diabetes mellitus. *Pediatrics* 2005;116:473-480.

³⁷⁸ Taylor ED et al. Orthopedic complications of overweight in children and adolescents. *Pediatrics* 2006;117:2167-2174.

³⁷⁹ Sturm R et al. Increasing obesity rates and disability trends. *Health Aff* 2004;23:1-7.

Economic impact

Obesity outranks both smoking and drinking in its deleterious effect on health care costs.³⁸⁰ And, obesity and smoking are primary risk factors for several chronic conditions and early death. Among the obese, 4.7% or about 9 million individuals smoke.³⁸¹ Further, there may be an association between a woman's smoking during pregnancy and her child being overweight by 8 years of age.³⁸²

In 2000, the economic burden caused by obesity related health problems had been put at \$117 billion. More than half of obesity related medical costs, which totaled \$75 billion in 2003, are paid for through Medicare and Medicaid.³⁸³ On average, states spend 5% of their medical costs on obesity. The share of private health care spending attributable to obesity among persons 18-64 years old rose from 2% to 11.6% (from \$3.6 billion to \$36.5 billion) from 1987 to 2002.³⁸⁴ Insurance spending on these obese individuals was 56% higher than that for people of normal weight, partially due to the number of medical conditions treated among the obese. And, for morbidly obese individuals, who comprise 3% of the US adult population, health care costs are nearly double those of normal-weight adults and are >10% of all health care spending.³⁸⁵

More recent data show that young adults are obese (≥ 30 lb overweight) will incur \$5,000-21,000 more in lifetime medical bills while those who are very obese (≥ 70 lb overweight) will incur \$15,000-29,000 more in lifetime medical expenditures.³⁸⁶ Expenditures related to higher BMI have risen dramatically among white and older adults, but not blacks or those younger than 35 years old.³⁸⁷ The higher spending for obese patients is mainly attributable to treatment for diabetes and hypertension.³⁸⁸ Hospitals are having to buy expensive new equipment such as reinforced toilets and oversized beds to treat the growing number of severely obese patients (www.novationco.com).

³⁸⁰ Strum R. The effects of obesity, smoking, and drinking on medical problems and costs: obesity outranks both smoking and drinking in its deleterious effect on health and health care costs. *Health Aff* 2002;21:245-253.

³⁸¹ Heaton CG et al. Smoking, obesity, and their co-occurrence in the United States: cross sectional analysis. *Br Med J* 2006;333:25-26.

³⁸² Chen A et al. Maternal smoking during pregnancy in relation to child overweight: follow-up to age 8 years. *Int J Epidemiol* 2006;35:121-130.

³⁸³ Finkelstein EA et al. State-level estimates of annual medical expenditures attributable to obesity. *Obes Res* 2004;12:18-24.

³⁸⁴ Thorpe KE et al. The rising prevalence of treated disease: effects on private health insurance spending. *Health Aff* 2005;W5:317-325.

³⁸⁵ Arterburn DE et al. Impact of morbid obesity on medical expenditures in adults. *Int J Obes Relat Metab Disorder* 2005;29:334-339.

³⁸⁶ Allison DB et al. Obesity as a disease: a white paper on evidence and arguments commissioned by the Council of the Obesity Society. *Obesity* 2008; 16:1161-1174.

³⁸⁷ Wee CC et al. Health care expenditures associated with overweight and obesity among US adults: importance of age and race. *Am J Public Health* 2005;95:159-165.

³⁸⁸ Thorpe KE et al. The impact of obesity on rising medical spending. *Health Aff* 2004;W4-480.

While it is desirable to reduce the prevalence of obesity and obesity-related morbidity and mortality, as well as the economic burden of obesity, there are data to suggest that although effective obesity prevention will lead to a decrease in costs for obesity-related diseases, this decrease will be offset by cost increases due to diseases unrelated to obesity during the life-years gained.³⁸⁹ In addition, the current economic environment favors underinvestment in obesity prevention by insurance companies.³⁹⁰

In addition to medical expenditures, obesity affects employers. Overweight and obese attributable costs range from \$175 per year for overweight male employees to \$2,485 for obese female employees with a BMI of 35-39.9.³⁹¹ The costs of obesity at a firm with 1,000 employees are estimated to be \$285,000 per year with ~30% of the costs associated with absenteeism. Morbidly obese employees (BMI ≥ 40), while representing only ~3% of the workforce, account for 21% of the obesity associated costs.

Prevention

Obesity is becoming one of the newest targets of public health law,³⁹² such as regulating sugary beverages. However, from a policy point of view, the various economic and psychosocial factors that fuel the obesity epidemic as well as increased availability of energy dense food and reduced physical activity, demand a more equal distribution of affordable nutritious food, and improved, more equitable, living and working conditions.³⁹³

There are two basic approaches to prevention of obesity-related morbidity and mortality. The first involves medical intervention often starting in childhood,^{394 395} and which must recognize ethnic/cultural differences in weight control practices.³⁹⁶ The other approach takes a more global view and focuses on the two most amenable risk factors - lack of regular physical activity and poor diet.³⁹⁷

³⁸⁹ Van Baal, PHM et al. Lifetime medical costs of obesity: prevention no cure for increasing health expenditure. *PLoS Med* 2008;2:e29.

³⁹⁰ Finkelstein EA et al. The lifetime medical cost burden of overweight and obesity: implications for obesity prevention. *Obesity* 2008;16:1843-1848.

³⁹¹ Finkelstein E et al. The costs of obesity among full-time employees. *Am J Health Promot* 2005;20:45-51.

³⁹² Gostin LO. Law as a tool to facilitate healthier lifestyles and prevent obesity. *J Am Med Ass* 2007;297:87-90.

³⁹³ Friel S et al. Unequal weight: equity oriented policy responses to the global obesity epidemic. *Brit Med J* 2007;335:1241-1243.

³⁹⁴ Barlow SE et al. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics* 2007;120(suppl 4):S164-S192.

³⁹⁵ Finkelstein EA, Trogon JG. Public health interventions for addressing childhood overweight: analysis of a business case. *Am J Public Health* 2008;98:411-415.

³⁹⁶ Chao YM et al. Ethnic differences in weight control practices among US adolescents from 1995 to 2005. *Int J Eat Disord* 2008;41:124-133.

³⁹⁷ Kartz D et al. Public health strategies for preventing and controlling overweight and obesity in school and worksite settings. A report on recommendations of the Task Force on Community Preventive Services. *MMWR Morb Mortal Wkly Rep* 2005;54(RR-10):1-12.

Regular physical activity performed on most days of the week reduces the risk of dying prematurely, dying from coronary heart disease, and developing diabetes and colon cancer. Regular activity also reduces blood pressure among people with hypertension, promotes psychological well being, and builds and maintains healthy bones, muscles, and joints so that older adults can avoid falls and maintain functional independence. Combined with poor diet, the lack of regular physical activity leads to obesity.

For Missouri, 2007 BRFSS data found that 25.5% of adults were physically inactive (23.4% of males; 27.6% of females). And, the *2004 Health Assessment Survey* commissioned by the Kansas City Health Department found that 43% of respondents usually or always exercised 3 times a week and 41% reported eating 5 servings of fruits and vegetables on most days, if not daily. BRFSS data from 2006, found that 20.8% of adults in the bi-state metropolitan area had no physical activity in the prior month.

One contributing factor to reduced activity is the composition of the built environment.^{398 399} For example, the ability of citizens to walk for recreation or business often comes down to whether sidewalks are available and if those walkways are considered safe to use. According to the federal Highway Administration, Americans make <6% of their daily trips on foot. Many public health experts say the way neighborhoods are built is to blame. The Urban Land Institute estimates that only 5-15% of new development follows the principles of “walkable neighborhoods.” However, there are reports that find no link between obesity and urban sprawl (www.registerguard.com). In a national ranking of the 40 largest cities in the US, Kansas City ranked 34th in walkability with a score of 44, which reflected the community’s dependence on automobiles (www.walkscore.com).

There is a growing awareness in public health about the need to integrate community development or infrastructure to the health and well being of the citizens.⁴⁰⁰ Kansas City with its large geographic area, low population density, and excellent interstate system, has an infrastructure that is associated with less walking and bicycling and with more automobile travel than more densely populated communities. As land use spreads further apart, existing transportation systems offer few attractive and safe alternatives to driving.

According to the 2003 BRFSS data, 26.2% of Kansas City residents were physically inactive despite the number of private physical fitness centers and the presence of 6 public recreation facilities. The Kansas City Parks and Recreation Department maintains 213 parks scattered throughout the community. Exercise alone, however, is not enough to offset obesity health risks.⁴⁰¹ It is not surprising that portion sizes and energy intake for specific food types have increased markedly with greatest

³⁹⁸ Committee on Physical Activity, Health, Transportation, and Land Use. *Does the built environment influence physical activity? Examining the evidence – special report 282*. National Academies Press, Washington DC, 2005.

³⁹⁹ Papas MA et al. The build environment and obesity. *Epidemiol Rev* 2007;29:129-143.

⁴⁰⁰ Lopez R. Urban sprawl and risk for being overweight or obese. *Am J Public Health* 2004;94:1574-1579.

⁴⁰¹ Hu FB et al. Adiposity as compared with physical activity in predicting mortality in women. *N Engl J Med* 2004;351:2694-2703.

increases for food consumed at fast food establishments and in the home.⁴⁰²

Intriguingly, there is some evidence for an infectious origin for at least some cases of obesity.⁴⁰³ Adenovirus 36 is known to be able to cause precursor cells to differentiate into fat cells, and that could promote obesity in humans and animals. A single gene, E4 ORF-1, in adenovirus 36 is responsible for triggering this process.⁴⁰⁴

⁴⁰² Nielsen SJ, Popkin BM. Patterns and trends in food portion sizes, 1977-1998. *J Am Med Ass* 2003;289:450-453.

⁴⁰³ Pasarica M, Dhurandhar N. Infectobesity: obesity of infectious origin. *Adv Food Nutr Res*. 2007;52:61-102.

⁴⁰⁴ Rogers PM et al. Human adenovirus Ad-36 induces adipogenesis via its E4 orf-1 gene. *Int J Obes* 2008;32:397-406.