Letter to the Editor

Modifiable lifestyle risks, cardiovascular disease, and all-cause mortality

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Dear Editor,

Carlsson and colleagues have recently published their results from a well-designed Swedish cohort investigating the correlations between modifiable risk factors, cardiovascular disease (CVD) events, and mortality [1]. In their study, they followed seven modifiable risk factors including smoking status, alcohol intake, physical activity, processed meat intake, fish intake, daily fruit intake, and daily vegetable intake in a prospective cohort of 60 year-old men (n = 2039) and women (n = 2193) from Stockholm County, Sweden. Participants were assigned healthy lifestyle scores ranging from 0 to 7 based on the risk factors above, and were followed for incident CVD and all-cause mortality over an 11 year period. Results showed that "very healthy" participants (6–7 points) had a hazard ratio (HR) for all-cause death of 0.25 for women and 0.35 for men, respectively, compared to unhealthy participants (0–2 points). Risk discrimination was preserved irrespective of adjustment by body-mass index (BMI).

We feel that the authors' findings above are important contributions to the literature that highlight the role that modifiable CVD risk factors play in improving survival. In fact, Carlsson and colleagues' findings support the results we have observed using comparable risk factors in the Multi-Ethnic Study of Atherosclerosis (MESA) in the United States, and for which we have recently published the results [2]. In our study, we evaluated the same dietary variables above including alcohol intake, as well as smoking status, physical activity amounting to 150 min of

moderate activity per week, and BMI. In MESA, there were over 6200 participants who were multi-ethnic and who came from six various US centers. Participants who demonstrated the healthiest behaviors including healthy diet, adequate physical activity, smoking avoidance, and normal weight maintenance had a HR of 0.19 for all-cause death compared to those with the least healthy behaviors. Therefore, the risk reduction in all-cause death in the healthiest group of this large multi-ethnic US study was similar to that of the Swedish study. This adds to the abundant evidence that lifestyle factors play a significant role in preventing future CVD events and mortality.

Where the Swedish cohort differed from MESA and other published studies is in the exclusion of BMI in their health scoring [2–4]. This is an important distinction because not all overweight individuals are inactive, and not all lean individuals are necessarily active or fit. In fact, we have previously observed fitness and fatness to be independently correlated with CVD risk [5]. Several authors have shown that in fit, overweight individuals it is fitness that is protective against much of the mortality effects of obesity [6–9]. Accordingly, Carlsson, et al. evaluated the healthy lifestyle factors above excluding BMI, and adjusted for anthropometric measures to see if healthier scores discriminated mortality risk regardless of BMI, which they appeared to.

There are several important limitations to the Swedish study that the authors did not allude to in their paper. First, all participants were from only one county of one country, which may reduce global generalizability of the findings. That is, participants from only Stockholm County, Sweden may have much less variability in their dietary behaviors compared to a combination of participants from rural China, Sweden, and Newark, New Jersey for example. Diversity in other variables such as genetic profiles, leisure time activity, work nature, and environmental pollution, to name a few, is similarly lost with single center studies. Second, the findings of this study were derived from only 60 year-old participants. Certainly, there may be effect modification of the risk factors studied across different age groups. For example, we have previously discussed how exercise may have a different effect on participants of various ages due to changes in inflammation, thrombosis, and coagulation over time [10]. Finally, the authors in the Swedish study used moderate physical activity once per week as a criterion for a healthy physical activity score which likely overestimates healthy physical activity behaviors in the cohort. The American Heart Association currently recommends at least 30 min of moderate physical activity most days per week, which is at least four times more frequent than the minimum amount categorized as "healthy" in the Swedish study.

Despite these limitations, the study published by the authors above is a well-designed prospective cohort that greatly underscores the importance of lifestyle modifications with regard to CVD and mortality risk reduction. Their exclusion of anthropometric measurement in the

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calculation of risk provides a unique approach in light of the emerging evidence in the "fitness versus fatness" debates, and further confirms the importance of healthy diet, smoking avoidance, and physical activity in prolonging survival.

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