

The Effects Of Obesity, Smoking, And Drinking On Medical Problems And Costs

Obesity outranks both smoking and drinking in its deleterious effects on health and health costs.

by Roland Sturm

ABSTRACT: This paper compares the effects of obesity, overweight, smoking, and problem drinking on health care use and health status based on national survey data. Obesity has roughly the same association with chronic health conditions as does twenty years' aging; this greatly exceeds the associations of smoking or problem drinking. Utilization effects mirrors the health effects. Obesity is associated with a 36 percent increase in inpatient and outpatient spending and a 77 percent increase in medications, compared with a 21 percent increase in inpatient and outpatient spending and a 28 percent increase in medications for current smokers and smaller effects for problem drinkers. Nevertheless, the latter two groups have received more consistent attention in recent decades in clinical practice and public health policy.

DATAWATCH**245**

MANY BEHAVIORAL RISK FACTORS, chief among them smoking, heavy drinking, and obesity, are known causes of chronic health conditions. Chronic health conditions, like cancer, diabetes, or heart disease, in turn are primary drivers of health care spending, disability, and death. This paper compares the associations of smoking, problem drinking, and obesity with health care use and chronic conditions. All three risk factors are prevalent, although only obesity has dramatically increased over the past twenty-five years. There is an extensive literature of the association of individual risk factors with selected clinical problems. Overall assessments are rare, however, and no direct comparisons of obesity and other risk factors have been reported. Obesity research is also a newcomer in health services and policy research, in contrast to a long tradition of influential work on tobacco and alcohol, starting

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with the U.S. surgeon general's reports on smoking from the 1960s.

Overweight and obesity refer to increased amounts of body fat, commonly assessed by the body-mass index (BMI, calculated as weight in kilograms divided by height in meters squared). The standard categories are underweight (BMI less than 18.5), normal (18.5–24.9), overweight (25–29.9), and obese (30 or more). According to these criteria, about one in three Americans are overweight but not obese, and an additional one in five are obese.¹ The primary drawback of the BMI is that it cannot distinguish fat mass from lean mass and therefore misclassifies some persons. Other methods occasionally used in epidemiologic studies are waist circumference, waist-to-hip ratio, and skin-fold thickness.

A higher BMI, beginning in the upper range of the normal weight category, is associated with increased mortality and increased risk for coronary heart disease, osteoarthritis, diabetes mellitus, hypertension, and certain types of cancer.² Even modest weight reductions can have substantial lifetime health benefits.³ In the United States there was only a minor increase in overweight (including obesity) rates between 1960 and 1980, but rates have increased dramatically since then. Moreover, this recent increase was concentrated in the obese category, which between 1991 and 2000 alone grew 60 percent.⁴ Other industrialized countries, in particular Britain and Germany, have experienced similar growth rates in obesity but started from lower levels.⁵

The debate continues about whether obesity should be considered a disease in its own right. Recognition of obesity as a disease or disability could lead to changes in tax treatment for weight maintenance programs, insurance coverage, and other legal rights. Advocacy groups such as the American Obesity Association strongly support this goal, which was pioneered successfully by mental health advocates and played an important role in mental health parity legislation. The disease paradigm also has been promoted, although less successfully, for alcohol and drug abuse. Others warn that applying the disease paradigm to obesity could be interpreted as self-serving advocacy without a sound scientific basis.⁶

Data And Methods

■ **Data source.** This DataWatch uses data from Healthcare for Communities (HCC), a national household telephone survey fielded in 1997–1998 with about 10,000 respondents who previously participated in the Community Tracking Study.⁷ The results shown here are based on adults ages eighteen to sixty-five. The main explanatory variables are overweight, smoking, problem drinking, and aging. The weight indicators are overweight (BMI, 25–29.9) and obese

“The effects of obesity on the number of chronic conditions are larger than those of current or past smoking or problem drinking.”

(BMI, 30 or more); smoking status is classified into ever smoking, daily smoking, and never smoking; problem drinking was assessed using the Alcohol Use Disorders Identification Test (AUDIT); and age is measured as a continuous variable.⁸ Other explanatory variables include gender, race, household income, and education.

■ **Obesity prevalence.** According to the HCC survey, 36 percent of the population in 1998 was overweight but not obese, and 23 percent was obese. There is a tendency toward underreporting of weight and overreporting of height; these numbers are therefore almost identical to the earlier third National Health and Nutrition Examination Survey (NHANES), which measured height and weight objectively. Both surveys give slightly higher estimates than the Behavioral Risk Factor Surveillance System (BRFSS) fielded at the same time as the HCC survey, which also uses self-reporting.⁹

■ **Dependent variables.** The main dependent variables are two measures of health status and two measures of health care use. The first health measure is a count of seventeen common chronic health conditions.¹⁰ The second evaluates health-related quality of life by the physical health scale on the SF-12 (PCS12), a shorter version of the more commonly used SF-36.¹¹

The first measure of service use is spending on inpatient and ambulatory care, based on the number of reported hospital stays and ambulatory visits and multiplied by unit costs from the Medical Expenditure Panel Survey (MEPS). The overall HCC numbers are very similar to MEPS estimates. For example, average inpatient and outpatient spending for adults ages 18–64 are \$1,494 in HCC and \$1,377 in MEPS.¹² The second measure is medication use based on survey questions about regularly used medication, mapped to insurance claims (for prescription drugs) or wholesale prices (others) to obtain spending estimates.¹³ The usual limitations of this approach apply, especially the underreporting in self-reports and incomplete assessment of services. Even after scope of coverage is adjusted for, MEPS estimates are lower than estimates from the National Health Accounts. Relative effects may be less biased than absolute numbers are, and I therefore show percentage changes based on the ratio of predicted costs for the population with and without the risk factor.

Study Results

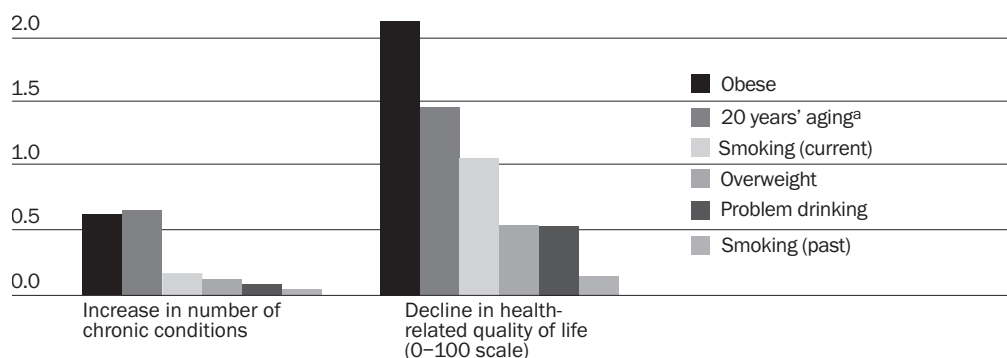
■ **Health effects.** The effects of obesity on the number of chronic conditions are significantly larger than the effects of current or past

smoking or problem drinking ($p < .001$) and similar (not statistically different) to twenty years' aging (Exhibit 1). The effects of smoking or problem drinking are similar to those of being overweight (not statistically different from each other, although significantly different from 0 at $p < .05$, except past smoking, $p = .10$). The same overall picture appears for physical health-related quality of life, although here the effects of obesity are similar to thirty, not just twenty, years' aging. Being overweight is again similar to problem drinking and between current and past smoking, with no statistical differences between these four risk factors.

■ **Cost effects.** In terms of absolute changes in costs for inpatient and ambulatory care (which probably understate true absolute effects because of underreporting), obesity is associated with an average increase of \$395 per year, overweight with an increase of \$125, current or ever smoking about \$230, problem drinking with \$150, and aging with \$225. Only the effects of problem drinking and being overweight are not statistically significant.

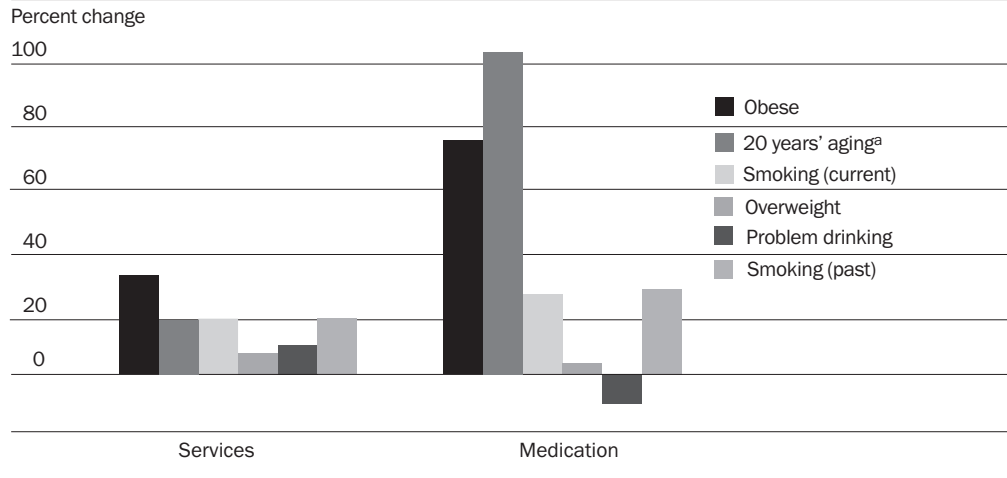
In relative terms, the point estimates suggest that obesity increases health care costs 36 percent and medications costs 77 percent, compared with being in a normal weight range; twenty years' aging increases service costs 20 percent and medications costs 105 percent; current or past smoking increases service costs 21 percent and medications costs 28–30 percent (Exhibit 2). Cost effects are less precisely estimated than are health effects because of the skewness of utilization. The cost effects of obesity on medication are significantly larger than the effects of daily smoking or problem drinking, but most other 95 percent confidence intervals overlap

EXHIBIT 1
Effect Of Obesity, Aging, Smoking, And Drinking On Chronic Medical Conditions And Health-Related Quality Of Life, 1998



SOURCES: Author's calculation based on data from the Healthcare for Communities (HCC) survey, wave 1.

^a Twenty years' aging is from age thirty to age fifty.

EXHIBIT 2**Cost Increases Associated With Obesity, Aging, Smoking, And Drinking, 1998**

SOURCES: Author's calculation based on data from the Healthcare for Communities (HCC) survey, wave 1.

^a Twenty years' aging is from age thirty to age fifty.

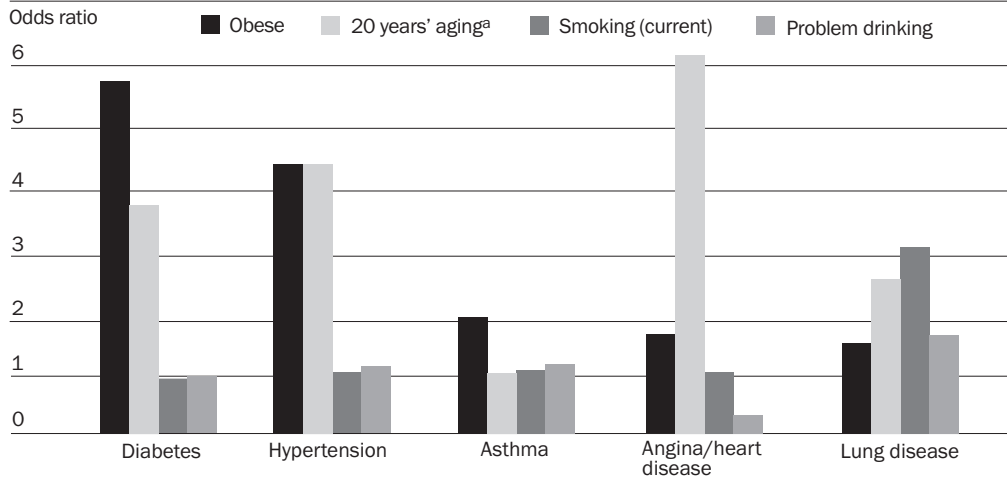
(but do not include 0).

■ **Links with specific physical conditions.** The statistical associations with specific health problems are consistent with known biomedical relationships and suggest an explanation for the cost effects. Obesity is significantly associated with an odds ratio larger than 1 for every condition in Exhibit 3; aging is significantly associated with every condition except asthma; and daily smoking is significantly associated with lung disease and cancer (all at $p < .05$, most at $p < .01$). Obesity and aging have significantly larger effects on heart disease, hypertension, and diabetes (common conditions treated with long-term drug regimens) than smoking or problem drinking has ($p < .05$). In contrast, smoking has the strongest effects on cancer and lung disease (in the case of lung disease, the effect is significantly larger than the effect of obesity at $p < .01$). Although cancer and lung disease can be costly, they are relatively rare and lead to death more quickly than diabetes or hypertension do.

Discussion

Obesity appears to have a stronger association with the occurrence of chronic medical conditions, reduced health-related quality of life, and increased health care and medication spending than smoking or problem drinking has. Only twenty years' aging has similar-size effects. Moreover, a larger proportion of the population is obese than are heavy drinkers, as identified by AUDIT (6 percent), or daily smokers (19 percent), based on this survey. Finally, even though the effects of overweight are small, they apply to a large population

EXHIBIT 3
Odds Ratios For Selected Physical Conditions Related To Obesity, Aging, Smoking, And Drinking, 1998



SOURCES: Author's calculation based on data from the Healthcare for Communities (HCC) survey, wave 1.

^a Twenty years' aging is from age thirty to age fifty.

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group.

■ **Other possible rankings.** There are no similar comparisons across these health risks, but the estimated cost effects of obesity are consistent with recent studies of HMO patients.¹⁴ The absence of a significant effect from problem drinking may seem surprising, since many believe that alcohol abuse has a large effect on health care costs, but it is also consistent with recent evidence.¹⁵ Important outcomes exist outside the scope of this analysis that could provide a different ranking. Smoking may still account for more premature deaths, and alcohol abuse is likely to account for farther-reaching effects (such as drunk-driving accidents).

A causal (rather than descriptive) interpretation of the results shown here assumes that risk behavior precedes health and spending impacts. Reverse causality (for example, diabetes or hypertension causing obesity) could invalidate this interpretation, as could other factors causing health-risk behavior and high medical spending that are not captured by race, education, or family income. Sedentary lifestyle is an unmeasured variable highly correlated with obesity, although it can have independent health effects. It is difficult to disentangle these two factors and may not be particularly relevant because virtually all interventions targeting obesity simultaneously target sedentary lifestyle.

■ **Income inequality hypothesis.** More problematic from a policy perspective are the potential omissions of contextual environ-

mental and social factors that cause both risky behavior and poor health status in less obvious ways. A prime candidate, the income inequality hypothesis, posits that economically more egalitarian communities have better health outcomes than more unequal communities have. This hypothesis has influenced a wide range of authoritative reports, and its prominent proponents argue that income inequality is a stronger determinant of health than is individual income.¹⁶ However, more recent studies cast doubt on the strength of the inequality effect. Income inequality across U.S. states or communities is not associated with the prevalence of any of the chronic conditions studied here, either, even though the same chronic conditions are highly correlated with individual income or education.¹⁷

■ **Weight control as a national priority.** Is it likely that making weight control a higher national priority would lead to weight loss and improved health? Achieving lasting health behavioral change is difficult and rarely achieved by exhorting individuals to exercise more, eat healthier foods, stop smoking, or drink responsibly. Car-friendly (and bike/pedestrian-hostile) urban developments; desk jobs; television; and relatively cheap, calorie-dense foods are some of the recent environmental changes that have changed relative prices in favor of less physical activity without a corresponding decreased caloric intake. In contrast, taxation and access control on tobacco (indoor smoking bans) and alcohol products are environmental interventions (or relative price changes) that have reduced smoking rates and some alcohol problems.

AS WITH SMOKING AND PROBLEM DRINKING, a time lag intervenes between obesity and the development of chronic health problems. The largest declines in smoking rates happened between 1960 and 1980, whereas the largest increase in obesity has occurred since 1980. The full long-run consequences of increased obesity rates at the aggregate level are probably not yet visible.

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NOTES

1. National Center for Health Statistics, *Health, United States, 2000* (Hyattsville, Md.: NCHS, 2000), Table 69; K.M. Flegal et al., "Overweight and Obesity in the United States: Prevalence and Trends, 1960–1994," *International Journal of Obesity and Related Metabolic Disorders* 22, no. 1 (1998): 39–47; and A.L. Mokdad et al., "The Spread of the Obesity Epidemic in the United States, 1991–1998," *Journal of the American Medical Association* 282, no. 16 (1999): 1519–1522.
2. See, for example, A.E. Field et al., "Impact of Overweight on the Risk of Developing Common Chronic Diseases during a Ten-Year Period," *Archives of Internal Medicine* 161, no. 13 (2001): 1581–1586; National Task Force on the Prevention and Treatment of Obesity, "Overweight, Obesity, and Health Risk," *Archives of Internal Medicine* 160, no. 7 (2000): 898–904; World Health Organization, *Obesity: Preventing and Managing the Global Epidemic*, Report of a WHO Consultation, Geneva, 3–5 June 1997 (Geneva: WHO, 1998); A. Must et al., "The Disease Burden Associated with Overweight and Obesity," *Journal of the American Medical Association* 282, no. 16 (1999): 1523–1529; F.X. Pi-Sunyer, "Medical Hazards of Obesity," *Annals of Internal Medicine* 119, no. 7, part 2 (1993): 655–660; E.E. Calle et al., "Body-Mass Index and Mortality in a Prospective Cohort of U.S. Adults," *New England Journal of Medicine* 341, no. 15 (1999): 1097–1105; and T.A. Hillier and K.L. Pedula, "Characteristics of an Adult Population with Newly Diagnosed Type 2 Diabetes: The Relation of Obesity and Age of Onset," *Diabetes Care* 24, no. 9 (2001): 1522–1527.
3. Z. Huang et al., "Body Weight, Weight Change, and Risk for Hypertension in Women," *Annals of Internal Medicine* 128, no. 2 (1998): 81–88; J. Tuomilehto et al., "Prevention of Type 2 Diabetes Mellitus by Changes in Lifestyle among Subjects with Impaired Glucose Tolerance," *New England Journal of Medicine* 344, no. 18 (2001): 1343–1350; W.C. Willett et al., "Weight, Weight Change, and Coronary Heart Disease in Women," *Journal of the American Medical Association* 273, no. 6 (1995): 461–465; and D.J. Goldstein, "Beneficial Health Effects of Modest Weight Loss," *International Journal of Obesity and Related Metabolic Disorders* 16, no. 6 (1992): 397–415.
4. NCHS, *Health, United States, 2000*, Table 69; and A.H. Mokdad et al., "The Continuing Epidemics of Obesity and Diabetes in the United States," *Journal of the American Medical Association* 286, no. 10 (2001): 1195–1200.
5. WHO, *Obesity*.
6. S. Heshka and D.B. Allison, "Is Obesity a Disease?" *International Journal of Obesity and Related Metabolic Disorders* 25, no. 10 (2001): 1401–1404; and P.G. Kopelman and N. Finer, "Reply: Is Obesity a Disease," *International Journal of Obesity and Related Metabolic Disorders* 25, no. 10 (2001): 1405–1406; and M. Downey, "Obesity as a Disease Entity," *American Heart Journal* 142, no. 6 (2001): 1091–1094.
7. R. Sturm et al., "The Design of Health Care for Communities: A Study of Health Care Delivery for Alcohol, Drug Abuse, and Mental Health Conditions," *Inquiry* 36, no. 2 (1999): 221–233; and P. Kemper et al., "The Design of the Community Tracking Study: A Longitudinal Study of Health System Change and Its Effects on People," *Inquiry* 33, no. 2 (1996): 195–206.
8. World Health Organization, "The Alcohol Use Disorders Identification Test (AUDIT): Guidelines for Use in Primary Health Care" (Geneva: WHO, 1992). The study results are indistinguishable from a specification entering age in ten-year groups and comparing persons ages 25–35 with those ages 45–55 or from a specification that interacts age and gender.
9. Must et al., "The Disease Burden Associated with Overweight and Obesity"; and Mokdad et al., "The Continuing Epidemics of Obesity and Diabetes."
10. The seventeen conditions are asthma; diabetes; hypertension; arthritis; physical disability such as loss of arm, leg, eyesight, or hearing; trouble breathing;

cancer; neurological condition; stroke or paralysis; angina/heart failure/coronary artery disease; chronic back problems, stomach ulcer, chronic liver disease, migraine or chronic severe headaches; chronic bladder problems; chronic gynecological problems (women only); and other chronic pain conditions.

11. The chronic condition analysis follows R. Sturm and K.B. Wells, "Does Obesity Contribute as Much to Morbidity as Poverty or Smoking?" *Public Health* 115, no. 4 (2001): 229–235, except that men and women are combined, age is continuous, and the elderly are excluded.
12. S.R. Machlin et al., *Health Care Expenses in the Community Population, 1996*, MEPS Chartbook No. 5, AHRQ Pub. no. 01-0027 (Rockville, Md.: Agency for Healthcare Research and Quality, 2001).
13. There is no good national comparison for our medication numbers because the HCC survey asked only about medications taken regularly for more than one month but also included over-the-counter medications and dietary supplements. We estimate annual expenses to be around \$480 in this age group. MEPS only includes prescription medicines and estimates \$233 for that subset.
14. Charles Quesenberry and colleagues report a 44 percent increase among very obese individuals (BMI over 35) and a 25 percent increase among moderately obese individuals (BMI 30–35) among Kaiser Northern California members, compared with 38 percent for both groups combined. Nicholaas Pronk and colleagues report a cost increase of 1.9 percent with each BMI unit, or about 23 percent for the twelve-point difference between the obese and normal weight groups here. However, Pronk and colleagues controlled for the presence of diabetes and heart disease, which are partially caused by obesity and therefore reduce the estimated effect of obesity. C.P. Quesenberry Jr., B. Caan, and A. Jacobson, "Obesity, Health Services Use, and Health Care Costs among Members of a Health Maintenance Organization," *Archives of Internal Medicine* 158, no. 5 (1998): 466–472; and N.P. Pronk et al., "Relationship between Modifiable Health Risks and Short-Term Health Care Charges," *Journal of the American Medical Association* 282, no. 23 (1999): 2235–2239.
15. Although the study hypothesis was to confirm the strong effect of drinking patterns on costs, Michael Polen and colleagues concluded that they were not an important predictor of health care costs or service use. M.R. Polen et al., "Drinking Patterns, Health Care Utilization, and Cost among HMO Primary Care Patients," *Journal of Behavioral Health Services and Research* 28, no. 4 (2001): 378–399.
16. See R.G. Wilkinson, *Unhealthy Societies: The Affliction of Inequality* (London: Routledge, 1996); G.A. Kaplan et al., "Income Inequality and Mortality in the United States: Analysis of Mortality and Potential Pathways," *British Medical Journal* 312, no. 7037 (1996): 99–1003; B.P. Kennedy et al., "Income Distribution, Socioeconomic Status, and Self-Rated Health in the United States," *British Medical Journal* 317, no. 7163 (1998): 917–921; and M.J. Soobader and F.B. LeClere, "Aggregation and the Measurement of Income Inequality: Effects on Morbidity," *Social Science and Medicine* 48, no. 6 (1999): 733–744.
17. R. Sturm and C.R. Gresenz, "Relations of Income Inequality and Family Income to Chronic Medical Conditions and Mental Health Disorders: National Survey," *British Medical Journal* 324, no. 7328 (2002): 20; J.M. Mellor and J. Milyo, "Re-examining the Evidence of an Ecological Association between Income Inequality and Health," *Journal of Health Politics, Policy and Law* 26, no. 3 (2001): 487–522; and J.M. Mellor and J. Milyo, "Income Inequality and Health Status in the United States: Evidence from the Current Population Survey," *Journal of Human Resources* (forthcoming).