Providers Bring Technology To The Table

Providers increasingly turn to technology to improve quality and outcomes and manage risk.

Kathleen Vickery

Sometimes when Bob would try to stand up or walk through a doorway, his body would become temporarily paralyzed. His mind was as sharp as ever, but he was unable to make his legs move.

Bob has Parkinson's disease, and this experience is called "freezing." About 30 percent of people in the later stages of the disease experience it, with increasing frequency, and there is no consistently effective treatment for the symptom.

Presbyterian Homes in central New York State undertook to build a prototype nursing facility room—and ultimately an entire wing—designed specifically for people with Parkinson's, replete with technology to not just monitor a resident's condition, but to proactively prevent falls by such means as breaking freezes.

This was no small undertaking—especially for a facility whose level of technological advancement could be illustrated by the fact that all e-mail to anyone in the facility went to a single person who then printed out hard copies and distributed them by hand to staff.

The comprehensively retrofitted room, which has been occupied since September of last year and has been toured by hundreds of people with Parkinson's, has been a big hit, not only with Bob himself, but with staff, with members of the Central New York Parkinson's Support Group, and with potential residents. In fact, the room has lent a bright polish to Presbyterian's already good reputation as a provider for people with Parkinson's, has significantly increased the number of clients the facility serves, and seems likely to be a considerable census-booster for the future.

"We're getting new clients with Parkinson's disease traveling further distances just to get our Parkinson's outpatient treatment here," says Tony Joseph, Presbyterian's administrator. "They'll go by a lot of other providers to get to us."

The Turn To Technology

Long term care has generally lagged behind the rest of the health care sys-

tem in incorporating new technologies, but in the past few years some providers have begun to take advantage of the possibilities today's technology offers, including improved patient outcomes, reduced costs, and reduced staff work loads.

"In long term care, [incorporating new technologies] has been a little bit slow because they've always had money problems," says John Miullo, a tech-nology consultant for long term care facilities based in Deerfield, N.Y. "But now we realize a little money invested decreases overall costs way more than trying to keep things real cheap in an old dorm setting."

The new technologies most commonly being adopted range from monitoring devices to robotics, to telemedicine, says Miullo. "Everyone wants to stay short of cameras because they don't want that kind of intrusion into their privacy," he says, but technologies they do want include "remote sensing, robotics for cleaning, monitoring where people are going, 'smart home' technology for cooking and cleaning," and vital signs monitoring, he says.

"There's a great deal of activity [within the health care technology sector] in sensors and devices for fall

Providers, Tech Companies, Researchers Work Together

With more advanced technologies still so new in long term care settings, those providers that are breaking new ground find themselves virtually turning into research centers as they try to find out what works and what doesn't.

■ Terence Cardinal Cooke Health Care Center (TCC), in New York City, has deployed a wireless network for Medicare minimum data set (MDS) completion. The project began because TCC's MDS department "was constantly having to send incomplete or incorrect MDSs back to the floors for completion and correction," says Darrell Cohn, the facility's informatics project manager.

To turn this situation around, five registered nurses (RNs) were given sole responsibility for completing all Medicare MDSs, armed with wireless-enabled laptops that communicated with a new wide-area network. The laptops made it possible for the RNs to go to the floors to complete the MDSs, print them out, and place them in the resident's chart. Once the project is under way, data will be gathered to allow management to compare the new method with the old paper-based method to determine the project's impact on error rates and time spent on the task.

■ Homestead at Maplewood in St. Paul, Minn., has put a monitoring sys-tem in place in which a computer-based data manager wirelessly collects data from the sensor systems in residents' assisted living units. The sensor systems notify the central computer of any alerts (indicating, for example, that a fall has taken place), date and time-stamp the data, and log it for management's use in future quality improvement efforts.

■ Beverly Enterprises, Ft. Smith, Ark., has contracted a telemedicine company to provide residents in rural Virginia facilities with comprehensive psychiatric services, including assessment, medication management, and psychotherapy.

■ Longwood Retirement Homes at Oakmont, Verona, Pa., piloted a robot named "Pearl" equipped with the Autominder Cognitive Orthotic System. Developed by the Universities of Michigan and Pittsburgh and Carnegie Mellon University, Pearl is designed to remind people with cognitive impairments about activities of daily living, take vital signs, and fetch items. The system uses artificial intelligence to construct models of an individual's activities, to monitor the way tasks are completed, detect discrepancies between what a person is expected to do and what they actually do (such as medication compliance), and to reason about whether and when to issue reminders. Researchers are developing a version that would use wireless sensor networks.

■ Ohio Presbyterian Retirement Services residents are using automated medical dispensers to improve safety and reduce errors. The dispensers provide auditory and visual reminders and have an emergency response system. According to a facility spokesperson, the dispensers enable staff to manage more patients at one time and increase nurse productivity.

■ A technology company called Wheels of Zeus, based in Los Gatos, Calif., has developed state-of-the-art global positioning system-enabled technology that quickly identifies, locates, and tracks people with dementia who have wandered away from their facilities.

■ Rehabilitation Engineering Research Center on Technology, in Gainesville, Fla., is developing devices to help people with cognitive impairments who have become confused or gotten lost figure out where they are and how to find people to help them. They are also working on a wireless telephone that can provide reminders to people with cognitive impairment to help them with daily life tasks, as well as answer questions and assist decision making.

management and elopement," says Troy Griffiths, chief operating officer of Vigil Health Solutions, a long term care technology company. Risk management has been a driving force behind the increased interest in new technologies, he says.

"Over the past five years, I've seen a real trend in terms of better management of falls and elopement," says Griffiths. "Those are a real risk for providers, and what with the legal situation in states like California, Texas, and Florida, there's been a lot more emphasis on risk management. So providers are looking at technologies that can mitigate that risk and at clinical technological ways to improve quality of care."

New technologies will be increasingly important in long term care as the baby boomers age, says Griffiths.

"There isn't going to be enough staff to manage the coming age wave, let alone enough beds, so obviously technology is one of many ways to address this," he says.

Patient-Centered Technology

An increasing number of providers are putting technology into place that monitors residents' vital signs in unexpected and unobtrusive ways. And some technology companies are in a race to meet that demand.

Vigil, for example, recently partnered with a Scandinavian company that has developed a film so sensitive that it can be placed under a mattress and yet still detect heart rate, respiration, blood pressure, and a host of other vital signs.

"There's a lot of [monitoring] technology out there," says Griffiths. Until very recently, providers typically had "no computer in the facility, and the call system was a light switch in the bathroom that rang a bell at the nurse's station; really rudimentary. We're now seeing people see the need to more

aggressively adopt technology, especially sensors and wireless networking and Internet," he says. "In the last five years, in new buildings and retrofits, they're accepting that they need more sophisticated technology with better reporting capabilities and that they

A caregiver is alerted through her silent pager when a resident is in need of assistance.

have to catch up," says Griffiths.

Monitoring technology should reflect each patient's care plan, says Griffiths. For example, a particular patient may need to be monitored for fall risk, incontinence, room departure, prolonged time in the bathroom, and restlessness within her own room. The monitoring requirements during the day will differ from those for nighttime.

"For example, Mrs. Jones might be fine to leave her room, but if she doesn't come back after a while, caregivers need to be alerted," says Griffiths. Or the monitoring system for a patient who tends to become agitated and be at increased risk for falling, elopement, or some other less-than-desirable event could alert caregivers if the patient begins to pace back and forth in his or her room.

When monitoring systems are set up right, they can dramatically decrease the amount of time caregivers must spend on such time-consuming tasks as going from room to room checking residents' status.

Particularly with infrared sensors that notify caregivers of departure, and with incontinence sensors in an individual's bed, "a good number of facilities don't do rounds any more," says Griffiths. "Instead, they provide care when and where needed and don't interrupt patients during the night by opening the door every couple of hours," he says. "But if the patient falls out of the bed, they'll know immediately."

Using Tech To Prevent Falls

Falls are a leading cause of death for even healthy seniors, and long term care providers are constantly aware of the risk a fall poses for a frail elderly person.

This risk skyrockets for people with Parkinson's. A major key to improving these individuals' long-term health is to keep those falls from happening, or, failing that, to minimize the damage the falls cause.

To design effective methods for preventing falls necessitates understanding why the falls occur and what factors make one fall more dangerous than another.

One of the major causes of dangerous falls for people with Parkinson's is "freezing," says David Cram, MD, who has Parkinson's himself.

Episodes of freezing are sudden, temporary, unpredictable, and involuntary, says Cram. "It is as if someone hits an 'off' switch and stops you in your tracks." Freezes generally last from seconds to minutes, can become longer over time, and can cause severe disability or death, says Cram.

Identifying what triggers an episode of freezing can be difficult because the triggers vary so much from one person to another. For some people it often happens when trying to stand, or when they approach a doorway, tight spaces, elevators, rows of chairs or pews, rugs, steps, a curb, a street, or when turning their body.

For some people the episodes attack

without warning. But Bob is a little more fortunate in that respect; he sometimes has about one minute during which he can tell an episode is on its way.

Breaking a freeze is crucial for preventing a fall, Cram says. For some people, one or more of a variety of "tricks" can help people get themselves moving again.

For example, putting a piece of tape across a doorway can prompt the brain to allow the individual to step over it, thereby breaking the freeze. For some people, rocking from side to side can break the spell. For others, hearing loud, rhythmic music, like military marches, can do the trick. No one knows why these things work, but they have proven effective for many people, says Cram.

One inexpensive bit of technology that some have found useful for breaking a freeze is a simple, hand-held laser. Individuals can point the laser beam on the floor and then find themselves able to step on the point of light, breaking the freeze.

Designing With Patients' Needs In Mind

With the goal of designing not just a monitoring system but an entire technologically sophisticated environment conducive to improved health and heightened quality of life for people with Parkinson's, Presbyterian was taking patient-centered care to a new level.

"There's a need nationwide for more specific services for people with Parkinson's living in skilled nursing facilities," says Presbyterian's Joseph. In 2001, Joseph was approached by the local Parkinson's support group with the idea of renovating a portion of the facility to better meet the needs of people with Parkinson's.

"I've been in the field for 20 years and never seen" the kind of specific services envisioned by the support group, Joseph says. He spent a lot of time on the Internet trying to find out

> **For some people, hearing loud, rhythmic music, like military marches, can break a freeze.**

what other providers had come up with. "I thought, geez, there must be something out there, but we didn't find much," he says. "But I thought it's high time that this population got the services it needs. So, okay, let's see what we can do."

Since real-life models were few and far between, Joseph and his team of clinicians and other staff members went to the real experts—people who live with Parkinson's every day. The team spent a year educating themselves with the help of the Central New York Parkinson's Support Group and other people with Parkinson's disease.

One advantage, Miullo notes, of designing specialized services for people with Parkinson's—compared with doing so for people with Alzheimer's, an area that has received significantly more attention from technology companies and providers alike—is that they're generally cognitively intact, so the services can be designed with input directly from the end users of those services.

Finding The Funding

Funding being the constant problem that it is—especially with such a comprehensive retrofit of an aging facility—that issue had to be addressed first. With the help of the support group, Presbyterian was able to convince a U.S. representative—who not only lived in the town but was chair of a

national committee on science and technology—of the importance of funding a pilot project that could be a national model for state-of-the-art Parkinson's services. The representative put a rider on an appropriations bill that got Presbyterian a $250,000 grant.

That made the physical renovations possible. Then the support group raised $13,000 from its annual Parkinson's Awareness Walk to give Presbyterian the latitude it needed to be innovative.

With the money problem resolved, Joseph called Miullo—the two had worked together on technology projects for 10 years.

First, Miullo held a series of intensive meetings with Presbyterian staff, the Parkinson's support group, an array of designers and consultants, and the resident (Bob) who they'd identified as the best candidate for the pilot project, to hash out the details.

Miullo soon returned with reports that detailed project goals, technological alternatives and the least expensive ways to acquire them, and a variety of floor plans and retrofitting ideas for renovating the unit, along with a cost-benefit analysis for the various alternatives. Preventing falls in a cost-effective manner was a primary goal. Miullo's solution was a series of fall-abatement technologies designed to reduce staff intervention and increase Bob's independence.

Assessment And Design

The project was a challenge; in some ways, more difficult than building something from scratch, says Miullo. "It was a retrofit," he says. "We were taking a room that was very old and not very nice and trying to turn it into a model for Parkinson's-specific services."

Miullo drew up two "assessments," or reports describing what could be done, how it could be done, and how much it would cost. The first report was a "facility remake assessment," a

comprehensive, 37-page document that outlined the physical retrofit. The second 27-page report focused specifically on technology, detailing the final choices arrived at by a team comprised of Miullo, Joseph, Presbyterian's nurse supervisor, a therapy professional, a retrofitting subcontractor, an architect, an interior designer, and subcontractors for masonry and carpentry. The report also included an implementation strategy, costs, and a matrix that set out all components—environmental controls, technology research, where each device would be located, the name of each product and the characteristics of its use, and where Presbyterian could purchase each product at the least expense. It's a tool that Miullo is justi-

fiably proud of. "I'm not interested in making money off of 'stuff,'" says Miullo. "The best thing I can do for clients is to offer them least-cost 'stuff solutions.'"

Most homeowners know that sometimes it just makes more sense to buy a utilitarian item from, say, Wal-Mart, rather than from a store that spends a lot of money on fancy packaging and glamorous displays. "It's the same thing with adaptive equipment, sensors, and all kinds of technology," says Miullo.

"A well-known company may sell a certain sensor for $500, but with a little research you can find it somewhere else for $14. That's always been my gripe, that there are much more cost-effective ways to do this if you can find

a [technology consultant] who doesn't have a vested interest in selling you something," he says.

A Room Of Bob's Own

Because there's no way to tell what will help an individual break a freeze, and because preventing falls was the No. 1 priority, Miullo tried to design a room that would provide a lot of visual and auditory cues that could help Bob break a freeze. And because Bob is very verbal even in the midst of a freeze, Miullo was able to make use of voice recognition technology.

So, the first state-of-the-art technological solution design was an entertainment center, with a home theater and a panoramic music system, complete with a subwoofer at the foot of Bob's bed. But what really makes it special, both as a clinical tool and as an enhancement of Bob's independence, is

Limitations Of Monitoring Technology

I t's important to remember, and to educate staff, that all monitoring systems will have limitations that must be kept in mind. For example, a system designed to monitor whether a resident is remembering to take his or her medication will likely only be able to tell whether the medication caddy was opened or pills removed from containers, and not whether the medications were actually ingested. A system with the goal of monitoring a resident's sleep will likely only be able to report whether the individual is in bed, not whether the person is actually asleep.

It's also very important that any monitoring system has backups for connectivity. For example, the system may report data over a broadband connection (allowing real-time reaction), but if the broadband connection goes down, failsafes must be in place, such as using ordinary phone lines to transmit data. In addition, recovery proto-

cols must be established to make system reboots less disruptive to monitoring.

Installing a network of monitoring modules will inevitably be a challenge, say researchers with Honeywell Laboratories. For multisite providers, "small changes in network configurations, differences in broadband service providers, wireless networking issues, and numerous other issues, including faulty or inadequate hardware components, conspired to make each installation a unique experience," the researchers wrote. "Even within the same community living facility, using the same broadband provider, small differences in wireless configurations caused significant consternation in one or two units. Correct configuration was never straightforward."

Motion Sensors
These sensors need to be very carefully located to ensure accurate measure-

ments. A sensor incorrectly placed to see kitchen activity may have a line-of-sight that leads into a hall or another room. So, if the caregiver gets alerted when there's no kitchen activity, they won't get alerted if someone walks down the hallway. Bedtime monitors can be set off by normal behavior, like turning over in bed. Sensors aimed too low toward the floor could work against the no-mobility alert by picking up flailing arms or legs associated with a person in distress on the floor.

Fall sensors
Body-worn dedicated fall sensors are becoming more reliable (fewer false positives). Honeywell Laboratories researchers found that those commercial sensors employing accelerometers are more accurate, provide more data, and are far less prone to false alarms than those that sense orientation (vertical vs. horizontal).

However, no commercially available

that it's all controlled by voice recognition technology. So when Bob experiences a freeze, he can tell the entertainment center to play his favorite polka music, whose heavy beat sometimes breaks the freeze.

Visual cues, such as the light of a lamp turning on or window blinds going up, can also help break one of Bob's freezes. For $10 at Wal-Mart, Presbyterian purchased a lamp that turns on or off when tapped.

Miullo hooked it into a "command console" purchased from www.smarthome.com. "This is stuff that's been luxury devices for years, but no one thought to use it in long term care." The command console is an infrared module that's compatible with a voice recognition device and that sends signals over power lines to control a number of things in the room, from air conditioning and heating to

doors, windows, lights, fans, vertical blinds, and the entertainment center.

Having the ability to control so much of his environment simply through voice commands means that Bob doesn't have to get up as often (and getting up can trigger a freeze), and doesn't have to spend as much time moving around his room when he's having trouble moving due to Parkinson's characteristic gait disturbances, physical rigidity, and tremor—all conditions that put Bob at high risk for falls.

It wasn't a problem-free installation. "One thing I found out is that you have to have good, integrated, consistent wiring," Miullo says. In addition, he found that fluorescent lighting blocked the signals that the command console tried to send out, thereby debilitating the system. "We had to use all

incandescent lighting," he says. "There are all kinds of stumbling blocks you run into from a technical standpoint when you do this stuff."

Miullo also wanted to use infrared proximity switches—like the automatic switches that appear in some bathrooms to, for example, turn the sink water on and off with the pass of a hand or trigger a toilet to flush when the person stands up.

But he ran into a couple of problems. The proximity switches he found first ran from $300 to $400 and only had a two-inch area that it could "see" where movement would trip it to operate. Not only was the cost high, but with such a limited range of "sight," the switches would be highly frustrating for people with movement disorders. For example, if they moved in and out of the two-inch range while washing

fall sensors are 100 percent effective at sensing a "crumpling body," according to Honeywell researchers. Elderly people frequently fall in graceful ways, catching themselves on nearby objects, slumping against a wall, or otherwise falling or landing in positions that would not set off alarms in any of these sensors.

Voice-Recognition Technology
Although it seems like a good idea, it often proves to not be useful in a long term care setting. One reason is that an elder's voice or speech patterns can change dramatically with medical issues such as a stroke, or just due to everyday conditions such as fatigue or removed dentures, according to Honeywell Laboratories researchers. That dramatically reduces its effectiveness in the event of an emergency.

Interactive speech interfaces can be distressing to elders; hearing a disembodied voice may confuse them (hav-

ing the computer use a voice familiar to the elder doesn't appear to fix this problem), and they may have trouble coping when the system misunderstands.

Further, according to Troy Griffiths of Vigil Health Solutions, voice recognition systems are very unsuited to people with dementia, and not only for the reasons listed above. They also may not know when they are in trouble, and so not call for help, or they may frequently call for help when they don't actually need it.

Artificial Intelligence Technology
Also known as "machine learning" and "machine intelligence," artificial intelligence is the ability of a computer to improve its performance based on previous results.

This kind of technology is most commonly being used for "task tracking" applications. These systems attempt to monitor an individual's

activity and detect when he or she is trying to achieve a particular goal. These systems require many sensors because human behavior is so complex that the computer must gather an enormous amount of data upon which to identify behavioral patterns and their goals.

Task tracking systems have to be able to track tasks in a variety of situations:

■ Abandoning plans: when people forget what they're doing, get distracted, or decide to abandon a goal.

■ Hostile agents: some elders don't like to be monitored and try to hide their actions—a significant challenge to monitoring.

■ Partially ordered plans: when people are multitasking, the system must be able to recognize interleaved plans.

■ Multiple hypotheses: one set of actions might be contributing to more than one plan; the task tracker needs to rank different possibilities.

their hands, the tap would keep turning on and off.

But Miullo kept hunting and eventually found a switch that could be tripped by movement within eight inches of the infrared beam. It could also be tripped with a remote control beam and had the advantage of a manual bypass. "I used it everywhere: lighting, window treatment, opening and closing doors," he says. "And the best part? It was a $26 device that goes right into any standard light switch. That saved a massive amount of money."

Using the switches and other devices, "we totally automated the bathroom," says Miullo. One of the benefits of automated things like tap water was "you don't have to worry about scalding problems and having someone do a thermometer check of all the bathrooms every day." The designers also chose to use electronic soap and paper towel dispensers and a regular tank toilet with both a manual and electronic flush.

Further, they decided to install a bidet toilet seat, so that residents would always be able to wash and dry if their movement disorders made that kind of self-care difficult. "Bidets are prevalent in Europe and Asia; I don't know why no one uses these things over here," says Miullo. The bidet cost $400 at Lowe's, and had a heated seat and heated water.

"Bob himself came up with the great idea of putting an automated infrared drinking fountain in his room, so he wouldn't have to ask constantly for water, thereby making him feel more independent."

Along with the technology infusion, Bob's room was overhauled.

The bathroom, for example, was a falls nightmare, with its ceramic tile walls and floors. Throughout the unit, designers installed a new stipple vinyl tile that had some cushioning under it. They also installed a chair rail around the room with a wainscoting underneath that's backed by foam to further

Because fewer people were coming into the room, the level of allergens and similar person-borne contaminants decreased.

cushion falls. "The first thing people with Parkinson's say about the room when they walk through is how much safer the floor feels," says Joseph.

Training Is Essential
"I can't overestimate the importance of educating all staff members about what goes on in that room," says Joseph. "Things are a little different in there. Walk in the wrong place, and doors are going to open, lights will go on and off."

Bob also had to be trained in how to use the new technology. At first, he worried that he'd have difficulty learning how to use it, and that the changes and challenges would be overwhelming to him.

"It took time" for Bob to become comfortable with the new room, says Joseph. "It didn't happen overnight. But every month I see him getting more and more confident."

Improved Health, Lower Costs
Increased independence for the resident not only improved his quality of life, but meant less staff intervention, says Miullo. "Bob didn't have to call staff to open a window, raise the shades, things like that," he says.

Decreased staff intervention—fewer caregivers going in and out of the room—benefited Bob and other staff members in some unexpected ways. For example, because fewer people

were coming into the room, the level of allergens and similar person-borne contaminants decreased. And because the room itself was safer and easier for Bob and staff to move around in, fewer things were spilled or broken, which not only reduced environmental hazards but also meant less cleaning for housekeeping staff.

The cushioned tile flooring also benefits staff because it's so much easier on their legs and backs. In fact, as Presbyterian continues with its renovation, "we're going to put that same tile down the whole corridor to help the staff," says Joseph.

Presbyterian is expecting to renovate the whole wing by mid-year.

"Right now, we've got a feedback loop going on trying to figure out what works, what's more useful than other things, and then we're going to expand to other rooms," says Miullo.

Looking To The Future
"Wireless" is the word on Griffiths' lips when he talks about where long term care technology is moving. "I see a hybrid of wireless and wired systems," he says, "that allow greater flexibility to take advantage of multiple products on a consistent platform so there's real flexibility and scalability." Especially as facilities try to provide a broader range of services and settings, from home care and outpatient to independent and assisted living, skilled nursing, and long term acute care. Expanding operations "need that scalability," he says.

But underpinning the "success" of new technologies is how much it improves the health and lives of the residents.

Bob, for one, appears to be the real success story. "He's learned to use the equipment, the voice-activated and infrared technology," says Joseph. "Now he's essentially independent with doors, radio, music, television. He's independent in the bathroom, and he's able to adjust himself in bed. He's doing great." ∎