

# Run for your life: tweaking the weekly physical activity volume for longevity

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There is nothing better than exercise but more exercise.

Regular physical activity (PA) and high cardiorespiratory fitness (CRF: aerobic capacity,  $\text{VO}_2$  max) reduce all-cause mortality even after adjusting for relevant confounders.<sup>1,2</sup> Large-scale studies indicate an almost linear relationship between increasing CRF and longevity, with no signs of an upper limit.<sup>3</sup> It remains less clear which PA volumes are optimal for a long life. Public health guidelines recommend a minimum of 150–300 min moderate intensity aerobic PA or 75–150 min vigorous intensity aerobic PA per week to induce general health benefits.<sup>4</sup>

## HOW MUCH BANG CAN YOU GET FOR A PA BUCK?

Dr Hannah Arem and colleagues, using pooled data from six studies in the USA and Europe (including 661 137 adults), showed that meeting PA guidelines was associated with a large longevity benefit.<sup>5</sup> And there were even further improvements until the benefit for longevity reached a threshold at a level 3–5 times higher (450–750 min/week) than the minimum recommendations, without adverse effects in those performing PA at  $\geq 10$  times that minimum. The maximum all-cause mortality reduction was almost 40% without relevant differences between moderate and vigorous intensity PA. Men benefited more from vigorous and women more from moderate intensity PA. Generally, PA-related benefits were larger for older individuals. The reduction of mortality from cardiovascular diseases (CVD) was more pronounced than that from cancer; the maximum risk decrease from CVD mortality was reached at exercise doses 3–5 times the minimum recommendations, while that from cancer mortality required doses  $>5$  times the minimum recommendations.<sup>5</sup>

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These findings build on those from another large prospective cohort study (416 175 individuals in Taiwan) that highlighted longevity benefits (later death!) starting from brief daily periods (15 min; 14% mortality-risk reduction) of moderate PA up to a threshold of 700 min (100 min daily!) per week.<sup>6</sup> This threshold was already attained after 350 min of vigorous PA accompanied by maximum mortality reduction from all causes by  $\sim 45\%$  compared with somewhat above 35% with 700 min of moderate intensity PA weekly. The decrease of cause-specific mortality was most pronounced for diabetes mellitus, followed by CVD and all cancer.<sup>6</sup>

## WHAT HAPPENS TO THE RISK DECREASE OF MORTALITY IN INDIVIDUALS WITHOUT MAJOR PRE-EXISTING DISEASES IF YOU REPLACE SITTING TIME WITH EXERCISE OR NON-EXERCISE PA (EVERYDAY LIVING ACTIVITIES)?

A positive association between sitting time and all-cause mortality in those not meeting minimum PA recommendations was demonstrated in a large prospective follow-up study (149 077 individuals).<sup>7</sup> All-cause mortality was  $\sim 50\%$  higher in the most sedentary ( $>8$  hours daily sitting time) compared with the least sedentary ( $<4$  hours sitting per day). Negative effects of longer sitting times were almost eliminated at increased PA, especially in the highly active group ( $\geq 420$  min of moderate-to-vigorous PA per week).<sup>7</sup>

A recent epidemiological study (88 140 individuals),<sup>8</sup> that evaluated dose-dependent effects of a broad variety of leisure activities, showed similar results as reported by Wen and colleagues.<sup>6</sup> All-cause mortality risk was decreased by 42% with total leisure activities of  $\sim 700$  min/week, without striking changes if activities exceeded 1500 min/week.<sup>8</sup> Benefits were larger for vigorous compared with moderate intensity activities. In this study, an inverse J-shaped association was demonstrated between reduced CVD-related mortality and the amount of leisure activities, up to a maximum benefit at  $\sim 500$  min/week. The maximum decrease

in cancer-specific mortality was reached only at  $\geq 1200$  min/week.<sup>8</sup>

A similar non-linear dose–response relation between higher PA, based on accelerometer recordings, and lower mortality, was reported in a meta-analysis (8 studies including 36 383 individuals; mean age 62.6 years).<sup>9</sup> The extent of PA associated with maximal mortality risk reduction decreased with increasing intensity of PA. Respective amounts were  $>2000$  min/week (55% risk reduction) at very light intensity, and 560 min (60% risk reduction) at high light intensity, probably representing rather moderate intensity PA in this cohort of older adults.

## What's the bottom line? Is 700 min/week the magic number?

Mortality reduces as PA increases, apparently in a non-linear dose-response pattern. While large amounts of only very light PA are necessary to reduce all-cause mortality as low as it will go, the same benefit accrues from about 700 min of weekly moderate intensity PA. CVD mortality may be minimised with a somewhat lower dose ( $\sim 500$  min/week); the higher doses (up to  $>1200$  min/week) are associated with the greatest reductions in cancer mortality. These volumes of weekly moderate PA (exercise and/or daily living activities) for optimal benefits can be halved when replacing moderate by vigorous-intensity activities and this applies more for men than for women.

*In summary* even though 15 min of daily PA is associated with reduced mortality risk in the general population, the optimal volume for longevity is substantially larger but may vary between individuals, for example, depending on age, sex, health status and/or exercise preferences. We exhort consulting doctors to discuss both the optimal and the minimal dose of PA with patients. Inform the patient of his/her options. If good health came in an exercise pill, and the best results came from taking two pills/day, would you (the patient) want to take two or just one? Individually tailored PA volume should provide greater benefits than the very valid public health message of at least 150 min/week.

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