

Virtual Mentor

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Can Health Care Engineering Fix Health Care?

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Start with the assumption that U.S. health care is badly broken and very expensive, plagued by inefficiency, waste, error, and duplication, and that this all is further compounded by inequities in distribution and access, safety issues, and disruptive behavior. In some ways this is like having an old, expensive car that you really like. It fits your self-image. It's quick and agile. But it constantly requires adjustment, goes through tires quickly, has only two seats, gets poor gas mileage, and costs a lot to insure. For a while, it might make sense to keep finding the money to deal with the problems and limitations, but eventually it makes sense to get a car that actually meets your needs and not your memories. Since we can't just get rid of our health care system—the socioeconomic cost would be crippling—and replace it with a new one, the only rational alternative is to roll up our sleeves and actually fix it.

By fix the health care system, I mean improve efficiency, minimize waste and error, limit duplication and unnecessary redundancy, develop “supply chain” approaches to distribution and access, design with safety in mind, and change the culture of the workplace. If this hadn't already been done in many U.S. industries, it might sound specious. But in fact health care is one of the holdouts, protected in its “cottage industry” safehouse, veiled in an aura of professionalism—individual doctors have professionalism, whereas “health care” is a trillion dollar industry—and, much like the quality and computerization movements within health care, is at least a decade behind the times.

How can I make these claims? A practicing academic physician for 35 years, I finally recognized that I was spending more and more of my time “making up” for the failures of the system, while becoming increasingly worried about safety. Then, I suddenly became a patient and directly witnessed how bad the system actually was. After recovering from my illness, I decided that I needed to do something. As I attempted to analyze the situation, I realized that the problems with health care were not primarily managerial and financial in nature but were systems and process problems, the domain of the industrial engineer. So I went back to school and earned a PhD in industrial engineering.

As I sat in class or worked on projects in manufacturing, assembly lines, statistical quality control, computer simulation, optimization, project management, and the like, I didn't see machine components traveling down assembly lines or robots assembling cars. I saw hospitals and clinics and operating rooms. Instead of the black

and white, right and wrong world I had known in medicine, I saw probability distributions, uncertainty, and decision analysis. And I learned about just-in-time inventory systems and Lean-Six Sigma [1]. While relearning calculus, differential equations, and several new computer languages, I envisioned new ways to interpret lab results, sequence imaging procedures, and decrease individual variability. As I memorized the equations for bottleneck analysis, down time, and throughput, I saw outpatient clinics and emergency departments.

Fixing health care will largely be a re-education process before it can become a re-engineering process. Much of the inertia and resistance to change is a matter of the culture and attitudes of medicine, carefully mentored during medical school and residency. Fixing health care will require individuals who are “bilingual” in health care and in systems engineering. It will require training highly visible and credible physicians and nurses to become analytical problem solvers and systems thinkers, while at the same time acclimating systems engineers to the culture, values, and terminology of the hospital and of the physician and recognizing how different they often are. And it will require training an entire cohort of individuals in new competencies that have either slipped through the cracks of current education (for example, where does one actually learn how a hospital works?) or represent new territory, like designing safe systems for new technology.

I realize that I have had two unique opportunities: I was a graduate student with tenure, and I started a sabbatical shortly after graduation. On sabbatical at a major university with a college of medicine and a college of engineering, I clarified the competencies of a health care engineer and drafted a curriculum that might allow them to be learned. I also had the opportunity to meet with leaders of the American Medical Association, the Joint Commission on the Accreditation of Healthcare Organizations, the Accreditation Council for Graduate Medical Education, the American Board of Medical Specialties, the American College of Surgeons, and the Department of Veterans Affairs. After initial skepticism, each organization seemed to develop an enthusiastic interest in the concept of fixing health care. I spoke with leaders in industry and found a similar acceptance. There appeared to be a general realization that something needed to be done, and a willingness to consider that health care engineering could be the route.

I am not alone. The University of South Florida Colleges of Medicine and Engineering, where I serve on the faculty and completed my graduate training in health care engineering, has been asked to participate in a multi-university proposal for a National Science Foundation grant. Our proposal, which has made the cut for serious consideration, would create the first officially recognized Health Care Engineering Research Center, distributed over five major universities. The grant focuses on developing programs in three areas (advancing data-driven predictive modeling, enabling the care cycle, and catalyzing transformational changes) and in three domains (discovery, development, and deployment).

Every journey begins with a single step. So, too, this journey must start somewhere—not everywhere—and must achieve some tangible, early success. Patient safety, which no card-carrying health care professional can reasonably ignore, is the natural starting point. Formal, structured programs in patient safety should be mandated in undergraduate medical education, graduate medical education, and continuing medical education. Understanding human error, the contributions of system design, and the need for human factors engineering should be as important in medical education as the Krebs cycle and the distribution of the coronary arteries. The University of South Florida is launching a broad-based program in patient safety for all residents and fellows; an innovative course in patient safety for fourth-year medical students, graduate nursing students, graduate public health students, and graduate engineering students; and a workshop on patient safety for residency program directors. Our masters-prepared graduate medical education librarian is creating a virtual library on patient safety immediately accessible to all of our faculty, residents, and students.

Once a beachhead has been established, the next steps might address the processes by which care is delivered and the processes by which professionals are educated and trained. The opportunities are limitless. But it will depend on the willingness of physicians and nurses to accept responsibility to fix the system, to roll up their sleeves, and to lead the march. In the words of George Bernard Shaw “Some men see things as they are and ask why. Others dream things that never were and ask why not.”

Note

1. Lean is a manufacturing tool that has the major benefit of minimizing inventory and waste. Six-Sigma is a system of measuring the number of defects per million operations in a statistical way and using that information to drive performance improvement. The popular combination of the programs is known as Lean-Six Sigma.

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