COMMENT ON JURASCHEK ET AL.

Cardiorespiratory Fitness and Incident Diabetes: The FIT (Henry Ford ExercIse Testing) Project. Diabetes Care 2015;38:1075–1081

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We read with interest the study by Juraschek et al. (1) in which the authors reported that higher cardiorespiratory fitness predicts a lower incidence of diabetes. We commend the authors' diligent data collection and modeling and accept the validity of their main finding. We disagree, however, with their conclusion that the demonstrated association is independent of baseline risk factors. In our view, the reported measures are insufficient to resolve the complex interrelations between obesity, cardiorespiratory fitness, and diabetes. The treadmill test that the authors used introduced a bias against obese subjects, and the resulting misclassification cannot be eliminated by adjustment or stratification for self-reported obesity.

Obesity is a strong predictor of diabetes. Establishing the independent association of fitness and diabetes requires, therefore, a measure of cardiorespiratory fitness that is independent of obesity and body composition. Direct measurement of oxygen consumption during a maximal exercise test is the accepted standard measure of cardiorespiratory fitness. The obtained values need to be standardized for body composition (2). Failure to do so may introduce a substantial bias in obesity-related outcomes such as diabetes (3).

As direct measurements of oxygen consumption are cumbersome, simplified tests have been developed for clinical practice. The current study is based on such a treadmill protocol. Yet, this protocol has only been validated for normal-weight subjects (4), not for comparisons across different strata of obesity. This matters especially in weight-bearing fitness tests, as obese subjects have to carry an extra burden in the form of fat. Other things equal, every kilogram of extra body fat has been shown to reduce maximal treadmill time (5). As a result, obese subjects are misclassified into lower categories of fitness.

Self-reported history of obesity is a crude estimate of body composition. In the current study, this estimate did not modulate the association between fitness and incidence of diabetes (see Fig. 2 in ref. 1). Yet, in the subgroup with measurements of BMI, obesity markedly attenuated the explanatory value of cardiorespiratory fitness (see Supplementary Table 3 in ref. 1). As demonstrated recently, an even more specific estimate of body composition, such as bioimpedance measurements, may be required to avoid a body-composition bias (2).

What is the overall impact of these limitations on the results of the current study? Most likely, the use of a biased estimate of fitness and a crude estimate of obesity resulted in an overestimation of the role of fitness in the main results (see Fig. 2). These categories of fitness combine the diabetogenic effects of both fitness and obesity. The fully adjusted model for the subgroup with BMI measurements (see Supplementary Table 3) is more likely to have underestimated the role of fitness, as after adjustment for obesity, only the attenuated effect of misclassified categories of fitness remains.

We agree with the authors that future studies should examine the association between change in fitness over time and incident diabetes. Proper assessment of both cardiorespiratory fitness and body composition should be part of the protocol.

Duality of Interest. No potential conflicts of interest relevant to this article were reported.

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