Is Obesity in the Eye of the Beholder?

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Like smoking before it, obesity has become a central topic of research and policy in many areas, including medicine, epidemiology, public health, and social science. But unlike smoking, obesity is not a behavior. Obesity is a state or condition usually defined as having excessive body fat. Because body fat is difficult to measure directly, obesity is typically defined instead as having excessive body weight (adjusted for height) using a set of standard, yet fairly arbitrary cutoffs along the body mass index (BMI) (Odgen et al. 2007).[1] The continuous BMI scale is traditionally divided into four major intervals (underweight, normal, overweight, obese) with sub-classifications of mild, moderate and severe within these groupings. Although other measures of body fat exist (e.g., waist to hip ratio, waist circumference, body volume index) these are far less commonly used in the larger research literature.

Obesity is associated with poorer health, including higher rates of diabetes, heart disease, and disability (Odgen et al. 2007) but the relationship between obesity and well-being is not just a medical and public health concern. Obesity is also associated with poorer socioeconomic outcomes, including lower income, wages, education, marriage rates, spousal earnings, and spousal occupational prestige (Averett and Korenman 1996; Cawley 2004; Conley and Glauber 2005; Glass, Haas, and Reither 2010). Although the direction of causality in these socioeconomic relationships is difficult to establish and some findings are mixed, the literature overall suggests that women with excessive body weight hold lower social status while men do not face similar disadvantages. Several studies also examine whether the effect of obesity differs by race or ethnicity (Averett and Korenman 1996; Cawley 2004). If the effect of obesity on social status is

[1] BMI is calculated as weight in kilograms divided by the square of height in meters. A BMI sore below 18.5 is called "underweight"; from 18.5 to 24.9 considered "normal"; from 25-29.9 considered "overweight"; and 30 and above considered "obese".

in part a result of the socially constructed stigma of being "fat," then what is defined as undesirably "fat" may differ for different social groups. The evidence suggests that these norms indeed differ by social group. For example, obese white women are more disadvantaged than are comparably sized black and Hispanic women (Averett and Korenman 1996; Cawley 2004). Thus, these predefined BMI categories of "overweight" and "obese" are not associated with the same disadvantages across different social groups.

Although the use of these standard cutoffs for obesity makes studies comparable across topics and disciplines, the application of medically-based categories of body size to the social world seems both arbitrary and limiting. If body size has a causal effect on life chances (net of lower productivity or correlated health limitations) this would function through the social construction of "fatness" rather than a predefined set of medically motivated groupings of BMI. The evidence suggests that the effect of body size on social outcomes could not only be nonlinear, but could also differ in important ways for different social groups. The usual organization of BMI into two to four standard categories does not allow for such complexities.

In this paper, we treat the cut offs for body size along the continuum of BMI as an empirical question. We use change point models (Zacks 1982; Bhattacharya 1994) to determine empirically where along the continuum of body weight the substantively important relationships between body size and social status actually fall. This approach allows us to estimate flexible and nonlinear relationships between BMI and a set of socioeconomic outcomes and allow the relevant cutoffs for obesity to differ both by group and by socioeconomic outcome. Using this method we can identify what the substantively meaningful categories of body size should be for socioeconomic relationships and how these compare to those used traditionally (ie, BMI≥25 and BMI≥30).

Change point models have been used in biostatistics and epidemiology (Hall et al. 2000) and demography (Raftery, Lewis and Aghajanian 1995). Intuitively, a change point is a place along a continuous variable, such as BMI, where the relationship between the variable and a given outcome changes in a statistically significant way. We will first use change point methods to estimate the best fitting categories for BMI. For example, suppose we have a model with three categories:

$$Y_i = \beta_0 + \beta_1 I(c_1 < bmi_i < c_2) + \beta_2 I(bmi_i > c_2),$$

where I(.) is an indicator function that equals one if the condition is true and equals zero if the condition is false. In a traditional analysis, the cut points (c_1 and c_2) would be arbitrarily set to BMI cutoffs of 25 and 30, but we will estimate c_1 and c_2 as parameters along with the coefficients of the model (β_0, β_1, and β_2). That is, we will evaluate the model likelihood over a fine grid of the potential cut points to determine the best fitting set. Second, we will estimate piecewise linear models (splines) that allow BMI to affect outcomes as a continuous variable and just as above, the cut points (knots in this case) are estimated parameters:

$$Y_i = \beta_0 + \beta_1(\min(bmi_i, c_1) + \beta_2(\min(bmi_i, c_2) - c_1) I(bmi_i > c_1) + \beta_3(bmi_i - c_2) I(bmi_i > c_2)$$

We make use of two large, nationally representative data sets: the National Longitudinal Survey of Youth (NLSY) and the National Health and Nutrition Examination surveys (NHANES). These two data sets have been used extensively in the literature for studying the relationship between body size and social outcomes. The NLSY, a nationally representative sample of respondents ages 14 to 22 when first surveyed in 1979, contains detailed information on education, wages, income, marriage histories, and spouses characteristics. The panel nature of the NLSY allows us to use young adult measures of BMI to predict later outcomes and thus reduce the risk of endogeneity bias that might come from using a concurrent measure of BMI.

NHANES is a nationally representative series of repeated cross sections ranging from 1972 to 2008. The NHANES collects detailed health and demographic information and unlike the NLSY, it includes measured weight and height, rather than self-reported measures.

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