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Beyond BMI: The value of more accurate measures of fatness and obesity in social science research

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Abstract

Virtually all social science research related to obesity studies a person's body mass index (BMI). Yet there is wide agreement in the medical literature that BMI is seriously flawed because it does not distinguish fat from fat-free mass such as muscle and bone. This paper studies data that include multiple measures of fatness and finds that many important patterns, such as who is classified as obese, group rates of obesity, and correlations of obesity with social science outcomes, are all sensitive to the measure of fatness and obesity used.

We show that, relative to percent body fat, BMI misclassifies substantial fractions of individuals as obese or non-obese; in general, BMI is less accurate classifying men than women. Furthermore, when percent body fat instead of BMI is used to define obesity, the gap in obesity between white and African American men increases substantially but the gap in obesity between African American and white women is cut in half. Finally, total body fat is negatively correlated with employment for some groups and fat-free mass is not significantly correlated with employment for any group, a difference that was obscured in previous research that studied BMI.

In the long run, social science datasets should include more accurate measures of fatness. In the short run, estimating more accurate measures of fatness using height and weight is not possible except by making unattractive assumptions, but there is also no reason to adhere uncritically to BMI as a measure of fatness. Social science research on obesity would be enriched by greater consideration of alternate specifications of weight and height and more accurate measures of fatness.

JEL classification: I10

Keywords: Obesity; Fatness; Body mass index; Employment

1. Introduction

A wide variety of social science outcomes are affected by health (Culyer and Newhouse, 2000), and one important dimension of health is fatness. Fatness is a concept that refers to the abundance of adipose tissue, in which energy is stored in the form of fat cells (Bjorntorp, 2002). Fatness is a risk factor for ischemic heart disease, congestive heart failure, stroke, cancer, respiratory disease, diabetes, hyperlipidemia, hypertension, asthma, sleep

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apnea, arthritis, degenerative joint disease, gastric reflux, and depression (Pi-Sunyer, 2002; U.S. DHHS, 2001; NIH, 1998).

The health impact of fatness is particularly troubling because the average weight of Americans has risen considerably in the past few decades (Hedley et al., 2004; Ogden et al., 2006). Given the link between fatness and morbidity and mortality, excessive fatness is now recognized as one of the most serious public health challenges facing the U.S. (U.S. DHHS, 2001) and other industrialized countries (International Obesity Task Force, 2005).

To date, fatness has almost universally been measured in the social science literature using body mass index (BMI), which is weight in kilograms divided by height in meters squared (U.S. DHHS, 2001; NIH, 1998).[1] The advantage of BMI is that the information required to calculate it (weight and height) is easy to collect and relatively common in social science datasets such as the National Longitudinal Surveys of Youth (NLSY), the Panel Study of Income Dynamics (PSID), the Health and Retirement Study (HRS), the Behavioral Risk Factor Surveillance System (BRFSS), the National Health Interview Survey (NHIS), and the National Longitudinal Survey of Adolescent Health (Add Health).

Despite the widespread use of BMI among social scientists, within the medical literature BMI is considered to be a noisy measure of fatness and obesity because it does not distinguish body composition, i.e., it does not distinguish fat from muscle, bone, and other lean body mass (McCarthy et al., 2006; Yusuf et al., 2005; Gallagher et al., 1996; Smalley et al., 1990; Garn et al., 1986). As a result, BMI overestimates fatness among those who are muscular (U.S. DHHS, 2001; Prentice and Jebb, 2001).

Obesity is a concept that refers to excessive fatness (Bjorntorp, 2002; Bray et al., 1998). The most common definition of obesity used in the social science literature is based on BMI: a BMI greater than or equal to 30. However, there are a variety of definitions of obesity, corresponding to the various measures of fatness, and the strengths and weaknesses of each definition of obesity depends on the strengths and weaknesses of the measure of fatness on which it is based. For this reason, the clinical weight classification of obesity that is based on BMI suffers the same limitation as BMI: it ignores body composition. Medical researchers have concluded that the ability of BMI in particular, and weight–height indices in general, to identify obesity (defined using direct measures of fatness) is "poor" (Smalley et al., 1990, p. 408). Moreover, the inferiority of BMI at predicting health outcomes relative to more accurate measures of fatness led medical researchers to conclude ". . . current practice with body-mass index as the measure of obesity is obsolete, and results in considerable underestimation of the grave consequences of the overweight epidemic" (Kragelund and Omland, 2005, p. 1590).

This paper evaluates more accurate measures of fatness (e.g. total body fat and percent body fat) that have greater theoretical support in the medical literature. In particular, we investigate whether obesity defined using BMI, though theoretically inferior, is a reasonable proxy for true obesity. We find that obesity defined using BMI is only weakly correlated with obesity defined using more accurate measures of fatness, and that obesity defined using BMI results in substantial misclassification of individuals into weight classifications. African Americans are particularly likely to be misclassified by BMI. We also find that black–white differentials in obesity prevalence are highly sensitive to the measure of fatness used to define obesity. For example, when percent body fat, instead of BMI, is used to define obesity, the gap in obesity between African American and white women is cut in half (with African American women still significantly more likely to be obese). Finally, we show that the correlation of fatness with labor market outcomes varies based on whether one uses BMI or a more accurate measure of fatness. Collectively, these findings suggest that social scientists should avoid uncritically using BMI as a measure of fatness and that social science research on obesity will be enriched by greater consideration of more accurate measures of fatness.

2. More accurate measures of fatness

While there is consensus in the medical literature that BMI is a poor measure of fatness (McCarthy et al., 2006; Yusuf et al., 2005; Gallagher et al., 1996; Smalley et al., 1990; Garn et al., 1986), there is no consensus on which of the more accurate measures of fatness is best (Freedman and Perry, 2000). Candidates include: total body fat; percent body fat, which is total body fat divided by total mass; waist circumference; and waist-to-hip ratio. Each of these measures

[1] For example, as of 1 March 2007, EconLit lists 73 articles with the words "body mass index" or "MI" in the abstract, but zero articles with the more accurate measures of fatness in the abstract.