BI&T: How can wireless technology help to lower healthcare costs?

Joseph Smith: Even a superficial view of U.S. healthcare spending would suggest there should be many opportunities to reduce overall healthcare costs while simultaneously increasing both quality and access. After all, we lead the world by a substantial margin in per-capita spending on healthcare, while we rank well down the list in important metrics of healthcare outcomes, such as infant mortality and overall life expectancy.

Many have already drawn attention to the impact of perverse incentives (rewarding physicians and hospitals for procedures and visits while hoping to achieve a marginally related goal of a healthier population, which would ideally result in less of each); the enormous wasted expenses related to defensive medicine (physicians’ rational response to exceptionally aggressive plaintiffs in the absence of medical malpractice reform); and gaming of the complex and uninspired reimbursement systems.

At WWHI, we are taking a direct approach of innovating and validating solutions that when broadly deployed can change the process of healthcare. It is illustrative to consider that our current healthcare system was developed to treat accidents and emergencies. Yet it is chronic diseases that consume the overwhelming majority of our healthcare dollars.

Our delivery systems are best designed to rescue and resuscitate while the need is more for continuous course correction. We need to move the delivery of care for chronic diseases from the doctor’s office and hospital wards and emergency rooms back to the home—effectively placing the patient in the center of an infrastructure-independent healthcare network. This decentralized view of healthcare requires a mixture of near-, on-, or in-body sensors; wireless communication; analytics and decision support, all married to titratable therapeutics.

Early and ubiquitous examples of this model of decentralized care are in diabetes and cardiac disease. In diabetes, we are all familiar with home glucometers now giving way to continuous glucose sensors and self-administered insulin now yielding to smart insulin pumps. The marriage of the continuous glucose sensor to the insulin pump is a closed-loop system that illustrates the concept of infrastructure-independent care.

Similarly, implanted defibrillators (ICDs) are a closed-loop solution to the problem of intermittent ventricular tachycardia/ventricular fibrillation. The embedded sensor detects the problem—in this case, a malignant ventricular tachyarrhythmia—and provides an appropriate and often life-saving therapy in seconds. At WWHI, we are working to extend this same model of infrastructure independent care to the management of chronic diseases that would otherwise consume significant resources at times of clinical decompensation or in relation to predictable complications. Congestive heart failure and chronic kidney disease are two very significant examples.

BI&T: What’s the biggest challenge in healthcare today?

Smith: There are many conditions we incompletely understand and for which we have no effective treatments; there are therapies that we know work well for some conditions and yet we struggle with the identification of those who most benefit from them; there are problems with wild disparities of care delivery; and there are clear issues with the quality with which we deliver care. But in the main, the biggest issue we face is that our healthcare system is simply unsustainable. We can-
not continue as we are. We spend too much to treat too few with a system too poorly configured to self-correct, and we are headed into a persistent economic downturn coupled with an aging population and a relative doctor shortage.

We desperately need to change the way we deliver healthcare, focusing on care as opposed to rescue, treating people where and how they live as opposed to waiting for them to get so sick they need our most sophisticated and highly developed centers of extraordinary intervention.

**BI&T:** What’s the biggest change that medical technology managers face over the next decade?

**Smith:** The intersection of engineering and medicine has been one of the most productive professional collisions in history. Innovations ranging from the pacemaker, to the heart-lung machine, to a raft of successful applications of biomaterials, to the implantable defibrillator and the dialysis machine and the coronary stent can all be traced to the beneficial collisions between engineers and clinicians. All of these examples and many more have in common two things: an unmet clinical need and a thoughtful engineering solution. The biggest change we face is that we now have an urgent need to focus on unbearable cost as the global unmet need in healthcare and this opens up a wide range of previous solutions for reconsideration, of new cost-effective or cost-saving solutions.

**BI&T:** How does the United States compare to other countries in using wireless technology to advance healthcare?

**Smith:** From my vantage point, we are all just starting to take advantage of wireless technology for its healthcare uses. With nearly 6 billion cell phones worldwide, it is said that more people have access to cell phones than to flush toilets. The ubiquity and pervasiveness of wireless communication affords enormous opportunities to monitor and treat chronic conditions, even prevent their occurrence by the timely provision of actionable information. And with this enormous opportunity before us, we struggle to take full advantage as innovators are uncertain about what regulatory requirements their candidate solutions will be subject to, as venture capitalists are dissuaded from engagement owing to regulatory and reimbursement uncertainty.

At the same time, physicians, particularly in the United States, are concerned that streaming channels of patient-related information, useful for analysis and prevention of high-cost clinical decompensation, may inadvertently be fodder for malpractice claims. In this setting as in many others, it is not the technology that poses the largest impediments, but the context in which the technology needs to be deployed, and many of these problems—regulatory and reimbursement hurdles, malpractice concerns—have uniquely American attributes.

**BI&T:** Do you think U.S. schools are preparing healthcare professionals for the wireless world and the technologies they will face on the job?

**Smith:** It is difficult to marry the pace of technological
innovation with the pace of innovation in our schools. That being said, wireless technologies, by their ubiquity, are present in every student’s life, even if not part of their formal education. And the good news is that engineering disciplines teach a way of thinking which is durable and always more valuable than any training on a specific technology.

**BI&T:** Anything else you’d like to share with our readers?

**Smith:** Engineers and physicians are similar in that they are both drawn to problem-solving. Engineering is said to rely more on a deductive form of reasoning that conditions engineers to know well what they can know, and be fully cognizant of when and by how much they must extrapolate to yield a potential solution.

It is said that clinicians are forced to operate in the murky space between the known and unknown, using pattern matching and other forms of art and judgment and experience to solve one-off problems while exuding confidence that at times exceeds their deep understanding. The history of medical innovation in general, and medical device innovation in particular, is writ large with the successful combination of these two separate but related disciplines.

We are now entering a new age of medicine, one where it may well be possible to have an unprecedented amount of information about a specific patient available at the time of a critical decision—information that was previously unimaginable—complete medical history, genomic background, sleep history, date of time of every medical exposure, longitudinal records of vital signs and biomarkers. How we will catalog and store such information and extract actionable information will be challenge we will face together for years to come.