Sensory Overload?

By Barry P. Chaiken, MD, FHIMSS

Although the tourist slogan for Las Vegas claims "what happens in Vegas, stays in Vegas," some of the most exciting consumer technology announcements come out of Las Vegas each year. The annual Consumer Electronics Show (CES) held each January introduces to the world the latest gadgets that manufacturers hope will be hit items for the coming year. Two years ago, 3D television drew all the attention. Last year it was computer tablets to compete with the iPad. In 2012 it was sensors. What? Huh?

For many technology geeks, the long march through ever more sophisticated televisions, computers, and other electronic toys has run its course. The buzz at CES drew its energy from the integration of electronics, Internet, social networking, and data analysis. The key to achieving that harmony of technology is through sensors, devises that collect vast amounts of data from an almost infinite number of sources. Fortunately, the technology that can deliver these sensors inexpensively and with very powerful capabilities is now available. This opens the floodgates to allow entrepreneurs to utilize these unique devices in previously unimaginable ways.

Innovators first took advantage of these sensors by designing smartphone applications utilizing the sensors (i.e., accelerometers) built into these devices. For example, runners use the sensors in their phones to build a record of their runs by recording track time, distance, and speed. A major running shoe manufacturer builds sensors into its shoes to allow runners to record training data

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that can be uploaded to a website for later analysis using cloud-based applications.

Sensing Beyond Accelerometers

The current sophistication of sensors goes far beyond accelerometers. To assist asthmatics, a Madison, Wisconsin, start-up developed a small sensor that tracts position using GPS signals. The sensor is attached to rescue inhalers used by asthmatics. Every time a patient uses the inhaler, the sensor records the location of use. By coupling this usage data to other information known about the specific location, researchers can learn what conditions might trigger an individual's asthma.

For example, one patient's asthma was exacerbated each time she shopped at a local supermarket. Through analysis of the location data, her physician learned that there was a horse farm located next to the shopping center, which was the likely cause of her patient's attacks. The patient is allergic to horses. Once the patient switched supermarkets, the use of the rescue inhaler dropped dramatically. The Madison start-up hopes to record similar events from thousands of users to understand how physicians can better manage asthmatics.

Self-Tracking

Early adopters of sensors rally around the concept of "self-tracking," collecting information about one's self to improve their lives. Whether to lose weight, sleep better, eat healthier foods, or manage chronic disease, these sensors provide an inexpensive, easy method to measure physical condition (e.g., heart rate, blood pressure) and behavior. This allows users to discover insights that can be applied to improve one's being.

Some innovators see "gamification" as a way to encourage self-tracking. Gamification turns everyday activities into games by awarding points and merchandise, and encouraging people to compete with their friends.

Although some disease management programs previously employed such strategies to encourage healthy behavior and compliance with treatment plans, the new availability of sensor data offers a significant advantage over efforts that require patients to enter their own data. Sensors allow for data to be recorded with little or no patient effort, thereby ensuring the reliable and regular collecting of data. This permits disease management programs to keep closer tabs on patients, and allows patients to keep a closer look on themselves.

Health Tracking

A San Francisco start-up developed tiny motion sensors that can be attached to everyday items, sending a wireless signal to a base station every time the item is used. Therefore, sensors attached to a toothbrush, prescription drug bottle, or glucometer could report how often patients brush their teeth, take their medication, or test their blood sugar. Gamification can be applied to these activities as well, encouraging people to follow good behavior that drives them toward health.

Collecting sensor data offers healthcare researchers a treasure trove of data for use in healthcare research. As already noted, sensors allow the capture of both physiological and behavioral data from patients with little or no effort on their part. This contrasts greatly with current research work that burdens patients with the tedious effort of recording data. Invariably this data collection suffers from recorder bias and the incomplete collection of the information. Sensors do not suffer from these limitations.

The availability of semantic technology for linking data and performing sophisticated analytical techniques offers a special opportunity to conduct relatively inexpensive population-based medical research by tapping into various collections of sensor and patient data.

To address the needs of an aging population while restraining the increase in healthcare costs, healthcare professionals must emphasize the use of more effective and efficient therapeutic approaches. Although cost effectiveness research helps us understand what treatments work best, our focus must be on monitoring patients, preventing disease, promoting wellness, and empowering patients to effectively manage their own chronic illness. Sensors offer a powerful tool to help in this effort.

At the recent HIMSS conference in Las Vegas, Biz Stone, the founder of Twitter, described the moment he knew his new technology would be accepted. While attending the South by Southwest techie conference in Austin, Texas, a few years back, he saw the power of his social media tool, which at the time was available to only a few thousand people. A single tweet from one attendee announcing that he planned to shift from one pub to another led to long lines and huge crowds at the pub he tweeted as being his destination. Self-tracking may seem odd now, but tweets seemed just as strange only a few short years ago. For those who participated in Arab Spring in Tunisia, Libya, and Egypt last year, tweeting is about as mainstream as one can get.

The use of sensor data in healthcare is limited only by the imagination of medical researchers and caregivers. Patients have already embraced the data available from these sensors to impact their lives. It is up to us in healthcare information technology to figure out how best to utilize this new technology to improve care delivery. ▌

Barry Chaiken is the chief medical officer of DocsNetwork, Ltd. and a member of the Editorial Advisory Board for Patient Safety & Quality Healthcare. *With more than 20 years of experience in medical research, epidemiology, clinical information technology, and patient safety, Chaiken is board certified in general preventive medicine and public health and is a Fellow, and former Board member and Chair of HIMSS. As founder of DocsNetwork, Ltd., he has worked on quality improvement studies, health IT clinical transformation projects, and clinical investigations for the National Institutes of Health, U.K. National Health Service, and Boston University Medical School. He may be contacted at bchaiken@docsnetwork.com.*

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