

Smartphones could be game-changing tool for cardiovascular research, study shows

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Widespread ownership of smartphones around the world could potentially transform cardiovascular research by providing rapid, large-scale and real-time measurement of individuals' physical activity, according to a new study by researchers at the Stanford University School of Medicine.

"People check these devices 46 times a day," said Euan Ashley, MD, PhD, associate professor of cardiovascular medicine. "From a [cardiovascular health](#) standpoint, we can use that personal attachment to measure [physical activity](#), heart rate and more."

Ashley is senior author of the study, which will be published Dec. 14 in *JAMA Cardiology*.

In March 2015, Stanford researchers launched a free iPhone app—MyHeart Counts—which gave users the ability to participate in a first-of-its-kind, easy-to-use cardiovascular research study. The app uses Apple's ResearchKit framework, which gives potential users a simple way to consent to participate, measure daily activities, complete tasks and answer surveys through their iPhone. Within six months of the app's launch, researchers had enrolled 47,109 participants from all 50 states who had consented to participate in the study.

Within weeks, researchers were able to collect data from 4,990 participants who completed a six-minute walk fitness test using the phone's built-in motion sensors—a number several times larger than the

largest study previously published, the researchers said.

"The ultimate goals of the MyHeart Counts study are to provide real-world evidence of both the physical [activity patterns](#) most beneficial to people and the most effective behavioral motivation approaches to promote healthy activity," said Michael McConnell, MD, a professor of [cardiovascular medicine](#) at Stanford who is currently on leave while serving as head of cardiovascular health innovations at Verily Life Sciences. McConnell and Anna Shcherbina, a graduate student in bioinformatics, are co-lead authors of the study.

"Physical activity can reduce the risk of heart disease by 50 percent," Ashley said. "We are all working to find ways to help our patients be healthier by encouraging healthy behaviors."

Accuracy vs. estimates

Researchers have already established the importance of physical activity, fitness, sleep and diet in maintaining cardiovascular health, the study noted. Low fitness levels, in particular, are a key risk factor for heart disease, with previous research indicating that insufficient physical activity accounts for 5.3 million deaths per year worldwide.

But in most of the prior clinical studies, researchers have relied on participants to estimate the time spent on physical activity in the preceding days. And people have been consistently shown to overestimate their [activity levels](#), the study noted.

"Traditional research on physical activity and cardiovascular health has been based on people writing down what they remembered doing," McConnell said. "Mobile devices let us measure more directly people's activity patterns throughout the day."

Users who consented to participate in the MyHeart Counts study were asked to keep their phone with them as much as possible. They were also asked to provide some basic health information—such as age, weight, blood pressure, cholesterol levels and risk factors—all of which was kept confidential. This enabled the app to provide participants with feedback on their chances of developing [heart disease](#).

Participants were also asked to complete occasional surveys on such topics as diet, well-being, risk perception, work-related and leisure-time physical activity, sleep and cardiovascular health status.

"The large numbers of subjects we were able to get so quickly provided very rich data sets of information," said Shcherbina, an expert in data analysis, who added that one of the limitations of the study was the disproportionate number of men in their 30s who participated, reflecting the demographics of typical smartphone users.

'When' and 'what' matters

"One of the most interesting things we found was that not just the amount of activity mattered but also the pattern," Shcherbina said. "We looked at activity states and compared, say, one person who worked out just at the end of the work day with another person who was active in short bursts throughout the day, changing from sitting to standing to walking."

Results showed that among groups of subjects with similar activity levels, those who were active throughout the day rather than in a single, relatively short interval reported better levels of cardiovascular health with lower rates of chest pain, heart attacks and atrial fibrillation.

This aligns with prior findings that link prolonged periods of uninterrupted, sedentary time with increased risk for metabolic

syndrome and diabetes, the study said.

Results also confirmed what was already generally known: that participants were not accurate at estimating their actual activity levels, she said.

Other notable findings regarding activity patterns indicated that "weekend warriors," those who got most of their exercise on the weekend, were among the healthier groups. And, in relation to sleep, the old adage "early to bed, early to rise" was found to be true, with participants with that type of sleep pattern reporting higher levels of well-being.

Researchers are working on an Android version of the MyHeart Counts app to broaden the reach of the ongoing study, as well as an updated version of the app that will include more motivational feedback to the users about how to improve their heart health.

The work is an example of Stanford Medicine's focus on precision health, the goals of which are to anticipate and prevent disease in the healthy and precisely diagnose and treat disease in the ill.

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