



# WIRED AT HOME

Web-enabled devices let seniors live independent lives for longer. Is there a robot in your future?

**LAURA EGGERTSON**

When the phone rang in the middle of the night, Jennifer Haire knew instantly that something was amiss 900 kilometres away. An electronic monitoring system installed in her 93-year-old mother’s home in St. George, N.B. was telling her that the bungalow’s back door had been opened.

Haire didn’t have to wonder long whether her mother, Margaret — a former nurse with a mild cognitive impairment — was awake and wandering outside. Within seconds she was scanning a log on her computer linked to door, window and motion sensors in her mother’s house. The logs indicated no movement and an alarm on Margaret Haire’s bed had not been triggered. A quick scan of the feed from video cameras installed in the house told her that that her mom was in bed and no one else appeared to be snooping around.

One quick phone call later and Margaret was checking the door (the wind had blown it open). Twenty minutes later, everyone was sleeping peacefully again — Jennifer in Chelsea, Que., and her mother in the home she’d owned for nearly 40 years.

“It’s a wonderful system,” Jennifer Haire, a university librarian, says of CareLink Advantage, the wireless monitoring system that’s the brainchild of a Sudbury, Ont., businessman who was trying to keep his own parent safe at home. CareLink, she says, was “key” to allowing Margaret Haire to stay in her own home until she turned 96 and finally had to enter an assisted living facility. “We used it for about three years, and it was really, really, good.”

For years now we’ve been hearing about the “internet of things” — web-enabled

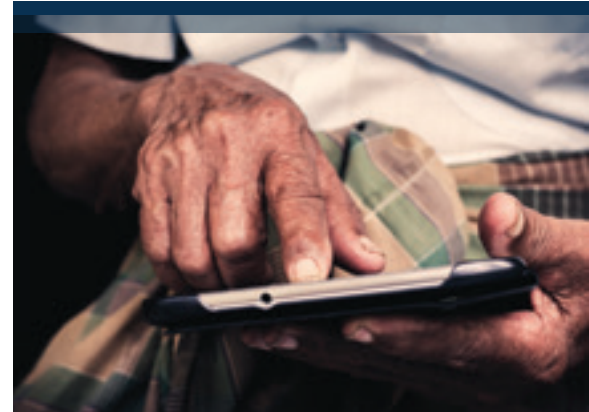
appliances and interlinked devices that can communicate with one another. It turns out the technology has much more to offer than a refrigerator that can tell you when you’re out of milk; web-enabled devices can make it easier and safer for the elderly to live at home for longer, with little or no outside care.

Floor tiles that monitor heart rate and blood pressure. Pressure-sensitive mats and bed alarms designed to prevent or detect falls. Smart phone apps to manage chronic illnesses. Intelligent scooters, power wheelchairs that detect and avoid obstacles — even robots that prompt seniors to carry out daily tasks. All of these technologies, and more, are gradually moving from the laboratory to the marketplace.

“There’s a huge investment in research that’s using various apps, tablets, and all sorts of computer-enabled technologies to aid older adults in maintaining independence at home,” says Dr. Ross Upshur of the University of Toronto. He’s a family doctor and the scientific director of Bridgepoint, a U of T-affiliated rehabilitation and complex care hospital in Toronto. He describes himself as “relatively technologically friendly” and is cautiously optimistic about the potential of assistive technology to help seniors stay healthy and independent for longer.

Upshur is working on a project that uses tablets and apps to help seniors identify and articulate their health goals — such as being pain-free or improving their moods or mobility — and communicate those goals to health care professionals. He also sees enormous potential in video-conferencing technology — which can limit the need for seniors to travel to hospitals — and remote monitoring devices that can alert health care professionals to a pending health crisis and send a doctor or nurse to a senior’s home.

But he warns against relying on shiny new gadgets in order to avoid a deeper



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debate about the urgent need to reform our health care system — to make it more patient-centred and better able to serve the most vulnerable seniors by bringing health services to them, rather than forcing them to adapt to a health care professional’s schedule.

“What this patient population needs is security, more than anything else,” says Upshur. “This is not a group that is embracing disruptive innovation. They ought not to be beta-testers. The technologies that we use need to be absolutely reliable, consistently supported and easy to navigate.”

Still, investment in assistive technologies is likely to outpace the substantive health care reform that Upshur believes should go hand-in-hand with innovation. In January of 2015, for example, the federal government announced an investment of \$36.6 million over five years in the AGE-WELL Network of Centres of Excellence, anchored by the Toronto Rehabilitation Institute and Simon Fraser University.



University of Toronto researcher Rosalie Wang takes a cue from Ed, a robot prototype, at the Toronto Rehabilitation Institute lab.

Source: Mark Blinch

Since its inception, the network has attracted another \$22 million in cash and in-kind commitments from more than 115 industry and community partners — all of them betting on technology to solve the problems posed by the demographic shift that will see almost a quarter of Canadians identify as seniors by 2036, according to Statistics Canada.

Almost all of those seniors will want to stay put. The overwhelming majority of senior citizens polled by the Canada Mortgage and Housing Corporation in 2008 — 85 per cent — indicated that they want to remain in their current homes for as long as possible, even as their health

declines. And since the burden of seniors' care is also expected to weigh down Canada's aging public health care system, governments are slowly turning their focus to the need to find solutions that will reduce long-term care expenses.

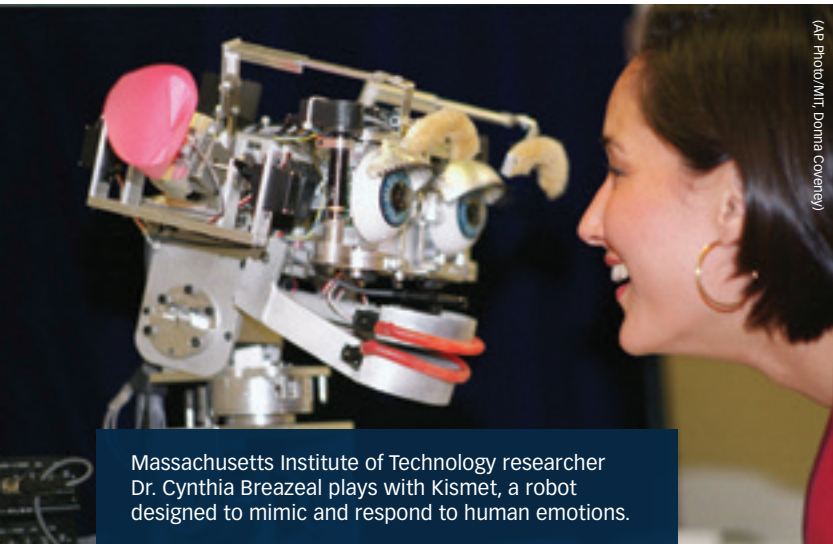
The health care system is slowly reorienting its spending away from acute care towards targeting prevention and management of chronic conditions such as diabetes, heart disease and even cancer. That's why many of the assistive technologies being developed now are designed to remotely deliver information about a senior's health status, or facilitate online video consultations with nurses and doctors.

Pairing remote monitoring with robotics has resulted in some dazzling prototypes — like Ed, for example. Ed hangs out at the Toronto Rehabilitation Institute, one of Canada's leading facilities in the field of assistive technology. The five-foot-tall robot consists of a monitor screen and speakers perched atop a commercially available Roomba vacuum cleaner (sold by iRobot). By hacking into the system and creating their own platform, Toronto Rehab researchers programmed Ed to talk seniors with dementia through the steps involved in basic tasks — washing their hands, for instance, or making a cup of tea.



(CP PHOTO/HO - Georges Pimentel)

Alex Mihailidis, a scientist at Toronto Rehab, demonstrates a rehab robotic device for stroke patients.



(AP Photo/MIT, Donna Coveney)

Massachusetts Institute of Technology researcher Dr. Cynthia Breazeal plays with Kismet, a robot designed to mimic and respond to human emotions.

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out these tasks. Ed’s cameras pinpointed any difficulties the seniors had, such as remembering where the tea cups were stored, or the location of a garbage can in which to discard a used teabag. By moving about the room to indicate locations, Ed also helped to orient the seniors, who followed him quite naturally.

“Overall, using Ed to understand how older adults with dementia interacted with a robot was a positive experience,” says Alex Mihailidis, a senior scientist at Toronto Rehab and the scientific director of the AGE-WELL Networks of Centres of Excellence.

“The seniors followed the prompts, they interacted with the robot. Several of our subjects in the study actually started to personalize the robot — they started to build a relationship with the device.” Even seniors with dementia recognize that a robot is a machine, not a person — which means robots don’t have to be designed to look more-or-less human (a more expensive proposition) to help older adults complete tasks without a caregiver’s supervision.

Ed and robots like him are probably at least three to five years away from commercial availability, says Mihailidis. But simple robots such as the Jibo, created by MIT researcher Cynthia Breazeal, are poised to enter the marketplace as early as late 2016. Breazeal is marketing Jibo as “the world’s first social robot.” The tabletop device (which looks like a smaller, sleeker version of R2D2) is being marketed as a personal assistant with the ability to relay messages and provide reminders of things like appointments and family visits. The robot is relatively affordable — the pre-order price is US\$749 — and could be helpful in reducing seniors’ isolation. It also has the ability to provide video-enabled phone calls, remote monitoring through cameras and networked control of lights and thermostats in a home.

Making homes smarter and better equipped to evolve with their owners as they age is another one of Toronto Rehab’s research goals. Mihailidis, an engineer, envisions homes with sensors and artificial intelligence systems embedded seamlessly throughout the structure — a home that can actually *anticipate*

If his human hosts forget a step, Ed can show them a video explaining how to complete any activity.

Take something as basic as boiling water in an electric kettle. Ed can run through three separate levels of prompts to help a patient who’s forgotten what to do next.

“We started off with a suggestive verbal prompt: ‘Try pressing the button to boil the water,’” says Rosalie Wang, an affiliate scientist at Toronto Rehab and an assistant professor of occupational science and occupational therapy at the University of Toronto. “If that didn’t work, it would be a more specific prompt that used the person’s name: ‘Bob, press the button to boil the water.’ And if that didn’t work, there was a video.”

During experiments in Toronto Rehab’s HomeLab — a one-bedroom, single-storey apartment created to invent and test assistive technology — Ed shadowed seniors as they carried

what its residents want and need to do. It could use voice prompts in the bathroom to remind residents to take their medication or brush their teeth, track motion sensors to detect falls — even call for medical help if someone is unresponsive. Ideally, these smart homes would adapt to their residents' changing needs — using algorithms, for example, to measure gait and movement patterns and predict changes in health status, such as the onset of dementia.

Mihailidis believes that as these technologies advance it will become easier to retrofit existing homes, rather than building them from scratch.

He and his team already have designed 'smart' building materials — such as floor tiles embedded with sensors that can be installed in front of a sink or toilet to measure blood pressure and heart rate. They've even designed sofa cushions with sensors that measure the heart's electrical activity — a home electrocardiogram.

"As I'm sitting there watching TV, it is taking my heart rate, my blood pressure, automatically, without me having to put anything on myself," Mihailidis explains. He's also working with Toronto-based Myant, a wearable technology company that designs smart textiles, to create shirts and

other articles of clothing that can read and transmit the wearer's health data.

Many of these wearable devices are intended to provide health data to their wearers, to help them take care of their own chronic conditions. But that information — blood pressure, heart rate, blood sugar levels — also could be sent to caregivers or health care practitioners.

The availability of all that personal health data, and the need to store and access it, raise both privacy and usability issues, says Neil Charness, an expatriate Canadian psychology professor who is the director of the Institute for Successful Longevity at Florida State University in Tallahassee. Charness has studied how well seniors accept assistive technology. The key, he says, is to make sure the technology is simple, affordable, secure and reliable, and that seniors have access to good tech support.

"The underlying core issue for almost all of telehealth technology ... is the technology needs to be both useful as well as usable by the people who are going to be interacting with it," he says. "Abandonment for assistive devices is very high when you don't have adequate support for them."

Providing good tech support is a challenge for the companies that make ordinary household electronics; the standard for potentially life-saving medical monitoring devices must be higher. Upshur says maintaining virus-free, functional, reliable assistive technology "has to be as close to failsafe as nuclear codes."

After all, a robot responsible for monitoring the health status of a frail senior, and alerting health care professionals when something goes wrong, is a far more critical piece of kit than any smartphone or tablet — and everyone knows how often smartphones fail.

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MIT researcher Cynthia Breazeal with her latest project — the Jibo.

"I'll be all for robots when I am completely persuaded that they have the failsafe provisions that I articulated earlier," says Upshur. "Tech developers and innovators are accustomed to failure. But the question is, who's bearing the burden of the failure? It ought not to be on the backs of the old, or even the young/old."

Still, while they may not be completely failsafe, remote monitoring and alarm systems like the one Margaret Haire used to maintain her independence do try to anticipate problems. They use battery packs that kick in during power outages to reduce the potential impact of life-threatening power outages, for example. And researchers at the forefront of developing assistive technologies are sensitive to the privacy and confidentiality concerns that are top-of-mind for many consumers.

"It really has to make sense for people to want something like this, considering that it could potentially be a privacy breach,"

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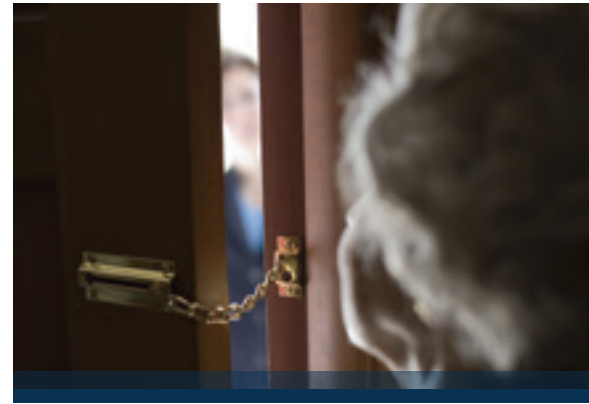
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acknowledges Wang. "It really has to be useful, because somebody is getting a lot of your health information."

For Jennifer and Margaret Haire, the independence Margaret retained outweighed any privacy concerns arising from living in a home wired with cameras and sensors.

"The privacy thing didn't bother her, perhaps because of her memory loss,



and also because she liked the idea that I could check up on her," Jennifer says. "I knew what was going on, and she was safe."

That, to the Haires, was a trade-off they could live with. ■

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