

# In-home passive monitoring can help seniors stay independent

Stony Brook University experts describe key design points for a successful in-home senior-health-monitoring system, and their efforts to develop such a tool.

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April 29, 2020

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The shift toward "aging in place" has been fueled by a range of health monitoring technologies – fall-detection pendants, emergency alert systems, fingertip blood pressure monitors, ECG patches and so on. But the senior population has needs and preferences unique from the general population, creating a home health monitoring challenge that can't simply be solved by sending them home with clinical-grade monitors or even consumer-friendly wearables.

"There are a lot of problems with these," Fan Ye, an associate professor at the College of Engineering & Applied Sciences at Stony Brook University, said during [a recent HIMSS20 online seminar](#). "Traditionally, equipment [is] bulky, expensive and hard to deploy and wear at home. Wearables, people have to remember to charge them every day and put them on. This can be challenging for cognitively challenged older adults."

With this in mind, Ye – along with Elinor Schoenfeld, a research professor at Stony Brook University School of Medicine, and colleagues – set out to develop a non-wearable home health-monitoring system for seniors. To do so, the group conducted a handful of group-discussion sessions with 57 community-dwelling older adults from New York City (n = 24) and suburban Long Island (n = 33).

Of these, 79% lived with their spouse, 83% used smartphones, 86% had WiFi access in their home and 60% had used video conferencing technologies at their home. Their ages ranged from 60 years to 90 years.

While their comfort with hypothetical in-home sensors generally varied, the respondents most often said they were comfortable with as many sensors as would be needed to allow them to continue living in their homes. What's more, the cohort became increasingly accepting of the sensors in scenarios where their home or health conditions might change, such as if they were recovering from a recent illness or if they found themselves living alone. And as for the data being collected, roughly 90% said they would be comfortable sharing it with a provider and 81% with family.

But these responses don't mean that the seniors didn't have some misgivings regarding their privacy.

"All participants were less comfortable using visual means of data collection. They raised concerns that security and privacy, loss of independence from monitoring, the ethics of data collection and sharing, ... and they were worried about themselves, family members and providers being overwhelmed by the vast amounts of data that can be collected from sensors," Schoenfeld said during the HIMSS20 digital presentation. "These discussions informed requirements to develop a sensor system that's flexible enough to accommodate individuals in different life phases, with different levels of comfort, different home environments, amounts of expendable incomes and available support systems."

The seniors' feedback helped Ye and his team as they developed their own passive monitoring system comprising a depth-sensor camera and an ultra-wide-band (UWB) radio. The first component, much like Microsoft's Kinect, detects multiple bodies in the room, estimates distance and recognizes limb positions – without being able to recognize certain identifying information

such as the subject's face. Meanwhile, the UWB radio bounces short pulses off of surfaces well enough to detect minor changes such as respiration, heart beat or muscle tremors.

While he said that there's still room for the "preliminary" tech to improve over the next few years, Ye and his team found the approach to collect vitals data offered an accuracy similar to other monitors. He said that the team is working with several labs to bring the system into the real world, and highlighted a promising test among 21 patients alongside the university's Division of Pulmonology and Critical Care Exercise Lab.

When paired with an artificial intelligence system for analysis and automatic intervention, Ye said that the approach would check all of the major boxes for an ideal home senior-health-monitoring system: it requires little input from the senior, collects data 24/7 in real time, preserves privacy and knows to act only when a senior's behavior deviates from the norm.

"This is not for clinical purposes, or to replace clinical equipment, but rather provide a low-cost and portable system for home-based monitoring," he said. "And the value proposition for this technology, for the patients and families, is to know you're in good hands. Especially if you live alone, any changes in their health or home status ... may not be able to be [detected] immediately. But the technology would be able to detect and notify."

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