

Smartwatches can pick up abnormal heart rhythms in kids, study finds

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Smartwatches can help physicians detect and diagnose irregular heart rhythms in children, according to a new study from the Stanford School of Medicine.

The finding comes from a survey of electronic [medical records](#) for pediatric cardiology patients receiving care at Stanford Medicine Children's Health. The study will publish online Dec. 13 in *Communications Medicine*.

Over a four-year period, patients' medical records mentioned "Apple Watch" 145 times. Among patients whose medical records mentioned the smartwatch, 41 had [abnormal heart rhythms](#) confirmed by traditional diagnostic methods; of these, 29 children had their arrhythmias diagnosed for the first time.

"I was surprised by how often our standard monitoring didn't pick up arrhythmias and the watch did," said senior study author Scott Ceresnak, MD, professor of pediatrics. Ceresnak is a pediatric cardiologist who treats patients at Stanford Medicine. "It's awesome to see that newer technology can really make a difference in how we're able to care for patients."

The study's lead author is Aydin Zahedivash, MD, a clinical instructor in pediatrics.

Most of the abnormal rhythms detected were not life-threatening, Ceresnak said. However, he added that the arrhythmias detected can cause distressing symptoms such as a racing heartbeat, dizziness and fainting.

Skipping a beat, sometimes

Doctors face two challenges in diagnosing children's cardiac arrhythmias, or [heart rhythm abnormalities](#).

The first is that cardiac diagnostic devices, though they have improved in recent years, still aren't ideal for kids. Ten to 20 years ago, a child had to

wear, for 24 to 48 hours, a Holter monitor consisting of a device about the size of a smartphone attached by wires to five electrodes that were adhered to the child's chest. Patients can now wear event monitors—in the form of a single sticker placed on the chest—for a few weeks. Although the event monitors are more comfortable and can be worn longer than a Holter monitor, they sometimes fall off early or cause problems such as skin irritation from adhesives.

The second challenge is that even a few weeks of continuous monitoring may not capture the heart's erratic behavior, as children experience arrhythmias unpredictably. Kids may go months between episodes, making it tricky for their doctors to determine what's going on.

Connor Heinz and his family faced both challenges when he experienced periods of a racing heartbeat starting at age 12: An adhesive monitor was too irritating, and he was having [irregular heart rhythms](#) only once every few months. Ceresnak thought he knew what was causing the racing rhythms, but he wanted confirmation. He suggested that Connor and his mom, Amy Heinz, could try using Amy's smartwatch to record the rhythm the next time Connor's heart began racing.

Using smartwatches for measuring children's heart rhythms is limited by the fact that existing smartwatch algorithms that detect heart problems have not been optimized for kids. Children have faster heartbeats than adults; they also tend to experience different types of abnormal rhythms than do adults who have cardiac arrhythmias.

The paper showed that the smartwatches appear to help detect arrhythmias in kids, suggesting that it would be useful to design versions of the smartwatch algorithms based on real-world heart rhythm data from children.

Evaluating medical records

The researchers searched patients' electronic medical records from 2018 to 2022 for the phrase "Apple Watch," then checked to see which patients with this phrase in their records had submitted smartwatch data and received a diagnosis of a cardiac arrhythmia.

Data from watches included alerts about patients' heart rates and patient-initiated electrocardiograms, or ECGs, from an app that uses the electrical sensors in the watch. When patients activate the app, the ECG function records the heart's electrical signals; physicians can use this pattern of electrical pulses to diagnose different types of heart problems.

From 145 mentions of the smartwatch in patient records, 41 patients had arrhythmias confirmed. Of these, 18 patients had collected an ECG with their watches, and 23 patients had received a notification from the watch about a high heart rate.

The information from the smartwatches prompted the children's physicians to conduct medical workups, from which 29 children received new arrhythmia diagnoses. In 10 patients, the smartwatch diagnosed arrhythmias that traditional monitoring methods never picked up.

One of those patients was Connor Heinz.

"At a basketball tryout, he had another episode," Amy Heinz recalled. "I put the watch on him and emailed a bunch of captures [of his heartbeat] to Dr. Ceresnak." The information from the watch confirmed Ceresnak's suspicion that Connor had supraventricular tachycardia.

Most children with arrhythmias had the same condition as Connor, a pattern of racing heartbeats originating in the heart's upper chambers.

"These irregular heartbeats are not life-threatening, but they make kids

feel terrible," Ceresnak said. "They can be a problem and they're scary, and if wearable devices can help us get to the bottom of what this arrhythmia is, that's super helpful."

In many cases of supraventricular tachycardia, the abnormal heart rhythm is caused by a small short-circuit in the heart's electrical circuitry. The problem can often be cured by a [medical procedure](#) called [catheter ablation](#) that destroys a small, precisely targeted region of heart cells causing the short circuit.

Now 15, Connor has been successfully treated with catheter ablation and is playing basketball for his high school team in Menlo Park, California.

The study also found smartwatch use noted in the medical records of 73 patients who did not ultimately receive diagnoses of arrhythmias.

"A lot of kids have palpitations, a feeling of funny heartbeats, but the vast majority don't have medically significant arrhythmias," Ceresnak said. "In the future, I think this technology may help us rule out anything serious."

A new study

The Stanford Medicine research team plans to conduct a study to further assess the utility of the Apple Watch for detecting children's [heart problems](#). The study will measure whether, in kids, heart rate and heart rhythm measurements from the watches match measurements from standard diagnostic devices.

The study is open only to children who are already cardiology patients at Stanford Medicine Children's Health.

"The wearable market is exploding, and our kids are going to use them,"

Ceresnak said. "We want to make sure the data we get from these devices is reliable and accurate for children. Down the road, we'd love to help develop pediatric-specific algorithms for monitoring heart rhythm."

The study was conducted without external funding. Apple was not involved in the work. Apple's Investigator Support Program has agreed to donate watches for the next phase of the research.

Apple's Irregular Rhythm Notification and ECG app are cleared by the Food and Drug Administration for use by people 22 years of age or older. The high heart rate notification is available only to users 13 years of age or older.

More information: Aydin Zahedivash et al, Utility of smart watches for identifying arrhythmias in children, *Communications Medicine* (2023). DOI: 10.1038/s43856-023-00392-9 , www.nature.com/articles/s43856-023-00392-9

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