Fragmented physical activity linked to greater mortality risk

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Although reduced physical activity during the day is widely seen as a harbinger of mortality in older people, fragmentation of physical activity—spreading daily activity across more episodes of brief

activity—may be an earlier indicator of mortality risk than total amount of daily activity, according to a new study from scientists at the Johns Hopkins Bloomberg School of Public Health.

The study, to be published October 2 in *JAMA Network Open*, used physical activity data collected using wearable monitors in 548 well-functioning older adults enrolled in the National Institute on Aging's Baltimore Longitudinal Study of Aging. The scientists found that for this group of people during the period 2007-17 there was no association between overall daily activity levels and greater mortality risk. However, there was an association between mortality risk and more fragmented physical activity.

"Fragmentation of physical activity may be an early indicator of increasing mortality risk," says study lead author Amal Wanigatunga, Ph.D., assistant scientist in the Bloomberg School's Department of Epidemiology. "By examining these patterns of routine activity and the decline in patterns of fragmented activity, we can begin to identify trajectories toward premature serious illness and death sooner and work to develop interventions and preventive strategies to reverse it."

Adults age 65 and older are one of the fastest growing segments of the U.S. population. They are also increasingly sedentary, and prior studies have shown that less physical activity among older adults is a predictor of more illness and premature death. But in recent years, Wanigatunga, along with study senior author Jennifer Schrack, Ph.D., associate professor in the Department of Epidemiology at the Bloomberg School, and their colleagues, have begun to explore activity fragmentation as a complementary and potentially more sensitive marker of overall health and functioning among older adults.

For the new study the scientists analyzed data from the ongoing Baltimore Longitudinal Study of Aging (BLSA), the U.S's longest-

running study of human aging, which began in 1958 and in recent years has included the use of accelerometers by participants to track both quantities and patterns of daily physical activity. The analysis was based on accelerometer data collected between 2007 and 2015 and subsequent mortality data collected between 2007 and 2017 from 548 BLSA participants aged 65 and older.

Of the 548 participants studied, 487 were alive at the end of 2017, and 61 were deceased. The living participants engaged in an average of 5.7 hours of activity per day, compared to 4.7 hours for those who later died. But after accounting for confounding factors such as age, sex, race, body mass index, and existing illnesses, Wanigatunga and colleagues found that total physical activity overall was too weakly associated with mortality risk to reach statistical significance.

Not so for activity fragmentation. The researchers found that for each 10 percent higher activity fragmentation there was a 49 percent increase in the risk of mortality. The researchers defined activity fragmentation as the probability of transitioning from an active state to a sedentary state for each participant, so shorter average activity periods meant higher fragmentation.

The researchers also analyzed the duration of each participant's bouts of activity, and found that "percent of activity spent in bouts of less than five minutes" appeared to be another good marker of mortality risk. Each additional 10 percent of active time spent in such short bouts was associated with a 28 percent increase in the chance of mortality. Percent of active time spent in 5- to 10-minute bouts was not a significant indicator of mortality risk.

Percent of active time spent in bouts longer than 10 minutes—such as deliberate physical exercise—also didn't reach statistical significance as a marker of mortality risk, but unsurprisingly showed a trend towards

being a marker of reduced mortality risk.

Wanigatunga notes that the BLSA cohort they studied had an average age of 76 but was, on the whole, healthier than the general population of older adults in the U.S.

He notes too that although time spent exercising, such as brisk walking, is often examined as a marker for mortality risk, most physical activity for older adults comes from the ordinary, lighter-intensity activity routinely performed throughout the day, such as doing laundry, preparing meals, gardening, and even getting the mail.

Wanigatunga and Schrack and their colleagues are continuing to study activity fragmentation as a potential indicator of health decline, including cognitive decline and dementia. In principle, older adults could have their activity fragmentation monitored this way with wearable monitoring devices to help maintain a high quality of life and preserve the ability to live independently.

"A doctor seeing a patient transitioning into a more fragmented activity pattern and a more sedentary state might initiate a prescription for a tailored physical activity regimen, hopefully as an effective way to restore normal patterns of activity, rather than just saying 'You need to exercise more!'" Wanigatunga says. "I think that type of clinical application, where we aim to wield exercise formally as medicine, is where the study of activity fragmentation can take us."

More information: "Association of Total Daily Physical Activity and Fragmented Physical Activity and Mortality in Older Adults" *JAMA Network Open* (2019).