

Fit or Fat? A Review of the Debate on Deaths Attributable to Obesity

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ABSTRACT Scientific debate surrounding the burden of obesity on the population's health has escalated in recent months following the release of differing reports on the population attributable fraction of obesity mortality. Differing views on statistical methodology for estimating the number of deaths attributable to being overweight and obese were widely reported in the popular media. There was concern that the public was left unsure of how to perceive the health information about obesity. Furthermore, food industry groups exploited this moment of scientific development to generate support in corporate interests in the name of "consumer freedom." This review examines the state of the debate on deaths attributable to obesity. Public health nurses can use this information to work collaboratively with their service populations to ensure that accurate public health information is disseminated regarding obesity and mortality. This paper also highlights areas of obesity-related public health research that have been emphasized by this debate. Nurses should be actively engaged in such research in an effort to understand the epidemic of obesity and develop programs and influence policy to curb the determinants of obesity.

Key words: body mass index, epidemiology, mortality, obesity, public health nursing.

Approximately 65% of adults in the United States are overweight (body mass index [BMI] 18.5 to < 25)¹ with almost one-third of the population being classified as obese (BMI ≥ 30)¹ (U.S. Department of Health and Human Services, 2001). The prevalence of overweight children has more than doubled and overweight adolescents have more than tripled since 1980 (Hedley et al., 2004). The latest research from the U.S. Centers for Disease Control and Prevention (CDC) demonstrated that obesity was associated with 111,909 excess deaths compared with normal weight people (BMI 18.5–24.9)¹ annually (Flegal, Graubard, Williamson, & Gail, 2005). This was lower than the CDC's earlier reports, which noted that 400,000 deaths could be attributed to obesity annually (later revised to 365,000 deaths) (Mokdad, Marks, Stroup, & Gerberding, 2004, 2005; see Table 1). In contrast, the Flegal et al. (2005) study also noted that there

may be protective effects of being overweight (BMI 25 to < 30)¹. Following significant media attention (see Table 2) and scholarly debate, the CDC stepped back from its position that being overweight might be healthy and reaffirmed that both overweight and obesity are public health risks.

Ultimately, there has been concern that the shifting viewpoints may have led to public confusion regarding the impact of obesity on health (Institute of Medicine, 2005). It is essential for public health nursing to synthesize the developments in public health science in an effort to expand our discipline and continue to be a primary source of public health education and service for patients, families, and communities (MacDonald, 2004). The purpose of this paper is to provide an overview of recent CDC publications related to mortality attributed to obesity and the implications for public health nurses.

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¹The 1998 Clinical Guidelines on the Identification, Evaluation and Treatment of Overweight and Obesity in Adults, developed by the National Heart, Lung and Blood Institute, recommend the following classifications for BMI: underweight—BMI less than 18.5; normal weight—BMI 18.5–24.9; overweight—BMI 25–29.9; obesity—BMI 30–34.9 (class 1); obesity—BMI 35–39.9 (class 2); extreme obesity—BMI greater than 40 (class 3).

TABLE 1. *Timeline of Events (Mishra, 2005)*

Date	Event
March 10, 2004	Mokdad et al. (2004) study shows that 400,000 Americans die annually from causes related to excess weight
May 7, 2004	<i>Science</i> magazine quotes anonymous CDC sources and other public health critics who question the Mokdad et al. study's methodology
June 21, 2004	Rep. Henry Waxman (D-CA) requests an investigation and the CDC starts an internal inquiry 2 days later
August 15, 2004	CDC researcher Katherine Flegal and colleagues publish papers criticizing the Mokdad et al. study's methods
January 18, 2005	The CDC correction in <i>JAMA</i> states that computational errors were made. Obesity death estimate reduced to 365,000 annually
February 9, 2005	CDC's internal investigation concludes that the Mokdad et al. study's methodology and data were flawed
April 20, 2005	Flegal et al. (2005) publish an estimate indicating that obesity kills about 112,000 annually and being moderately overweight may be beneficial
June 3, 2005	CDC Director Julie Gerberding reinforces health risks of overweight and apologizes for confusion

Methods

A literature review of research related to deaths attributable to obesity was conducted. The databases Medline and CINAHL were explored using keyword searches with the terms obesity, CDC, overweight, mortality, and BMI. An author search using the names K. M. Flegal, A. H. Mokdad, J. L. Gerberding, and J. E. Manson was also conducted. A bibliography review on each article examined was also undertaken to find relevant articles.

A search of lay literature news sources reporting on the obesity research controversy was conducted using LexisNexis and Westlaw search engines as well

as a library search. Keywords including obesity, CDC, Flegal, Mokdad, Gerberding, overweight, mortality, and BMI were used as search terms to identify relevant articles for analysis. A search of lay literature focusing on the dates when the CDC released its obesity studies or made relevant announcements was also carried out.

Actual causes of death in the United States, 2000 (Mokdad et al., 2004)

The controversy of mortality attributable to obesity began on March 10, 2004, when the CDC released a paper indicating that 400,000 Americans die annual-

TABLE 2. *Newspaper Press Headlines*

Original Mokdad et al. Study (March 10, 2004)
<i>USA Today</i> —Obesity on track as No. 1 killer
<i>Baltimore Sun</i> —Fat, inactivity: fatal combo; Obesity: A new study says unhealthful eating and lack of exercise are overtaking tobacco as the top cause of U.S. deaths
<i>Chicago Sun Times</i> —Obesity may soon be No. 1 preventable killer; CDC says by 2005 smoking could sink to second place
Mokdad et al. <i>JAMA</i> Correction (January 19, 2005)
<i>Boston Globe</i> —CDC reports that '04 study overstated rise in obesity
<i>Wall Street Journal</i> —CDC cuts estimate of deaths from obesity
<i>Philadelphia Inquirer</i> —CDC data overstated obesity risk
Flegal et al. Study (April 20, 2005)
<i>New York Times</i> —Some extra heft may be helpful, new study says
<i>San Francisco Chronicle</i> —U.S. scales back on obesity deaths: Government researchers sharply reduce the estimates of the toll caused by being extremely overweight
<i>Kansas City Star</i> —"This ought to be positive news" CDC says obesity is not the epidemic we thought it was
CDC Reinforces Health Risks of Overweight (June 3, 2005)
<i>Chicago Sun Times</i> —CDC backs off report that downplayed obesity
<i>Kansas City Star</i> —Stay fit, not fat, CDC insists: April report flawed, director concedes
<i>Atlanta Journal and Constitution</i> —CDC apologizes for mixed messages on obesity

ly from causes related to excess weight (Mokdad et al., 2004). This investigation updated a groundbreaking study by McGinnis and Foege (1993), which estimated the contribution of lifestyle factors to death including tobacco use, alcohol use, and poor diet and physical inactivity. Mokdad et al. assessed the impact of poor diet and physical inactivity on mortality by examining annual deaths due to being overweight. The research design modeled an earlier study by Allison, Fontaine, Manson, Stevens, and VanItallie (1999). The statistical method utilized, population-attributable fraction (PAF) (sometimes called population-attributable risk), determines how many deaths could be avoided if the risk factor (being overweight in this case) was eliminated (Mark, 2005). Generally speaking, PAF is a function of the prevalence of overweight and the magnitude of its causal association with mortality, expressed as a relative risk (RR). A basic equation for PAF can be expressed as

$$\text{PAF} = \frac{\text{Prevalence of exposure} \times (\text{Relative risk} - 1)}{1 + \text{Prevalence of exposure} \times (\text{Relative risk} - 1)}$$

Thus, in order to determine the excess number of deaths due to overweight and obesity, researchers need to know the number of deaths in the time period of interest, the prevalence of overweight and obesity in the time period of interest, and the RR of mortality associated with overweight and obesity in the U.S. population (Flegal, Williamson, Pamuk, & Rosenberg, 2004).

Data regarding mortality rate and prevalence of overweight and obesity were obtainable from the U.S. Vital Statistics and National Health and Nutrition Examination Survey (NHANES) databases, respectively. RR, the source of much of the controversy over the PAF calculation, varied depending on the characteristics of the study population. Six major population-based studies were used to derive annual deaths.

The Mokdad et al. (2004) study estimated that 400,000 deaths were attributable to overweight and obesity. The researchers noted that deaths were greater among nonsmokers and those who never smoked because smoking is associated with a lower body weight and higher mortality. Mokdad et al. took this into account as the effects of obesity can be masked because smokers are thinner and more likely to die from smoking-related causes (Manson, Stampfer, Hennekens, & Willett, 1987).

The aftermath (Mokdad et al., 2004)

Shortly after the release of the Mokdad et al. (2004) study, anonymous sources within the CDC and other public health critics questioned the study's methodology in *Science* magazine (Marshall, 2004). Prompted by the contention noted in the *Science* article, Rep. Henry Waxman (D-CA) requested an investigation by the Government Accountability Office (GAO) to assess the methods of the study (McKay, 2004). Rep. Waxman noted that "because the scope of the obesity problem has major implications for research and policy, it is critically important that the CDC's estimates are based upon the best available science" (CDC, 2004, p. 2). Two days after the representative called for an inquiry, the CDC initiated its own internal review (Mishra, 2005).

In early autumn 2004, researchers led by CDC epidemiologist Katherine Flegal published critiques of the methodology utilized by Mokdad et al. (2004) (Flegal, Graubard, & Williamson, 2004; Flegal et al., 2004). Flegal and colleagues noted that the estimates of attributable deaths were sensitive to the accuracy of RR in the cohort samples. The papers highlighted inadequate adjustment for confounding and effect modification. They suggested that a partially adjusted method that used adjusting RR estimates based on variables such as age, sex, and smoking status but applied an unadjusted PAF formula could lead to bias. Flegal and colleagues criticized the RRs of the Mokdad et al. study because they were based on samples that did not match the "mortality experience" of the U.S. population as a whole. The samples were challenged as being overcontrolled for baseline health status, smoking status, age, and gender, and as a result the association between obesity and mortality was inflated (Flegal, Graubard et al., 2004; Flegal, Williamson et al., 2004).

Correction: actual causes of death in the United States, 2000 (Mokdad et al., 2005)

The CDC subsequently submitted a correction of the Mokdad et al. (2004) findings in the January 19, 2005 edition of *JAMA* (Mokdad et al., 2005). The researchers noted that computational errors were attributed to an overestimation of deaths attributable to poor diet and inactivity. The calculations determined that 365,000 (not 400,000 deaths as reported earlier) could be attributed to overweight and obesity annually. The paper called for a panel to develop a new research agenda on obesity research and identify the

best methods for determining actual causes of death particularly related to lifestyle factors such as obesity (Institute of Medicine, 2005).

Excess deaths associated with underweight, overweight, and obesity (Flegal et al., 2005)

The most recent investigation carried out by the CDC revised its methodology and was carried out by a leading critic of the Mokdad et al. (2004) methodology (Flegal et al., 2005). An alternative PAF methodology was utilized in an effort to account for confounding and effect modification. Like the studies before it, this study did not dispute the fact that the prevalence of obesity has dramatically escalated and that between the years 1999 and 2002, 30% of adults were obese and 65% were overweight (Flegal, Carroll, Ogden, & Johnson, 2002; Hedley et al., 2004). The study demonstrated that obese people had higher RRs across all age groups studied (25 years old to ≥ 70 years old) and obesity was attributed to 111,909 excess deaths (95% confidence interval [CI], 53,754–170,064) compared with normal weight. Underweight (BMI < 18.5; see Footnote 1) was attributed to 33,746 excess deaths (95% CI, 15,726–51,766) compared with normal weight. The most controversial finding of this study was that there was a reduction in mortality, a so-called protective effect, among overweight persons relative to normal weight persons (–86,094 deaths; 95% CI, –161,223 to –10,966).

The aftermath (Flegal et al., 2005)

The Flegal et al. (2005) report purported to account for confounding factors and to be more accurate than prior attempts. Nonetheless, scientific discussion surrounding the methods has highlighted the challenges in estimating deaths attributable to obesity. For example, critics of the Flegal et al. methods have suggested that smoking participants, participants with preexisting illnesses, and the elderly must be excluded in order to ascertain the influence of the BMI–mortality relationship (Hu, Willett, Stampfer, Spiegelman, & Colditz, 2005; Manson et al., 1987).

Smoking affects obesity mortality findings because smoking is more prevalent in the underweight (Manson et al., 1990). In research samples, smoking can artificially inflate mortality in the lean, making increased weight appear protective. In order to eliminate the bias of smoking, researchers must look at samples of “never smokers.” It has been suggested

that multivariate analysis does not adequately control this effect because there is residual confounding from the intensity and duration of smoking that cannot be controlled (Manson et al., 1995).

A similar factor skewing results by increasing mortality among those with lower BMI is weight loss due to antecedent disease or “reverse causation.” Reverse causation is when subjects have illness that causes weight loss. Suggested means of reducing this bias are excluding participants with baseline illness and excluding the first several years of follow-up simultaneously with inclusion of only stable weight subjects (Hu, 2005). The high prevalence of chronic diseases in the elderly and this population’s increased likelihood of dying when underweight also suggest that inclusion of the very old is a confounding factor.

A final argument contrary to the finding that overweight is associated with reduced mortality is that it simply does not make sense based on the totality of clinical and biological science. For example, evidence suggests that even a small amount of weight loss can have beneficial health effects. Investigations of bariatric surgery outcomes demonstrate profound improvements and reductions in significant chronic disease mortality risk factors (Buchwald et al., 2004). Furthermore, the evidence linking the biologically active adipocyte to diseases including diabetes and cardiovascular disease is significant (Ehrhart-Bornstein, Arakelyan, Krug, Scherbaum, & Bornstein, 2004; McPherson & Jones, 2003).

CDC clarifies that overweight and obesity are health threats

Since the release of the Flegal et al. (2005) findings, the CDC has come full circle and reiterated its position that being overweight is, in fact, unhealthy. The CDC Director apologized for any confusion that was generated by the scientific discussion. As with each of the CDC’s prior statements, the story was presented in different ways to the public by the media (see Table 2).

Public Health Nurses’ Role in Dissemination of Public Health Information

In the last 18 months, the general public has received conflicting messages regarding overweight and obesity: fat is unhealthy, fat is not as unhealthy as we thought, a little fat is actually healthy, and then, fat is,

in fact, unhealthy. The scientific debate was heightened by media and interest group spin on the information. Nurses play a key role in the dissemination and interpretation of public health information. The diverse roles that public health nurses have in providing services to patients, families, and communities place nurses in a unique position to provide fundamental public health education. Communicating health messages to the public involves a strategic and collaborative plan (Witte, Meyer, & Martell, 2001). Health journalists must be familiar with the basic methods of epidemiology and public health in order to serve their viewers and readers more accurately (Wilkes, 1997). Public health nurses can work collaboratively with these professionals to ensure that the messages and research interpretations are accurate.

Public dissemination of health research is an important part of public health but it must be carried out responsibly. Food industry groups such as the Center for Consumer Freedom may misrepresent science to fit their political and economic agenda. This particular group funded a \$600,000 ad campaign in major U.S. newspapers pronouncing obesity as mere "hype" (Mayer & Joyce, 2005). This view of obesity defies the vast body of research regarding the social determinants of health and the interaction between the environment and obesity. Nurses must be aware of interest groups representing the food industry so that they may help patients disentangle the messages they espouse and to answer patients' questions regarding those messages.

Future of Obesity Research

Many areas of obesity science are novel and developing. However, the best evidence and clinical experience demonstrate that the basic issues of overweight and obesity are on the rise and have been and continue to be a threat to human health. This fundamental message is one that must clearly be communicated to the public.

Development of new hypotheses, open correction of errors, and expression of scientific differences must be encouraged in order to continue to define the parameters and degree of this problem. The CDC convened a panel with the Institute of Medicine, which raised many salient research topics (Institute of Medicine, 2005). One topic included determining the most appropriate metrics of obesity burden. Number of preventable deaths, morbidity, years of life lost, re-

duction in quality of years lived, disability, and economic impact are all possible means of assessing the impact of obesity. The use of BMI as the "measure" of obesity should also be reconsidered. Waist-hip ratio and waist circumference, skinfold thickness measures, dual-energy X-ray absorptiometry (DEXA), and bio-impedance tests show promise as alternatives.

An ongoing challenge for researchers will involve examining the long-term effects of obesity. Measuring and tracking body weight in mid to late adulthood only offers a small window into the contribution that body weight over a lifetime has made to health and mortality. Gillman (2004) outlined research demonstrating that early life determinants of obesity, starting as early as the prenatal period, influence adult obesity and obesity-related disease. Most obesity-related epidemiological data represent past populations and it is not applicable currently, particularly to the more than nine million children who will experience years of damaging effects from overweight, obesity, and related co-morbidities (Ogden, Flegal, Carroll, & Johnson, 2002).

Conclusion

The recent debate has been important in generating dialogue about the public health challenge of being overweight and obese. The debate should not shake the determination of scientists in researching this important subject. Consistent and focused attention will be required in order to address the problem of overweight and obesity. Along the way, nurses must be cognizant of the real consequences of the discourse as public policy is driven by research and public opinion. It is important for nurses to participate in the debate as the largest body of health care providers in the United States, to be able to provide public health education and service to their patients, patients' families, and service communities, and to conduct research that contributes to and moves the science related to obesity forward.

Acknowledgment

The author would like to acknowledge Dr. Holly M. Harner for her invaluable review of this paper.

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