Simulation Can Improve the Healthcare Systems We Work Within

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Restroom in a restaurant that encourages employee handwashing. An essential resource is missing: soap.

The employees in the restaurant where the photograph was taken are well-trained, capable, and customer-friendly, but I fear they are not washing their hands correctly. I do not doubt their knowledge, skills, or motivation,[1] but I know they cannot wash their hands effectively because an essential resource is missing.

Stocking a restroom with soap is relatively simple; healthcare delivery is immeasurably more complex, but like the situation for the restaurant employees, the resources in our work environments, as well as the design of the environments themselves, impact our ability to provide effective, efficient, safe healthcare. Sometimes obtaining the equipment or supplies our patients need is neither easy nor efficient. In an emergency, we may have to obtain some of the necessary medications from a local automated dispensing system and some from the pharmacy; other supplies, perhaps the intravenous fluids, may have to be retrieved from a different storeroom. Knowing where to find resources is a critical skill required of all healthcare workers and is rarely intuitive.

Maybe the resource we need is not as simple—or concrete—as a standard supply item. Sometimes the perfect process or policy, crafted by intelligent and engaged subject matter experts, does not work well in actual clinical practice. Sometimes the electronic health record system, implemented with conscientious planning, creates a cumbersome workflow for the healthcare provider. Our efforts to provide the best patient care are affected by the systems we work within, and we work within extraordinarily complex socio-technical systems.

These socio-technical systems can be evaluated and enhanced using simulation, which allows us to test and incrementally improve a wide variety of processes. "Simulating" (by demonstrating) handwashing in the restaurant restroom in the example above would have quickly and succinctly demonstrated the missing resource—soap. Healthcare providers, administrators, insurers, and even patients are recognizing the power and versatility of simulation to improve healthcare.

Conceptually, simulation applications fit into three broad domains. The domains are not mutually exclusive but provide a framework for discussion. The first domain of

simulation applications addresses the capabilities of *individuals*. Simulations can be designed to help individuals develop knowledge, technical skills (such as how to perform procedures), and nontechnical skills (such as how to engage in difficult conversations with patients or perhaps with colleagues). Simulation can be used as a formative process, to enhance the capabilities of individuals, or as a summative process, to assess or test those capabilities.

The second domain of simulation applications addresses the capabilities of *teams*. Simulation can be used to improve the knowledge, technical skills, and nontechnical skills of teams, addressing communication, leadership, delegation, shared mental models, situational awareness, and coordination.

As we increase our understanding of how to use simulation to the best advantage of our patients, there is a third application domain. This new frontier uses simulation to improve the healthcare *systems* we work within. No matter how skilled and engaged an individual or a team is, if the necessary resources are not readily available, the providers cannot accomplish their tasks efficiently or effectively. Capabilities in all three domains are needed for optimal patient care.

Unfortunately, sometimes deficits are discovered during a patient care event. Perhaps the oxygen tank is found to be empty during patient transport.[2] Perhaps the single-use defibrillator pads are not the same brand as the defibrillator. Perhaps the official policy does not take into account information that makes this particular patient's circumstances unique.

The third domain of simulation applications addresses improving the systems that surround (and integrate with) our patient care efforts. When simulations are conducted *in situ*, in actual patient care environments, we may discover and proactively mitigate hazards before they impact an actual patient. Evaluating the ability of employees to wash their hands *in situ*, in the pictured restaurant restroom, would have provided information that could have been missed in an artificial environment, such as a training center. Perceptive observers and astute healthcare providers may identify workarounds, which are, by their nature, clues to problems with the underlying processes. Unsafe conditions identified in this manner can be reported through the Pennsylvania Patient Safety Reporting System (PA-PSRS) using harm score A (unsafe conditions; circumstances that could cause adverse events).[3]

In addition to serendipitous hazard identification, facilities can use simulation as an intentional probe (e.g., to test new or renovated patient care environments). What path would the emergency response team follow to reach the patient promptly? Can members of the response team open all of the appropriate doors? Who will secure the elevator? Who will bring the emergency supply cart? Is the cart located close enough to allow sufficiently rapid retrieval? Changes can be implemented, evaluated, and refined using simulation as a testing process.

We can apply simulation testing even earlier: during planning, before walls are built and headwalls installed. Facilities can conduct simulations in room mockups to identify unintended consequences of design and procedural decisions. Will the emergency response buttons be located close enough to the patients' beds? Where are the best locations for computers, physiologic monitoring equipment, and hooks to hang fluids and medications? Will the patients' beds fit through the doorways? Even the best planning relies on "work as imagined"; simulation can bring our understanding closer to "work as done."

We can use simulation, particularly *in situ* simulation, to test and improve patient care processes and identify and mitigate hazards before they contribute to patient harm. Simulation is a powerful and adaptable tool that can be used to help us better understand, and improve, the complex socio-technical systems that impact patient care.

NOTES

1. Pennsylvania Patient Safety Authority. Decision-making map to improve hand hygiene behavior [online]. 2014 [cited 2015 Nov 6]. http://patientsafetyauthority.org/EducationalTools/PatientSafetyTools/handhygiene/Documents/map.pdf
2. Gardner LA. Identify sufficient supplemental oxygen for patient intrahospital transport. Pa Patient Saf Advis [online] 2015 Sep [cited 2015 Nov 6]. http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2015/Sep;12(3)/Pages/121.aspx
3. Pennsylvania Patient Safety Authority harm score taxonomy [online]. 2015 [cited 2015 Nov 21]. http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2015/mar;12(1)/PublishingImages/taxonomy.pdf

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