GOING THE DISTANCE

Developments in communications technology bring telemedicine to rehab

By Anne Scheck, MS

Photos by Richard Burns

At National Rehabilitation Hospital in Washington, DC., researchers hope to help change health care's future by giving children with motor disabilities a novel way to shake, rattle and roll-all in the name of "telerehab."

Dubbed "Boing!" the system is a free-standing children's "exercise arcade" that features a bungee cord suspended from the top of a light metal frame and contains the technology to offer virtual-reality games while assessing physical performance.

"It confronts perhaps the greatest challenge in telerehab-how to effectively do physical therapy from a distance," says Michael Rosen, PhD, who is director of both the Rehabilitation Engineering Service and the Assistive Technology Research Center at the hospital.

A screen features "gamercizes''-moving images and funny noises designed to keep the child enthralled with the activity (A flowering plant, for example, might grow or a balloon inflate with each repetition of an exercise).

But the invention aims to do far more than entertain, Rosen stresses. It provides resistance to movements while giving partial weight support, the kind of physical challenge needed to help strengthen the muscles of children with cerebral palsy or other neuromusculoskeletal conditions.

Where does the "telerehab" come in? The bungee cord connects to the frame through a sensor that produces an electric signal, which controls moving objects and characters in the video games. This "bungee sensor" not only records exercise movements, but also the degree of exertion that

Digital illustration by Alan Aspuria

went into them. This information can be transmitted almost instantaneously to a therapist and an electronic patient record elsewhere. "It's a prototype," Rosen cautions.

Nonetheless, he and investigators at the hospital, along with colleagues less than a mile away at Catholic University of America, want to put the "Boing!" on Minnesota's prairie, where cold and snow make some areas woefully hard to reach in winter. Thanks to the Sister Kenny Institute in Minneapolis, the two Washington-based facilities will have the capability to do just that.

A True Field Test

Years ago, SKI, as the institute is known locally, laid the infrastructure needed to carry out videoconferencing at small clinics and centers scattered across regions of frozen farm land.

"We heard about them [SKI], and our eyes just lit up," recalls Rosen, whose laboratory at NRH is developing what he calls a range of "home health care technology." His co-director is Jack Winters, PhD, professor and program director at Catholic University's biomedical engineering program.

"Several of the players in this project have very strong academic backgrounds, but every single one of us has a real bent for product design," Rosen adds.

The "Boing!" is one of about 10 such projects, and it-like many of the others-is likely to be equipped with a screen for two-way communication. Such technology, theoretically, "puts you in a position to interact with your therapist or doctor along with other images," says Rosen.

At the Sister Kenny Institute, the staff anticipates the day that their far-flung young patients can help christen "Boing!" Until now, the kind of rehabilitation undertaken through SKI's telemedicine program has been consultative in nature, generally diagnostic "second opinion" follow-ups, notes Tim Bowman, project director for Advanced Rehabilitative Technologies at the institute.

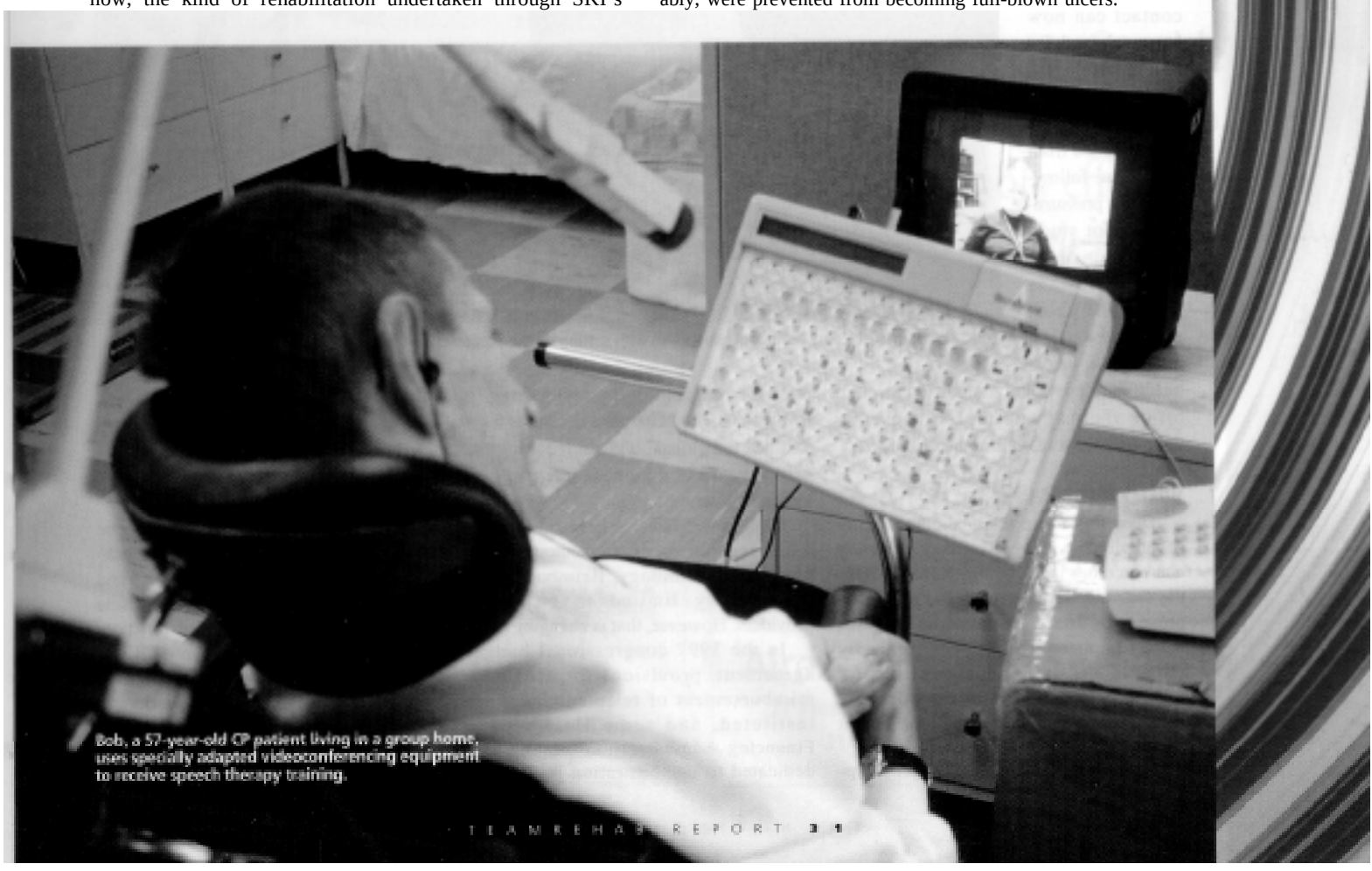
Now, Minnesota kids from small towns like New Ulm will likely get a crack at this swinging new exerciser- and probably will do so in full view of a health care professional 90 miles away.

Looking at the Future

As the millennium approaches, the field of rehabilitation may be thrust into a brave new world-one in which occupational therapists and physical therapists increasingly may be asked to step up to the camera, rather than to travel to the patient.

Already, programs are studying how well rehabilitation can be done by means of a small screen. At Shepherd Center in Atlanta, for example, a Centers for Disease Control-funded study will allow the center, in a study with Emory University, to determine whether the initial favorable results of a telemedicine-based preventive program for pressure ulcers will pan out over time, both in cost utility and outcome.

In the early study of about two dozen patients with spinal cord injury who were checked frequently either by phone or videoconferencing, the cost savings were substantial. Two of the control group who did not receive the same telemedicine counseling ended up in the hospital, at a cost of tens of thousands of dollars. All of the developing skin problems in the telemedicine group were caught early by self-reporting or by high-resolution photographs of suspected sores. All, presumably, were prevented from becoming full-blown ulcers.



Bob, a 57-year-old CP patient living in a group home, uses specially adapted videoconferencing equipment to receive speech therapy training.

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The study was done with the AT&T Picasso, which only transmits still images, notes Michael Jones, PhD, director of the Crawford Research Institute at the Shepherd Center and a co-author of the study.

He points out that image quality is not a problem with the Picasso as long as the lighting is adequate. "With the newer technologies we use, we now have the capability to adjust the frame transmission rate from a very good still image to pretty good gross movement," he explains. Even at the highest frame rate, however, it's not perfect and will not pick up small movements such as tremors, he adds.

Jones stresses that a system for two-way video contact can now be purchased for about $450. But he adds the "early corrective action" that stemmed from such close follow-up in the pressure-ulcer pilot study also seemed to generate cost, as well. The telemedicine participants saw their health care providers more often through office visits as a result of counseling over the two-way communication.

Education specialist Kathy Fellinham assists Bob with setting up the equipment and observes his progress.

Who Will Pay?

Does this mean telemedicine is truly accomplishing its goals of cost reduction and outcomes improvement? That is what the federally funded study has set out to prove, says Jones. However, he suggests, it may be managed care that eventually provides the revenue stream needed for telerehab to prosper-as providers are forced to share financial risk for patient health care costs.

Rehabilitation engineer Nigel Shapcott, ATP, notes that a lot of the technology is forging ahead, with costs plummeting. "I am sitting here looking at a $350 unit on my desk," says Shapcott, assistant professor at the School of Health and Rehabilitation Sciences at the University of Pittsburgh. Outside sits a van loaded with equipment that would take miles of road to get to a patient, he adds.

Jim Bates, PhD, director of the Center for Excellence for Remote and Medically Underserved Areas in Loretta, Pa., concurs: "We are getting the technology to be able to make a home visit and eliminate the road time for an occupational therapist. We are getting the technology to really be able to help make decisions for a disabled individual" without requiring the person to make a burdensome trip to a medical center.

Until now, Medicare has paid for only a few applications of telemedicine, most notably, teleradiology. Reimbursement was largely limited to physician providers. However, that is changing.

In the 1997 congressional budget agreement, provisions for Medicare reimbursement of telemedicine were instituted, and some Health Care Financing Administration funding was dedicated to demonstration projects to show more varied applications of telemedicine.

Meanwhile, Medicaid funds have financed some services, though so far in only 10 states. Typically such payments are confined to medically underserved areas, such as rural Kansas.

This year, a proposed addition to the Balanced Budget Act of 1997 calls for regulations to be amended so that payments for professional consultation by means of "interactive telecommunication" are included in such regions. Under the proposed change, the provisions for payment also extend beyond physicians to other health professionals. The-proposed rule would also establish a method for determining the amount of payments.

Filling a Gap

Telerehab increasingly seems to be defined as using telecommunication technology to support patients, caregivers and families for an extended period of time until they reach a maximum of function. How then will success be defined? If history is any guide, it will be with documented proof that telemedicine works and reduces the number of medical problems a patient encounters during this extended period, suggests Daniel Graves, assistant

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professor at Baylor College of Medicine and director of spinal cord injury research at the university.

With managed care reducing the amount of time patients stay in the hospital, most patients have "not even gotten over the shock of the injury when they are sent home," says Graves. "During the rehabilitation, there is an incredible amount of stress as patients and families try to cope. However, they are also expected to absorb a huge amount of information about how to care for themselves or loved ones," he stresses.

A catastrophic and disabling injury like a spinal cord injury, which sends shock waves throughout the family, not only extracts a huge financial toll, but inflicts a great deal of pressure on the family members as well. Most report a feeling of isolation after the patient comes home, observes Graves. "Patients with SCI usually have gradual improvement in function over a one-and-a-half- to two-year period," he adds.

A special document camera is mounted to Bob's wheelchair so the speech therapist can observe him scanning the DeltaTalker.

Effects on Providers

But even as the cost of technology has come down, concerns about the impact on health care have arisen. Will the advent of telemedicine put some people out of their jobs? By allowing some providers to broadcast their skills from a central bay station to patients, will it diminish the role of the local physical therapist or occupational therapist?

"I like to think it will expand the market for people already providing service," says David Brienza, PhD, associate professor of health and rehabilitation at the University of Pittsburgh. However, he says there might be renewed emphasis on credentials-and he doesn't discount the possibility of some kind of certification process for "telerehab."

In addition, no blanket permission exists for crossing state lines to conduct telemedicine. Indeed, in many states, consultation across state borders is strictly prohibited unless the health care provider is licensed in that state.

However, as George Starr, a supervisor of information technology services at the University of Iowa, sees it, the overwhelming advantages will surmount all of the complications. At the university, it is cheap to do because area high schools are wired for cross-communication. This is thanks to the facts that Iowa is home to more small towns than any other state in the union and that Iowa educators wanted to provide classes in foreign languages and other subjects for which they had no local teachers.

In a classroom set up for receiving two-way visualization from a French teacher miles away, patients from towns like Ottumwa see speech therapists and physical therapists from University Hospital School in Iowa City.

"The teams love it," Starr says. "For one thing, it often brings all disciplines into the same room [here] at the same time so that they can see what everyone else is seeing."

Today, health care professionals commonly estimate that 20 percent to 30percent of appointments in managed care are lost because of delays in scheduling, transportation problems or other factors. This statistic is thought to be even higher among the chronically ill or disabled community.

Now, with personal computers that can transmit images, telemedicine can be a video connected to a standard television set. Patient and clinician are able to view both the transmitted and received images, with simultaneous audio.

A Need for Proof

In recent years, however, telemeditine has not been subjected to rigorous scientific comparisons with more traditional forms. Research by Robert Glueckauf, PhD, director of the Center

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for Research on Telehealth and Health Care Communications at the University of Florida, is an exception.

Glueckauf's research, funded by the National Institute on Disability and Rehabilitation Research, involved adolescents with epilepsy, who ranged in age from 12 to 19 and lived largely in the rural Midwest Glueckauf showed that counseling by an audio-video communication system or speaker phone appears to be just as effective as sessions in which the participants were physically present.

The study was small-only 14 families were involved. But they reported "considerable improvement" whether the sessions were face-to-face, by audio-video link or by speaker phone, Glueckauf says. Just as important, they developed the same level of trust and rapport with their provider regardless of the method of communication used.

The federal government seems committed to the idea of finding less costly patient teaching and monitoring for such patients, while at the same time being able to more reliably provide a continuity of care. This year, in an inaugural effort, NIDRR is awarding a five-year, $4.5 million grant — in increments of $900,000 annually — to bolster the research efforts into "telerehab."

Distance medicine technology can improve the continuity of care for patients with disabling diseases.

As NIDRR project officer Bill Peterson explains it, the grant signals recognition of the sea change in health care. "It used to be that SCI patients were discharged at about 45 days, now it is down to 20," he says. An alternative way of providing patient and family support and education might go a long way to keeping people in their homes, getting them back to work, and forestalling the return to the hospital, he says.

Evidence seems to support that notion. In a meta-analysis published last year in the *Journal of the American Medical Association*, investigators from the University of Missouri and Brigham and Women's Hospital concluded that distance medicine technology can improve the continuity of care for patients with disabling diseases, such as arthritis, in which impact measurement scores showed improvement and pain was reduced. Although some of the telemedicine in the study constituted what some in the field call POTS (plain old telephone system), it did demonstrate that two-way, real-time communication doesn't have to be up close and personal to work.

Still, Andrew Balas, MD, director of the Center for Heath Care Quality at the University of Missouri and one of the principal authors of the analysis, believes much more evidence is needed to substantiate the effectiveness and cost utility of telerehab.

"Why should we prescribe computers without this scrutiny?" he asks. Studies must go further than documenting that telerehab visits cost less compared to a personal home visit, or save travel expenses compared to care provided by a clinic or med-

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ical center. “There are no randomized trials documenting the benefits.”

The Institute of Medicine, a federally funded scientific organization that independently conducts research on health policy, published a look at this advancing technology, *A Guide To Assessing Telecommunications In Health Care. The* authors, from academic centers and medical institutions from across the country, conclude that the technology will become “more commonplace and more easily used” in the years ahead.

This appraisal comes in stark contrast to their findings on telemedicine’s shaky start, which the report calls costly, cumbersome and dogged by hard-to-implement equipment.

A Long Way to Go

The term telemedicine is assumed to mean two-way audiovisual communication. In fact, in the recent Medicare stipulations, that is precisely how the federal government has defined it.

But when it comes to rehab, the video display screen is a long way from replacing the "roving eye," asserts Paul Tang, MD, medical director of clinical informatics at the Palo Alto Foundation in Palo Alto, Calif., and an author of the Institute of Medicine report. He notes that, even with recent advances, highly effective two-way visualization is, “logistically speaking, difficult to pull off.”

> The video display screen is a long way from replacing the “roving eye.”
> —Paul Tang, MD—

“A lot of things cannot be done yet; there is just too much motion,” which interferes with clear visualization in video display, agrees Mark Malagodi, president of Pittsburgh-based Artsco, the developer of a portable teleconferencing system that provides two-way communication between rehab professionals and their patients.

However, technological advances seem to hold the promise that those problems are relatively short term. In a study of nine such patients, notes Malagodi, the system proved effective in assessing seating fit, including transfer status, when it was used to screen patients. However, the same clinician did the direct evaluation, he acknowledges. And even Malagodi doesn’t think the company’s hardware and software, appropriately named Rehab Anywhere, will make actual face-to-face visits a thing of the past.

Still, he posits, “the insurers are going to go with what is cost-effective. Right now, that is phone lines. But soon the globe will be covered with in-orbit satellites, and what then? Things are changing very quickly.”

Some day soon, he envisions, it will no longer seem novel to do a second assessment for a wheelchair using a teleconference after an initial one has been done in a specialty center. “It is going to be a slow change,” he predicts. “People will not jump on at the same time . . but the bandwagon is, well, already there.”

Anne Scheck, MS, is a freelance writer specializing in medical topics.