Uncovering mechanisms to prevent dementia with quantifiable feedback from wearable devices

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Being diagnosed with dementia can be devastating. A recent Wall Street Journal article described dementia in the US as “not just an awful disease, but 90 million baby boomers are entering the prime age with dementia and will swamp Medicare and Medicaid.” To make matters worse, the report said, “if you get sick, there is no cure or even drug treatment.”

Prevention continues to be the major solution, and exercise stays at the top among 11 modifiable risk factors determined by the Lancet Commission on dementia. Indeed, in a study reported by A. R. Tari et al. in this issue, exercise above a threshold of 100 PAI (Personal Activity Intelligence)/week significantly reduced dementia risk. Based on a cohort of 29,826 healthy Norwegians followed for 24 years, increasing PAI score or maintaining a high one, measured 10 years apart, led to a reduction of 25% incidence and 38% mortality of dementia.

WHO guidelines clearly point out that physically active people, especially those at the highest level, are less likely to develop cognitive decline, vascular dementia and Alzheimer’s disease. While exercise is known to exert its effect through modifiable cardiovascular risk factors to reduce vascular dementia or post-stroke dementia, we are particularly interested to see if it could overcome Alzheimer disease, the most common form of dementia. Unfortunately, the authors were not able to stratify the data for analysis of various subtypes of dementia, a major limitation of the study. Nevertheless, this study confirmed the multipronged ability of aerobic exercise to reduce dementia risk as a whole both in incidence and mortality. Furthermore, this study uncovered two discrete secrets to promoting specific forms of exercise, consistent with WHO guidelines.

First, one needs motivators and constant reminders to sustain regular exercise. In competitive sports, you have winning or losing to guide your effort, but when you are jogging alone, no such guide is available. Now you can use a wearable digital watch to link with your cell phone and have PAI reported to you on a daily basis. By tracking one’s heart rate for the amount of time above a certain threshold, like 130 beats/min, PAI provides quantitative feedback much better than pedometers. Unlike pedometers, the heart-rate-related PAI score is not that easy to predict. The amount of PAI one has earned faithfully and objectively reflects how hard or how long one exercised, nudging one to achieve more.

Second, we know those with slow heart rates live longer. How can we slow down the heart? The mechanism that PAI health was built on is a “Heart rate paradox” where “faster heart rate generated by vigorous exercise is needed to slow heart rates down at rest.” Faster resting heart rate (RHR) shortened life expectancy on a linear relationship (Figure 1), shortening by 4 months for every beat above 70/min. A 30 beats/min difference can lead up to a 10-year life expectancy difference. Maintaining 100 PAI/week in the HUNT study achieved better cardiorespiratory fitness with slower RHR, and prolonged life by 2.5 years, while preventing and delaying dementia.

Authors collected data from Norwegians, a highly active population, and whether these findings are applicable to a less active or heterogeneous population is not clear. They indicated that PAI score of ≥100 can be achieved by 40 weekly minutes of vigorous-intensity exercise, an amount far less than the current recommendation of 30 minutes/day, except for its push for vigorous exercise. In fact, 15 minutes/day, the minimal amount of exercise that was reported to add 3 years of life expectancy may be sufficient for dementia prevention, if one can carry it out with vigorous intensity.
That vigorous exercise can achieve better benefits than moderate intensity, even an identical exercise volume (a product of duration and intensity), has been increasingly demonstrated, for preventing end stage renal disease, for reducing risk of certain cancers, and now for reducing dementia.

It is said that the best medicine is regular exercise, but sustaining 100 PAI/week with mostly vigorous activity requires grit, commitment, perseverance, and passion. Even an avid exerciser can struggle with this. The quantifiable feedback one gets from wearable devices reporting PAI creates a support system that works behind the scenes to motivate. With 100 PAI as the weekly goal to reach, spirited exercise becomes an enjoyable daily routine to prevent not only numerous diseases but also dementia.

Contributors
CPW drafted the first manuscript, JPMW provided technical support and CW did English editing. JPMW, CW, MKT, CHC, and HYC critically reviewed the manuscript for important intellectual content. All authors gave final approval of the manuscript.

Declaration of interests
All authors declare that they have no relevant financial interests. Dr. Chi Pang Wen’s contribution to this study is supported, in part, by the Ministry of Science and Technology (MOST 111-2321-B-039-005), China Medical University Hospital (DMR-111-105).

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