Commentary

New NHLBI Clinical Guidelines for Obesity and Overweight: Will They Promote Health?

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A B S T R A C T

Objectives. The purpose of this study was to assess the justification, on the basis of mortality, of the new National Heart, Lung, and Blood Institute (NHLBI) guidelines on obesity and overweight and to discuss the health implications of declaring all adults with a body mass index of 25 through 29 "overweight."

Methods. The relationships between NHLBI body mass index categories and mortality for individuals older than 31 years were analyzed for 6253 Alameda County Study respondents aged 21 through 75 years. Time-dependent proportional hazards models were used to adjust for changes in risk factors and weight during follow-up.

Results. Adjusted relative risks of mortality for 4 NHLBI categories compared with the category "normal" indicated that only being underweight or moderately/extremely obese were associated with higher mortality. Specific risks varied significantly by sex.

Conclusions. Our results are consistent with other studies and fail to justify lowering the overweight threshold on the basis of mortality. Current interpretations of the revised guidelines stigmatize too many people as overweight; fail to account for sex, race/ethnicity, age, and other differences; and ignore the serious health risks associated with low weight and efforts to maintain an unrealistically lean body mass. (*Am J Public Health*. 2000;90: 340–343)

The 1998 clinical guidelines for the treatment of overweight and obesity from the National Heart, Lung, and Blood Institute (NHLBI) divide adults into 6 categories on the basis of body mass index (BMI): lower than 18.5, underweight; 18.5 through 24.9, normal; 25.0 through 29.9, overweight; 30.0 through 34.9, mildly obese; 35.0 through 39.9, moderately obese; 40.0 or higher, extremely obese.[1] This classification identifies 55% of American adults as overweight or obese, nearly double the percentage who would be so identified on the basis of the second National Health and Nutrition Examination Survey (NHANES II), which used higher BMI cutpoints.[2] The new guidelines initially came with a number of important caveats. They noted that mortality risks for persons with BMIs of 25.0 through 29.9 (the overweight category) were only modestly elevated and might be even less elevated for older adults.They cited research that indicates considerable variation among ethnic minorities, including African Americans, in boundaries for the lowest-risk BMI levels. Further, the new guidelines noted exceptions for very muscular persons and for persons less than 5 feet in height, for whom the standard BMI calculation may not be valid.

The argument for health risks in the newly labeled overweight category was based more on morbidity than on mortality, which is one reason individuals with BMIs in this range were labeled overweight, not obese. Further, health providers were instructed to recommend weight loss for patients in the overweight category only if the patients expressed a desire to lose weight or if they also exhibited 2 or more cardiovascular risk factors, such as type 2 diabetes, cigarette smoking, hypertension, physical inactivity, low-density lipoprotein cholesterol serum concentration of 160 mg/dL or higher, or the presence or family history of coronary heart disease. The thrust of the recommendations for overweight persons below the obesity threshold appeared to be prevention of further weight gains, rather than weight reduction.

However, in October 1999, results from an American Cancer Society study were published that, along with several commentaries,[3–5] justified the inclusion of BMIs of 25.0 through 29.9 in the overweight category on the basis of mortality, ignored or attempted to refute the caveats issued with the guidelines, and generally confused the careful distinction made in the report between persons designated overweight and those designated obese. The American Cancer Society study results were based on the Cancer Prevention Study II,[3] which enrolled more than 1 million subjects in 1982. Weight and height were measured by self-report. Subjects were divided into 4 groups on the basis of smoking status and history of disease. For the majority of the subjects, the association between BMI and mortality was a U-shaped curve—low and high BMI were equally serious risk factors. In addition, only a modestly elevated relative mortality risk of about 1.2 was found for persons with BMIs of 25.0 through 29.9 compared with those in the reference category of 23.5 to 24.9.

The study then focused only on the 29% of subjects with no history of disease or smoking. These results indicated a less serious mortality risk for persons with low BMIs and, compared with the 71% of subjects not studied, a slightly increased risk for persons with BMIs of 25.0 or higher. On the basis of the

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results from this small subsample of subjects, the researchers (and others, in commentaries[4,5]) concluded that a definitive argument for the lowered NHLBI standards had now been made, on the basis of elevated mortality rates.[4] One physician called the results "irrefutable," and the distinction in the NHLBI report between overweight and obese was lost as news accounts of the study used the 2 terms interchangeably.[5] A similar blurring of the overweight and obese categories had already occurred in an August 1999 review article that recommended a weight loss program not only for all adults with a BMI of 25.0 or higher but also for those with BMIs below 25.0 who experienced weight gains of 10 pounds or more.[6]

Before such sweeping recommendations that take the NHLBI guidelines out of context are accepted, a brief review of the mortality evidence and a consideration of the likely consequences of such an emphasis on weight reduction are in order.

Previous longitudinal studies of the effect of BMI on mortality found inconsistent results. A 1987 summary of 25 longitudinal studies reported that 9 found no relationship between BMI and mortality, while the others revealed different associational patterns and different ideal-weight categories.[7] The authors attributed many of these differences to analytical flaws. Such flaws are absent from recent studies, but results are still not consistent. A large Dutch study reported an association between BMI and mortality for men but not women, while data from the Cardiovascular Health Study indicated an association between low BMI and mortality but no association between high BMI and mortality for older subjects (65 years and older).[8,9] Similar age differences in the association between BMI and mortality have been noted in other studies, as well as generally weaker associations for women than for men.[10–12] A recent summary of a number of studies concluded that mortality does not increase sharply until a relatively high BMI (above 30.0) is reached.[13]

Data reported in 1995 from the ongoing Nurses Health Study were cited in the NHLBI guidelines as supporting the lowered standards, but these data were similar to the American Cancer Society analyses in 2 respects: they were based on self-reported weight and height, and they applied to only a small subgroup of the nurses in the study (those who had never smoked, had stable weight, and had survived more than 4 years after assessment). Deaths in this subgroup constituted only 11% of total deaths.[14] Even so, the adjusted relative risk of 1.2 for mortality was not statistically significant for BMIs of 25.0 to 26.0. Further, the number of deaths during follow-up was equal to only 4% of the sample, raising further questions about the validity of the findings. Racial comparisons could not be made because 98% of the nurses in the study are White.

To examine the validity of the new guidelines, with particular emphasis on the overweight category, we used them to analyze the impact of BMI on mortality for respondents in the Alameda County Study. We tracked the relationship between BMI and mortality in this sample for 31 years, using an analysis method that takes into account changes in BMI and adjustment variables.

Methods

Study Population

The subjects were taken from the Alameda County Study, a longitudinal study of health and mortality that enrolled 6928 adults from a random household sample of Alameda County residences in 1965.[15] Alameda County borders San Francisco Bay and includes the cities of Berkeley and Oakland. In 1965, the county's age, sex, and racial/ethnic mix were similar to those of the United States as a whole. Survivors were resurveyed in 1974, 1983, and 1994, with response rates of 85%, 87%, and 93%, respectively.

The analyses reported here are based on data from 6253 subjects aged 21 to 75 years at baseline in 1965 who did not die in the first year of follow-up and who had no missing values on any of the baseline measures (including adjustment variables). Women constituted 53% of the sample; 12% of the subjects were Black, and 4% were from other minority groups (including Hispanics).

Measures

BMI was based on self-reported height and weight and was defined as weight in kilograms divided by the square of height in meters. Criterion variables were constructed on the basis of the new NHLBI categories, except that small numbers necessitated combining the moderately obese and extremely obese categories. Normal was used as the reference category. There is evidence that subjects understate weight and overstate height, thereby lowering BMI values based on self-reported data, but comparison studies indicate that such measurement error is modest.[16,17]

Demographic variables were age (measured in whole years), sex, race/ethnicity (Black vs other), and education (less than 12 years of education vs 12 years or more).

Clearly, researchers should avoid adjusting for health variables that are the consequences of obesity, such as hypertension, heart disease, and diabetes.[7,9] However, we also wanted to avoid determining that low BMI was associated with mortality simply because it reflected prevalent disease. Thus, we adjusted for the prevalence of cancer, cigarette smoking, and respiratory disease (as indicated by chronic bronchitis, the only condition asked about in all surveys). We also adjusted for physical activity, which we measured with a scale based on frequency of performing physical exercise, participating in active sports, and either taking long walks or swimming. Responses were "never," "sometimes," or "often." The scale has a range of 0 to 12 and has been shown to predict all-cause as well as cardiovascular mortality in other analyses.[18]

Statistical Analyses

Cox proportional hazards models with time-dependent covariates were used to analyze the relationship between BMI and mortality. The time-dependent covariate option takes into account changes in BMI and adjustment variables reported by survivors during any subsequent survey.[19,20]

Subjects were censored at loss to follow-up or at the end of 1996. Deaths were included through 1996 and numbered 1295 (21% of study subjects) (Table 1). Results are presented for all subjects as well as separately by sex. Two sequential models were used to assess the relative impacts of BMI on mortality. The first model adjusted only for age and sex; the second model added race/ethnicity, education, chronic bronchitis, cancer, cigarette smoking, and physical activity. Sex and age differences were tested by means of the log likelihood ratio test. Statistical analyses were performed with SAS software version 6.12.[21]

Results

In the first model, elevated mortality risks over the 31-year follow-up are indicated for both underweight and moderately/extremely obese subjects but not for those classified as overweight or mildly obese. The sex-specific results indicate a higher relative risk of mortality for underweight women than for underweight men but a lower relative risk for moderately/extremely obese women than for men in the same category. The pattern of results for the fully adjusted model is similar to that of the first model, except that the adjustments greatly reduce the relative risk for women in the moderately/extremely obese category.

Separate analyses using the log likelihood ratio test to assess sex and age differences in the associations indicated that the differences between men and women were statistically significant ($P<.05$), but there were no statistically significant age differences.

Discussion

Our results are consistent with those of a number of other studies that have failed to show an elevated mortality risk for persons with BMIs of 25.0 through 29.9, but our results do indicate a sharply higher relative mortality risk for those with low and very high BMIs. The 2 large studies that purport to show elevated risks for the newly defined overweight category coupled with modest or no increases in mortality for the underweight category do so only when the vast majority of the subjects in their respective cohorts are removed from the analyses. It is difficult to generalize to all American adults from such a small subset of subjects. Furthermore, although they are large in size, neither the Nurses Health Study nor the American Cancer Society study is based on a representative sample of community-dwelling adults. Even so, the relative mortality risk for subjects with BMIs of 25.0 to 28.0 in these studies is modest (1.2–1.3).[3,14]

This seeming rush to lower the standard for overweight to such a level that 55% of American adults find themselves being declared overweight or obese raises serious concerns.

TABLE 1—Relative Risk of Mortality by Body Mass Index Category Among Adults Aged 21 to 75 Years at Baseline (n = 6253): Alameda County Study, 1965–1996

Body Mass Index Category (Numeric Range)	Relative Risk (95% Confidence Interval)		
	Men (690 deaths)	Women (605 deaths)	Total Sample (1295 deaths)
Adjusted for age and sex			
Underweight (<18.5)	1.66 (0.93, 2.96)	2.31 (1.73, 3.10)	2.09 (1.62, 2.71)
Normal (18.5–24.9)[a]	1.00	1.00	1.00
Overweight (25.0–29.9)	0.74 (0.63, 0.89)	0.98 (0.81, 1.19)	0.82 (0.72, 0.93)
Mildly obese (30.0–34.9)	1.05 (0.77, 1.44)	0.71 (0.50, 1.00)	0.85 (0.67, 1.07)
Moderately/extremely obese (≥35.0)	1.93 (0.93, 3.91)	1.64 (1.06, 2.53)	1.70 (1.18, 2.46)
Fully adjusted[b]			
Underweight (<18.5)	1.40 (0.78, 2.50)	2.03 (1.51, 2.74)	1.84 (1.41, 2.39)
Normal (18.5–24.9)[a]	1.00	1.00	1.00
Overweight (25.0–29.9)	0.77 (0.65, 0.91)	0.89 (0.74, 1.09)	0.82 (0.72, 0.92)
Mildly obese (30.0–34.9)	1.09 (0.80, 1.50)	0.58 (0.41, 0.83)	0.80 (0.63, 1.01)
Moderately/extremely obese (≥35.0)	1.85 (0.87, 3.93)	1.19 (0.75, 1.87)	1.36 (0.93, 2.00)

Note. Relative risks and confidence intervals are based on proportional hazards models using time-dependent covariates.
[a]Reference category.
[b]Adjusted for age, sex, race/ethnicity, education, chronic bronchitis, cancer, cigarette smoking, and physical activity.

Stigmatization

Few physical conditions elicit such strong condemnation as does obesity. Even medical journals use terms such as "gluttony" and "sloth" to describe the behaviors of obese persons,[22] thus reinforcing the belief that obesity results from a lack of self-discipline. Former US Surgeon General C. Everett Koop has labeled obesity a disease.[23] Lowering the BMI standard for overweight will thus subject millions more to such derogatory labeling, despite clear evidence that even conscientious persons have great difficulty in losing weight and maintaining a lower weight.[22–24] As one editorial has noted, billions of dollars are spent each year on well-intentioned but futile attempts to lose weight, when the only result may be increased guilt and self-hatred.[25] Nor is it clear that persons with a higher BMI who lose weight reduce their mortality risks correspondingly.[26–28] It would be sadly ironic if fewer smokers now decided to quit because of heightened fears of attendant weight gain.

Overlooking the Health Risks of Low BMI and an Emphasis on Weight Loss

Emphasizing obesity diverts attention from the serious consequences of low BMI and may even promote an increase in the prevalence of eating disorders such as anorexia and bulimia, which are estimated to affect 5 million Americans, many of them young women.[29–32] Disturbed eating patterns increase the risks of developing a number of serious conditions, including metabolic abnormalities and osteoporosis.[33] Eating disorders and insulin omission are not uncommon in persons with diabetes as they struggle to balance the competing demands of nutrition, diabetes control, and body image.[34,35]

This new emphasis on weight loss and low BMI may have the unintended consequence of supporting efforts to achieve and maintain an unrealistically lean appearance. In addition to problems of poor nutrition, there is also psychological harm to be considered, and the obsessions with food and eating that occur for many who attempt to seriously limit their caloric intake.[36] Unfortunately, one commentary on the lowered NHLBI guidelines questioned the 18.5 to 24.9 "normal" range, stating that for nonsmoking women with stable weight, a BMI as low as 17.0 entailed no excess risk of mortality.[6] Others would describe someone with a BMI of 17.0 as anorexic.[29]

One Size Does Not Fit All

Most studies of the health risks associated with BMI have found differences by sex, as we did, and differences by age, which we did not. We did not have enough African Americans in our sample to test for possible racial/ethnic differences in outcomes, but others who have had larger samples of African Americans have found differences. In the American Cancer Society study, there was no association between higher levels of BMI and mortality for African American men or women, a result described as an anomaly.[3] As we noted in the introduction, the NHLBI report itself notes that the 25.0 BMI cutoff may not be valid for certain subgroups. In spite of these many exceptions, the standards are being interpreted as though they apply to all men and women regardless of age, body composition, and race/ethnicity.

It is important to note that we are not arguing that the serious health consequences associated with a BMI of 30.0 or more should be ignored. What we are questioning is the rush to ignore the many caveats in the NHLBI report and to declare all adults with a BMI of 25.0 through 29.9 to be overweight and in need of treatment. In the face of conflicting data, millions of Americans will be stigmatized as having a condition that is perceived as being both the sufferer's own fault and difficult to overcome. Furthermore, not only will the serious health hazards associated with being underweight be minimized, but the number of persons subject to these hazards will likely increase, as young persons will be even more motivated to maintain dangerously low BMI levels—with the attendant consequences of increased eating disorders, osteoporosis, and poor nutrition. Such a seri-

ous public health issue deserves a far more balanced discussion than it has received to date. □

Contributors

W. J. Strawbridge and M. I. Wallhagen planned the study and wrote the paper. S. J. Shema designed and carried out the analyses.

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References

1. *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults*. Bethesda, Md: National Heart, Lung, and Blood Institute; 1998.
2. Van Itallie TB. Health implications of overweight and obesity in the United States. *Ann Intern Med.* 1985;103:983–988.
3. Calle EE, Thun MJ, Petrelli JM, Rodriguez C, Heath CW Jr. Body-mass index and mortality in a prospective cohort of U.S. adults. *N Engl J Med*. 1999;341:1097–1105.
4. Williamson DF. The prevention of obesity. *N Engl J Med*. 1999;341:1140–1141.
5. Obesity can cause early death, million-person study confirms. *San Francisco Chronicle*. October 7, 1999:A4.
6. Willett WC, Dietz WH, Colditz GA. Guidelines for healthy weight. *N Engl J Med*. 1999;341: 427–434.
7. Manson JE, Stampfer MJ, Hennekens CH, Willett WC. Body weight and longevity: a reassessment. *JAMA*. 1987;257:353–358.
8. Seidell JC, Verschuren WM, van Leer EM, Kromhout D. Overweight, underweight, and mortality: a prospective study of 48,287 men and women. *Arch Intern Med.* 1996;156:958–963.
9. Diehr P, Bild DE, Harris TB, Duxbury A, Siscovick D, Rossi M. Body mass index and mortality in nonsmoking older adults: the Cardiovascular Health Study. *Am J Public Health*. 1998;88:623–629.
10. Stevens J, Cai J, Pamuk ER, Williamson DF, Thus MJ, Wood JL. The effect of age on the association between body-mass index and mortality. *N Engl J Med*. 1998;338:1–7.
11. Harris TB, Launer LJ, Madans J, Feldman JJ. Cohort study of effect of being overweight and change in weight on risk of coronary heart disease in old age. *BMJ*. 1997;314:1791–1794.
12. Rissanen A, Heliovaara M, Knekt P, Reunanen A, Aromaa A, Maatela J. Risk of disability and mortality due to overweight in a Finnish population. *BMJ*. 1990;301:835–837.
13. Troiano RP, Frongillo EA Jr, Sobal J, Levitsky DA. The relationship between body weight and mortality: a quantitative analysis of combined information from existing studies. *Int J Obes Relat Metab Disord*. 1996;20:63–75.
14. Manson JE, Willett WC, Stampfer MJ, et al. Body weight and mortality among women. *JAMA*. 1995;257:353–358.
15. Berkman LF, Breslow L. *Health and Ways of Living: The Alameda County Study.* New York, NY: Oxford University Press; 1983.
16. Rowland ML. Self-reported weight and height. *Am J Clin Nutr*. 1990;52:1125–1133.
17. Stevens J, Keil JE, Waid LR, Gazes PC. Accuracy of current, 4-year, and 28-year self-reported body weight in an elderly population. *Am J Epidemiol*. 1990;132:1156–1163.
18. Kaplan GA, Strawbridge WJ, Cohen RD, Hungerford LR. Natural history of leisure-time physical activity and its correlates: associations with mortality from all causes and cardiovascular disease over 28 years. *Am J Epidemiol*. 1996;144:793–797.
19. Cox DR, Oakes D. *Analysis of Survival Data*. New York: Chapman & Hall; 1984.
20. Kalbfleisch JD, Prentice RL. *The Statistical Analysis of Failure Time Data*. New York: John Wiley & Sons Inc; 1980.
21. *SAS/STAT Software: Changes and Enhancements for Release 6.12*. Cary, NC: SAS Institute Inc; 1996.
22. Prentice AM, Jebb SA. Obesity in Britain: gluttony or sloth? *BMJ*. 1995;311:437–439.
23. Koop urges docs to treat obesity as a disease. *Boston Herald.* October 30, 1996:2.
24. Germov J, Williams L. The epidemic of dieting women: the need for a sociological approach to food and nutrition. *Appetite*. 1996;27:97–108.
25. Kassirer JP, Angell M. Losing weight—an ill-fated New Year's resolution. *N Engl J Med*. 1998;338:52–54.
26. Lissner L, Odell PM, D'Agostino RB, et al. Variability of body weight and health outcomes in the Framingham population. *N Engl J Med*. 1991;324:1839–1844.
27. Williamson DF, Pamuk E, Thun M, Flanders D, Byers T, Heath C. Prospective study of intentional weight loss and mortality in overweight white men aged 40–64 years. *Am J Epidemiol.* 1999;149:491–503.
28. Williamson DF, Pamuk E, Thun M, et al. Prospective study of intentional weight loss and mortality in never-smoking overweight US white women aged 40–64 years. *Am J Epidemiol*. 1995;141:1128–1141.
29. Becker AE, Grinspoon SK, Klibanski A, Herzog DB. Eating disorders. *N Engl J Med*. 1999;340:1092–1098.
30. Takala JK, Mattila KJ, Ryynanen OP. Overweight, underweight and mortality among the aged. *Scand J Prim Health Care*. 1994;12: 244–248.
31. Manson JE, Willett WC, Stampfer MJ, et al. Body weight and mortality among women. *N Engl J Med*. 1995;333:677–685.
32. Brill PA, Giles WH, Keenan NL, et al. Effect of body mass index on activity limitation and mortality among older women: the National Health Interview Survey, 1986–1990. *J Womens Health*. 1997;6:435–440.
33. Biller BMK, Saxe V, Herzog DB, Rosenthal DI, Holzman S, Klibanski A. Mechanisms of osteoporosis in adult and adolescent women with anorexia nervosa. *J Clin Endocrinol Metab*. 1989;68:517–522.
34. Crow SJ, Keel PK, Kendall D. Eating disorders and insulin-dependent diabetes mellitus. *Psychosomatics*. 1998;39:233–243.
35. Rydall AC, Rodin GM, Olmsted MP, Devenyi RG, Daneman D. Disordered eating behavior and microvascular complications in young women with insulin-dependent diabetes mellitus. *N Engl J Med*. 1997;336:1849–1854.
36. Polivy J. Psychological consequences of food restriction. *J Am Diet Assoc*. 1996;96:589–592.