

# Systems engineering in the hospital

By Richard Quinn

Systems-engineering expert James Benneyan, PhD, doesn't want hospitalists to look at poorly working processes in their institutions and think, "I should try to tweak this process to improve it."

Instead, he wants them to walk out of his HM17 session at 8 a.m. today – appropriately titled, "Systems Engineering in the Hospital: What Is in Your Toolkit?" – thinking like engineers, which means designing a solution, analyzing how well that process works, and then optimizing it for improvements. If that means not just tweaking a process, but redesigning it from scratch, so be it.

"Systems engineering studies the performance and how to improve the performance of complex systems,

particularly sociotechnical systems," said Dr. Benneyan, who runs the Healthcare Systems Engineering Institute at Northeastern University in Boston, which encompasses four research centers. "Health care is a perfect example ... systems engineering can really help to understand and improve complex processes, whether it's patient flow, safety, on-time discharge [or] better discharge."

Dr. Benneyan says that systems engineering is, first and foremost, a mindset. It's an approach to problem solving that's different, if related, to quality improvement. Both have tremendous value, but they are based on different philosophies, tools, and work styles.

For example, many hospital operating rooms measure how many days the first procedure of the day begins on time. But instead of using that as a yardstick for quality, Dr. Benneyan said a better approach would be designing a system that can adapt to situations when the first case starts late. He compared the process to a delayed flight at an airport. An airline doesn't back up every plane's departure when one plane is running behind. Instead, it has systems that adapt to circumstances.

"There are methods and then there are philosophies," Dr. Benneyan said. "I don't think people in health care realize what my field did in the airline industry. We didn't design things that worked and clicked properly. We designed things that ... react to daily events and [everything] going on and perform pretty well."

Dr. Benneyan says that, while health care is an incredibly complex system, other fields with similar levels of technical expertise have used systems engineering much more effectively. Manufacturing, logistics, and global distribution networks are all precise industries requiring

hundreds of individual processes to ensure success.

"These are really complicated processes," he said. "The real barrier is a cultural barrier. Health care is not the most challenging environment to work in. ... I think something that people in health care have to have an appreciation for is that the process of doing this work is different from doing their other work. Systems engineering is not the same as quality improvement and can achieve fundamental breakthroughs in cases where QI has not – but also tends to take more work."

Still, Dr. Benneyan believes his field has lessons that complement quality initiatives. To wit, health care advocates – including the Institute of Medicine, the Agency for Healthcare Research and Quality, the National Institutes of Health, and the National Science Foundation – have all pushed for greater application of systems engineering in medicine with the goal of improving how well health care does its job.

While he hopes hospitalists and other HM17 attendees at his session walk away with a newfound respect for and understanding of what systems engineering can do, he doesn't want them to think it's too easy.

"There's a lack of appreciation of the process of engineering and how it's different," he said. "It's a big challenge, partnering clinician with engineers. ... We think differently even though we're both scientifically trained."

"I hope hospitalists take away an appreciation for how this toolkit can be useful in their world."

**Systems Engineering in the Hospital:  
What Is in Your Toolkit?  
Thursday, 8:00–9:30 a.m.**



Danielle Scheurer, MD, SFHM, MSCR, leads the Communications Strategy Committee meeting at HM17.