Commentary: BMI and mortality in the elderly—a life course perspective

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The prevalence of obesity is increasing among all ages, including the elderly.1 There is debate about the harm of obesity in the elderly, the relation between obesity in old age and mortality, its clinical relevance, and the need for treatment.2 Studies of the relationship between BMI and mortality have been conflicting and are hampered by reverse causality, healthy survivor effects, and lack of adjustment for confounders such as smoking and physical activity. Research needs to address whether the relationship between BMI and mortality in the elderly is modified by the BMI trajectory before old age or by lifetime changes in body composition (since fat to lean mass ratio increases with age3), and varies by cause of death. A paper in this issue of the International Journal of Epidemiology4 investigates the association between BMI and mortality in a sample of older men from the well-known Whitehall Study of civil servants. The paper considers the impact of change in BMI over a 30 year period for several causes of death.

The study found increases and decreases in BMI to be associated with increased risk of all-cause and CVD mortality, while only BMI decreases were associated with increased risk of respiratory disease mortality. The results need to be put into the context of the whole life course BMI trajectory. Broadly, BMI increases throughout adult life to ~55–60 years where it levels off and then starts to slowly decrease in older age as seen in the Health Survey for England (HSE) (Figure 1).5 However, these data constitute separate cross-sectional samples and ideally longitudinal data are required. In the MRC National Survey of Health and Development (NSHD),6 a cohort born in 1946 with heights and weights measured regularly throughout life, mean BMI was lower at all ages up to age 50 years compared with the younger cohorts in the HSE. The result was a steeper increase in BMI in the longitudinal than the cross-sectional data. Longitudinal studies in older people (aged 70+) suggest little change or only small decreases in BMI.3 BMI in older age thus depends on the life course peak in BMI and the rate of decline. Earlier life exposures could influence both peak and rate of decline, while exposures in old age can only influence decline. Thus a single measure of BMI in old age cannot be studied in relation to mortality in isolation of the rest of the BMI trajectory. In the Whitehall study the age range at baseline was 40–69 years and, therefore, at the follow-up 30 years later was ~70–99 years. A large decrease in BMI between 40 and 70 years may be more beneficial than a similar decline between 60 and 90 years.

Studies relating BMI change with mortality are limited by only being able to consider specific parts of the life course BMI trajectory and by the length of time between the BMI measures. Too short a gap may exacerbate problems with reverse causality, but too long a gap may mean that the vital period of the trajectory is not captured. Cohort studies such as Whitehall, which began in middle age do not have early adult and childhood measures of BMI. In contrast, historical cohorts, used to study the developmental origins of adult chronic disease, have body size measures at birth and sometimes into childhood and adolescence, but rarely adult measurements. Birth cohorts have BMI at all phases of the life course, but the oldest such cohorts have not yet reached old age. Increasing BMI from 2 years to adolescence is associated with later CVD mortality and events,7 but the effect of infant weight gain is less clear.8 BMI in adolescence9 and in early adulthood10 is associated with later mortality, but it remains unclear whether this is due to tracking of BMI across the life course, is additional to the effect of BMI in middle age, or reflects the length of time that a person is overweight. Even if BMI measures were available right across the life course, analysis of such data in relation to a later life outcome such as mortality is not straightforward. There are different ways to parameterize the model, even with just two measures of BMI. With more than two measures the interpretation becomes even more complex.11 An additional challenge is that BMI in older age is influenced not only by changes in weight, but also by shrinkage in height. The Whitehall study dealt with this by using height at baseline for both measures of BMI.

Figure 1 Mean BMI by age in the Health Survey for England (HSE) and the MRC National Survey of Health and Development. Means for HSE are plotted at the midpoint of the 10 year age range.
The differences in associations between BMI change for different causes of death are an intriguing aspect of the paper. The finding that large increases in BMI among those of normal BMI at baseline was associated with the highest CVD mortality risk contrasts with results from another study, which suggested that high BMI in old age was only a risk for coronary heart disease if BMI had been high throughout earlier life. Interpretation needs to consider whether those with high BMI at baseline and who continued to put on weight may have died before resurvey in Whitehall.

Could there be any other explanation than reverse causality for the associations between low BMI at resurvey and weight loss and mortality? Although the authors quite rightly carry out a re-analysis based on a healthy sub-sample, this may not completely eliminate the possibility of reverse causality. Those with high BMI who survived until resurvey may be healthier than those who died or may be resistant to the adverse effects of overweight. Both the reasons for weight loss and the type of weight loss may be particularly important when understanding the mechanisms linking weight change in old age with mortality. The British Regional Heart Study, a cohort aged 56–75 years, found that the benefit of weight loss was in those who intentionally lost weight through personal choice (largely a reduction in non-CVD mortality) and was most apparent in markedly overweight and younger men (<65 years). Unintentional weight loss and intentional weight loss on health grounds were associated with increased all-cause mortality. Weight loss in old age is due to loss of both fat and fat-free mass. Muscle loss, leading to a lack of physical exercise and further muscle loss can result in the ability to recover from illness being compromised. Both the Framingham Heart Study and the Tecumseh Community Health Study showed that while weight loss was associated with increased mortality, fat loss was associated with a decreased mortality rate. Grip strength, an approximation of total body muscle mass, was associated with a decreased mortality rate.14 Grip strength, an approximation of total body muscle mass, was associated with a decreased mortality rate.

References