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Accumulation of Moderate-to-Vigorous Physical Activity and All-Cause Mortality

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The health benefits of intermittent short bouts of moderate-to-vigorous physical activity (MVPA) have been advocated for >20 years, beginning with the Physical Activity and Public Health recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine.[1] Early experimental studies examined health benefits of short versus longer bouts of MVPA, concluding that short and longer bouts of MVPA resulted in improvements in both fitness[2,3] and cardiometabolic health risk.[3,4] Subsequent examinations of epidemiological studies suggesting MVPA benefits for all-cause mortality concluded that some of the existing self-report MVPA instruments implied engagement in intermittent MVPA (eg, number of stair flights climbed). On the basis of existing data that were largely obtained from self-reported MVPA, the 2008 Physical Activity Guidelines for Americans recommend accumulating MVPA in bouts of at least 10 minutes in length for significant health benefits.[5] No published research was available to examine the possible health benefits of shorter bouts. In this issue of *Journal of the American Heart Association* (*JAHA*), Saint-Maurice et al use data derived from accelerometers in the National Health and Examination Survey to examine the effects of MVPA bouts on all-cause mortality.[6] Their results indicate that total MVPA with no bout requirement, MVPA in 5-minute bouts, and MVPA in 10-minute bouts resulted in similar risk reductions for all-cause mortality. These data are similar to a recent report on health outcomes in older men that found total activity, including light intensity and activity expressed in bouts, was inversely related to all-cause mortality.[7]

In the research reported by Saint-Maurice and colleagues, the adjusted hazard ratios for all-cause mortality for increasing quartiles of total MVPA were 0.43, 0.24, and 0.27 for quartiles 2, 3 and 4, respectively (quartile 1 as reference).[6] In prior systematic reviews or meta-analysis using self-report PA data, the hazard or risk ratios for all-cause mortality when comparing the more or most active with the least active have been closer to 0.60 to 0.65.[8] If these risk ratios are an accurate expression of the mortality reduction of increased PA volume when determined by accelerometers, then the public health benefit of increasing MVPA is even greater than currently promoted.

Virtually all epidemiological studies report that higher volume of MVPA, whether performed intermittently or in sustained bouts, lowers all-cause mortality. The results from Saint-Maurice et al, as evidenced in Table 1, are consistent with the previous work, in which greater MVPA volumes resulted in lower hazard ratios.[6] There did appear to be a leveling off between the third and fourth quartiles, with no difference in hazard ratios at greater total MVPA or between the less and more bouted MVPA tertiles. A pooled analysis of epidemiological studies using self-reported assessments of MVPA as the exposure and mortality as the outcome examined the dose-response threshold for reduced risk of mortality.[8] The authors found a possible evidence of threshold at 22.5 to 39.9 metabolic equivalent task hours per week (ie, MVPA at ≈3 to 5 times the minimum recommended guideline of 7.5 metabolic equivalent task hours or 150 minutes of moderate-intensity PA per week). Saint-Maurice et al observed lower hazard ratios up to ≈675 min/d of MVPA (Table 1, quartile 3/tertile 1).[6] It is difficult to compare possible thresholds for mortality benefits with the existing literature because of the substantially lower accelerometer cut point for achieving moderate intensity used in this study. Further studies are needed using standardized accelerometer methods to determine if a threshold for daily MVPA minutes exists and is replicable.

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An epidemiological study cannot completely separate sporadic MVPA from that which occurs in bouts, so residual confounding of bout length within the bout ratio tertiles exists. A substantial amount of MVPA occurred in the low bout tertiles in these higher quartiles (ie, 35.6±0.5 min/d in quartile 3; 78.8±1.3 min/d in quartile 4).[6] MVPA is a behavior that is typically performed over some period of time, even if unplanned. Experimental studies are needed that would systematically assess cardiometabolic risk factors for short bouts of MVPA (ie, 1–5 minutes) compared with longer bouts. Although this type of study would not assess all-cause mortality, it would provide necessary information that would be required to change national physical activity guidelines on MVPA bout lengths.

With advancement in accelerometry and other wearable technologies, future public health recommendations will be based on studies using these technologies rather than self-report. These newer methods allow all physical activity to be continuously assessed, removing the limitations of recall bias and assessment only of activities or intensities queried by self-report instruments. Self-report data will likely become a secondary source of information. However, substantial research and development will be needed to standardize data collection, management, and analysis of wearables. Breakthroughs in analytic techniques may identify daily/weekly/monthly patterns of MVPA that confer optimal benefits for reduced mortality and chronic disease conditions.

The enduring question remains "what can be done to encourage more Americans to increase their MVPA?" The population-attributable fraction of physical activity to all-cause mortality is 10.9, behind only the other risk factors of blood pressure and current smoking.[9] Thus, it is important for Americans to increase their MVPA. Results of this study will not solve the question, but it could encourage policies that would make it easier to engage in short bouts of MVPA. Partnering with architects to design buildings with prominent stairways and parking lots that are distant from buildings may encourage intermittent MVPA. Efficient, safe, and affordable public transportation systems result in increased walking.[10]

In sum, results from this study support prior work that demonstrates MVPA volume reduces all-cause mortality. It provides evidence that total MVPA with no bout requirements confers benefits, particularly for those in the higher daily MVPA quartiles. For those in the lower quartiles, MVPA in at least 5-minute bouts confers reduced risk of all-cause mortality. Accumulating MVPA, however a person is able, reduces mortality.

Disclosures

None.

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