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## Weight and Body Mass Index in Old Age: Do They Still Matter?

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Research by Chen and colleagues<sup>1</sup> showing a minimal relationship between body mass index (BMI) and mortality risk in old age adds to the debate over the utility of BMI as an indicator in geriatric practice. Chen and colleagues used data from the Women's Health Initiative (WHI) to examine the relationship between weight, waist circumference, and mortality. They found few associations between older women's BMI and risk of mortality, and those that existed were only in population subsets: women initially in their 50s or 60s, older women at the extreme of obesity, and women with extremely low BMI (<18.5 kg/m<sup>2</sup>). Seeing this lack of association between higher BMI and mortality risk, one reasonable conclusion from Chen and colleagues' work is that BMI is an outdated measure with little practical application in modern geriatric practice, but we urge caution in any effort to dismiss BMI from relevance, even in light of the findings from Chen and colleagues' research. We discuss a number of other important uses for BMI as a clinical measure of the health of older and aging populations. These uses include lifelong weight patterns for risk estimates, the use of BMI when estimating body composition, and the utility of BMI in determining morbidity and disability risk.

Clinically, physicians tend to rely on current or recent weight when evaluating older adults, but estimates of lifetime weight change with age are a necessary way of gaining a complete and accurate understanding of an individual's risk profile. Recent weight loss is a warning sign of major disease risk. The importance of weight in assessing old age health risk is not limited to the premorbid period but is determined by lifelong trajectories. The rate of weight gain over an individual's lifetime determined risk of death even in old age, and higher BMI at maturity in young adult life or in midlife may predict risk of death, even when BMI is lower old age does not.<sup>2</sup> Weight trajectories also contribute to the paradoxical relationship between weight and risk of death in older populations; weight loss is an indication of high risk of death, whereas ability to gain weight or remain stable may be signs of good health, so although it may appear that risk associated with BMI in old age is lower, lifetime BMI can make an important contribution to assessments of risk of death in old age.

Understanding change in BMI over time may also help improve estimates of risk in research on weight-related factors in older populations because weight change affects the composition of population references. In younger, healthier populations, most people are gaining weight, so a low-weight reference population is composed primarily of people who

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are thin and weight-stable. A low-weight reference population is much more complex in old age, when weight is more dynamic. As individuals change weight and transition between weight categories, there can be unintended and deleterious effects if those individuals are not accounted for in reference populations. Because weight loss in old age is associated with negative health outcomes, as individuals “downshift”—transitioning from obese to overweight and from overweight to normal weight—researchers risk introducing bias into the relative risk of disease in the population groups. The ability to track BMI and weight change over time gives researchers an opportunity to control for these potential errors. Chen and colleagues analytically tested for potential bias in their reference population by removing smokers (who are thin and tend to die early) and removing the first several years of follow-up (which should remove people who were ill at baseline, who have a greater risk of early death), but they did not use prior weight to assess risk.

Change in body composition over an individual’s lifetime adds another dimension to how BMI might be useful in risk estimation. In general, with aging, muscle and bone are lost from the periphery, along with subcutaneous adipose tissue, and additional adipose tissue collects centrally. To demonstrate that a body composition measure contributes risk rather than weight itself, it is important first to examine the risk of the outcome of interest for total weight. With appropriate modeling, risks for selective body composition measures should be greater than those for BMI. Controlling for BMI also helps standardize risk so that comparisons can be made between groups. Chen and colleagues demonstrated that risk associated with waist circumference is present in all classes of BMI risk in the WHI thereby standardizing body composition risk with BMI. BMI also is important in understanding sarcopenia, defined as loss of muscle or low muscle with age accompanied by low strength or slow gait speed. Apart from genetics and exercise, BMI is a major determinant of body muscle. Sarcopenia is thought to have a bimodal relationship with BMI, being more common in thinner older persons and in heavier older persons, who have less muscle than younger persons of similar BMI. Studies are underway that should clarify the contribution of BMI and other body composition measures to sarcopenia.<sup>3</sup>

Even when the risk related to mortality is unclear, studies have consistently demonstrated that being overweight in old age is associated with greater risk of disability, particularly reductions in mobility or walking independence.<sup>4</sup> These data are consistent enough that age-specific guidelines for weight in old age should consider adding or focusing primarily on mobility disability as a basis for BMI recommendations. This would add a major consideration of quality of life and reflect that mobility disability is a concern for older individuals. Future recommendations for weight standards should place more emphasis on risk of morbidity and disability in old age—rather than death—reflecting the changing utility of BMI.

Among major morbidity risks in old age, cardiovascular risk has been amenable to intervention for hypertension and hypercholesterolemia. Large proportions of older adults take medications to remediate these weight-related conditions, but diabetes mellitus and prediabetes remain as major weight-related health problems, and the incidence and prevalence of these conditions are linked to BMI. Thus, BMI is important for physical and metabolic function. Since the success of the Diabetes Prevention Program,<sup>5</sup> the Centers for

Disease Control and Prevention has run programs targeting prediabetes in overweight or obese persons; in coming years, it is anticipated that the Centers for Medicare and Medicaid Services will support coverage of an intervention including weight loss and exercise, based on BMI and measures of hyperglycemia,<sup>6</sup> which is hoped will reduce morbidity and disability associated with these weight-related conditions.

Recommendations on weight or BMI focused on function would not be useful without data to show that weight loss can be beneficial, even in old age, and that it has few side effects. Villareal's trials of weight loss<sup>7</sup> as an intervention to improve poor function highlight another area for which BMI remains important for geriatric research. Villareal's work sought to address questions about whether weight loss improves function and how to minimize the negative effect that weight loss can have on muscle and bone mass. Based on this work, it is now known that functional problems associated with overweight or obesity can be addressed safely through weight loss, so individuals identified as obese may be considered for such interventions.

What are the conclusions for practicing geriatricians? BMI in old age retains clinical utility through an increasingly diverse set of practical applications. A history of weight change over an individual's lifetime identifies trajectories of risk and weight-related health conditions. Loss of weight or inability to regain weight, particularly important after hospitalization, may be a sign of serious medical risk. Very low weight increases risk and may predispose to sarcopenia, whereas heavy weight increases risk of functional loss and morbidity and may also predispose to sarcopenia, and evidence is growing that older people, like their younger counterparts, can benefit from weight-loss programs, especially programs with an exercise component. Thus, weight and BMI still matter in old age, but like many areas of geriatric medicine, the substantive medical content underlying the concept is large and complex, involving both ends of the BMI spectrum and many more outcomes than are considered in younger adults.

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