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Dear Sir:

In an editorial related to an article by Janssen et al (1), Bray recommended that we be reluctant toward replacing body mass index (BMI; in kg/m²) with waist circumference as the only clinical measurement for indicating health risks associated with overweight and obesity (2). We agree with Bray. In their article, Janssen et al (1) called for prospective studies. We published such a paper last summer (3). Our results support both the hypotheses of Janssen et al and Bray’s reluctance toward ignoring BMI.

Between 1993 and 1997, 57,053 men and women aged 50–64 years were recruited for a Danish prospective study, the Diet, Cancer, and Health study. The cohort represents 7% of the entire Danish population in this age group. From recruitment until 31 December 2002, 2323 deaths (1461 men and 862 women) were identified in the Civil Registration System by using the unique personal identification numbers assigned to all Danish inhabitants. Missing information about variables of interest led to the exclusion of 628 participants, which can be seen from the horizontal extent of the waist circumference between 60 and 130 cm, respectively, and the reference BMI was 25. The vertical axis is log scaled.

We examined the independent associations of waist circumference and BMI with all-cause mortality in this cohort of middle-aged men and women (3). We showed how BMI predicted mortality for given values of waist circumference and how waist circumference predicted mortality for given values of BMI (3). No sign of interaction was found (3). Our findings are summarized in the 2 new figures presented here, which show the estimated associations for each of the obesity measures for fixed values of the other measure. The estimated association with mortality is displayed for a 95% normal confidence interval (CI) for waist circumference and BMI (in kg/m²) among men (n = 26,916) and women (n = 29,505) in the Diet, Cancer, and Health study (1993–2002). The reference waist circumferences for the men and the women were 95 and 80 cm, respectively, and the reference BMI was 25. The vertical axis is log scaled.

Thus, the importance of BMI for mortality depends on the World Health Organization’s classifications of BMI (4). For overweight

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BMI of 25–29.9) and obese (BMI ≥ 30) persons, waist circumference alone captures the increase in the mortality rate and replaces BMI as a risk indicator in a graded fashion, as suggested by Janssen et al (1). In contrast, for underweight (BMI < 18.5) persons, BMI dominates the mortality rate, and in the normal weight range (BMI of 18.5–24.9), both waist circumference and BMI predict the mortality rate (3), but in opposite directions.

In summary, when BMI is >25, waist circumference alone is a very good predictor of mortality, whereas when BMI is <25, BMI is also important for the mortality rate, and waist circumference cannot fully replace BMI (3). Further studies investigating other endpoints related to obesity are needed.

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Reply to J Bigaard et al

Dear Sir:

We appreciate the editorial by Bray (1) that accompanied our recent article examining the independent relations of body mass index (BMI) and waist circumference (WC) with obesity-related health risk (2). We also appreciate the letter by Bigaard et al that was written in response.

The article (3) that is referred to in the letter by Bigaard et al is an important longitudinal analysis that complements and extends our cross-sectional observations (2). A key finding from both of these articles is that higher WC values predict an increase in morbidity or mortality after control for BMI. These observations show the importance of including WC as a routine clinical measure. The 2 articles differed in that BMI was not a significant predictor of obesity-related health risk after control for WC in our cross-sectional analysis (2), whereas BMI was negatively associated with mortality after control for WC in the study by Bigaard et al (3). This result is supported by the results of an earlier longitudinal study in which BMI was negatively associated with mortality after adjustment for WC in men (4). In other words, in both of these longitudinal studies, higher BMI values indicated a lower mortality risk once the risk attributable to WC was accounted for (3, 4). This observation is far from intuitive, because most researchers and clinicians would argue that higher BMI values indicate a greater health risk. This is an important observation, which suggests that after statistical control for WC, BMI may represent a unique aspect of body composition—one that decreases health risk.

It is important to clarify that at no point in our article (2) did we indicate that clinicians should not obtain height and weight measurements to calculate BMI, as may have been interpreted from the letter by Bigaard et al or from the editorial by Bray (1). Rather, we suggested “that BMI coupled with WC did not predict obesity-related health risk better than did WC alone when these 2 anthropometric measures were examined on a continuous scale. . . However, when WC was dichotomized into the normal and high-risk categories advocated by the NIH [National Institutes of Health], BMI remained a significant predictor of health risk.” On the basis of these findings, we suggested “that WC is a better marker of health risk than is BMI, and consequently a greater emphasis should be placed on

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