Preventing unnecessary deaths by moving meds safely

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An interdisciplinary team with a broad range of expertise – in nursing, civil engineering, computer science, and biostatistics – is working together to confront a serious problem in modern health care: unsafe medication practices.

Some 7,000 people are estimated to die and 1.5 million are injured by medication errors in hospitals and clinics, according to a recent report in the *Journal of Healthcare Engineering*. Research clearly indicates that flawed medication systems and complex delivery processes are at the heart of problem.

Rita Snyder, a health care systems expert in the College of Nursing who holds the SmartState Endowed Chair in Health Informatics Quality and Safety Evaluation, has been studying clinical care processes for a number of years. The administration process is a critical component of medication management systems, she said, yet little is understood about its complexity and risks.

A connection between transportation and medication delivery might not be obvious, but Snyder and Nathan Huynh, a civil engineer in the College of Engineering and Computing, see it clearly.

Medication administration is very much a traffic-flow process. A medicine slated for patient delivery has to proceed through a highly complex tagging, sorting and transportation procedure involving many moving parts along the way, including the nurses who administer the drugs.

"I'm a transportation and logistics person," Huynh said, "and I saw that what I do was very applicable to this sort of work."

A 2010 pilot study involved real nurses working with manikins in a College of Nursing simulation laboratory. The nurses treated the manikins as patients while Huynh developed a web application to collect data for how the nurses treated the "patients" on an iPod Touch.

"The data were then used to create a computer simulation – a gaming model, really – of the process," he said.

Snyder and Huynh are working with José M. Vidal, a computer scientist and agent-based modeling expert in the College of Engineering and Computing, and Bo Cai, a biostatistician and statistical modeling expert in the Arnold School of Public Health, to develop computer simulation and statistical models for how the medication administration process

works in hospitals.

In more recent studies, live observations at a local medical center are being used to refine the model.

"We haven't used tools like computer simulation much in health care," Snyder said. "To me, computer simulation gives us an opportunity to model clinical processes in a low-risk way, and then have experienced clinicians look at them and come up with feasible redesign options."

With a working model in hand, the team hopes to address current problems and anticipate others that arise with the inevitable changes that come on an almost daily basis in hospitals.

Computer simulation offers a real opportunity for improving the medication administration process, particularly by identifying critical points where interruptions to the work-flow might create a higher probability of error, Huynh said.

"This is one of the high-risk procedures in hospitals," he said. "When nurses are busy and bombarded by the number of patients and the number of medications to provide, they can make mistakes."

Decreasing the complexity of high-risk processes like medication administration will, ultimately, make the health care system safer, said Snyder.

"Both of us look at our practice worlds in a similar way. [Huynh] happens to be looking at cars and traffic lights, and in this case, I happen to look at nurses and how they move around when they give medications," Snyder said. "But the concepts are generally the same."