health outcomes and whether such a thing as too much exercise exists. Although it is tempting to speculate about an upper limit of exercise recommendations, in our opinion this is a step too far based on data that are presented to this point.

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In Reply—Association Between Weekly Exercise Time and Mortality

To the Editor: We would like to thank the esteemed Drs Aengevaeren, Eijsvogels, and Bakker for their insightful comments regarding our recently published manuscript.1 We chose the cohort doing 2.6 to 4.5 h/wk of exercise as the reference group because this approximates the 30 minutes daily of leisure-time physical activity recommended by national guidelines in Denmark.

In response to the request that we analyze this data set by a nonlinear model evaluating weekly exercise time as a continuous variable, we performed a Cox regression analysis for all-cause mortality using restricted cubic splines for exercise volume with adjustment for age, sex, education, smoking, alcohol, body mass index, and diabetes. In this analysis, the optimal exercise volume was around 3.5 h/wk; both lower and higher volumes were associated with increased all-cause mortality risk (Figure). Compared with the reference group (moderate exercise dose), the magnitude of the increased mortality risk was strikingly high (≈40%) for those doing little or no physical activity but only modestly increased (≈10%) for those doing very high exercise volumes.

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A possible explanation for this could be that individuals who exercise around 3.5 h/wk are generally healthy. Another explanation is that high exercise doses are not associated with increased mortality risk, and the apparent increased mortality in people doing very high volumes of exercise is due to unmeasured confounding. However, this attenuation of exercise-conferred longevity benefits among cohorts doing excessively large amounts of strenuous exercise (U curve or reverse-J curve) has been a recurrent finding in most other prospective observational studies as well.2

We agree with Bakker et al that repeated measures of the exposure variable would strengthen our results. However, this was not feasible because we have information only about this specific exposure 20 years after baseline and a rather short follow-up after that.

These results from the Copenhagen City Heart Study support the current dogma that exercise is a potent medicine at any dose, and individuals seeking to optimally improve life expectancy should strive for a moderate dose of physical activity rather than a low or extremely high dose. Even so, large improvements in life expectancy are realized by sedentary individuals who add even 15 or 20 minutes of daily physical activity to their routine,3 and people who chronically perform very high volumes of exercise still have improved longevity compared with those who perform no leisure-time sports activity.4

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