Implants and Wearables: Coming Soon to a Network Near You

By Shawn Masia, MD

Remote monitoring is now ubiquitous in today's health care landscape and is redefining how physicians practice medicine. Patients have in-home devices that measure and transmit information in addition to giving alerts for early intervention and follow-up. These devices may also serve as educational tools that reinforce positive behavior and prompt patients to take their medications, attend upcoming appointments, and to note any concerning symptoms.

As remote monitoring technology becomes more embedded in medical settings, the imminent next steps in their evolution may have a significant effect on medical practice. Wearable and implantable devices that offer continuous monitoring have quietly proliferated in nonclinical settings and are being tested for clinical use. Transdermal bracelets and patches that monitor and transmit blood glucose and other useful chemistries, such as blood alcohol content, are close to deployment. Continuous monitoring of ECG, blood pressure, blood oximetry, and other parameters is already used to monitor critical at-risk personnel such as in the military and advance police units. They may also someday be used for airline pilots, bus drivers, boat operators, and train conductors. Real-time data monitoring networks detect people at increased risk of urgent health issues and are capable of signaling a response to preset alarm values.

Many of the implantable devices we commonly see in practice are network capable or are being upgraded by their manufacturers to function over secure networks. For example, implanted cardiac monitors, pacemakers, and defibrillators send data over wireless networks. These data can be monitored by complex algorithms that flag actionable events, such as shock delivery, device malfunctions, and cardiac arrhythmias. CPT codes already exist for remote interrogation and related procedures. As implantable devices for neurological diseases evolve and expand, so too will their remote capabilities. For example, vagal nerve stimulators and deep brain stimulators have traditionally relied upon magnetic locally based interrogation and programming; however, responsive cortical neurostimulators use a wireless remote monitor at home that collects data and stores it on a laptop for transmission.

Noninvasive wearable and transdermal patches are being developed for a variety of neurological emergencies. Fall detectors immediately call automated centers that dispatch emergency help upon detection of a threshold impact. On the horizon, reliable remote seizure detection will be commonplace using EMG and scalp EEG-based networked monitors. Furthermore, early detection of cerebral hypo-oxygenation is being studied using scalp near-infrared spectroscopy and other biomarkers in high-risk inpatient settings. It is not difficult to envision a future of networked outpatient devices enabling continuous monitoring of patients at elevated risk of stroke with varying response levels based on the alerts that exceed threshold.

Of course, there are potential pitfalls to these advances. False-positive results with sensitive tests are commonplace, underscoring the need for monitoring networks to include a human component to ensure resources are deployed only when necessary. Also, connected devices are associated with security issues, and hacking is not impossible.

The response to so many life-threatening neurological emergencies depends upon patients being able to call for help. A wearable device that detects and transmits drug levels can be extremely useful and prevent emergencies before they start. Tools that immediately flag alert values and notify the needed level of care will bring us closer to the earliest possible detection of a patient in need. ■

Shawn Masia, MD is a board certified neurologist and clinical neurophysiologist.