THE FUTURE OF MEDICAL SIMULATION AND THE NEED FOR HUMAN FACTORS

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Recent studies indicate that the U.S. health care system is not as safe as it should be. It is estimated that medical errors contribute to as many as 100,000 deaths annually in U.S. hospitals with a cost to society of $37 billion (Kohn, Corrigan, & Donaldson, 1999; Health Grades, 2004). The estimated number of deaths due to medical error is twice as high as the annual number of U.S. highway fatalities and over 100 times higher than the annual number of airline fatalities.

In many high-risk occupations (e.g., aviation, military operations, etc.), computer-based simulators have been a fundamental component of training and have helped improve safety. By contrast, medical simulator training systems have only become commercially viable within the last 10 years.

Medical educators are beginning to recognize that simulators will forever change how medicine is taught and practiced (Dawson, 2006); however, most medical simulators have been developed with little or no human factors involvement. Unfortunately, the need for human factors is paramount. For instance, many current medical simulators emphasize physical fidelity at the expense of functional fidelity leaving critical aspects of procedures poorly implemented. Thus, they are built around what current technology *can* do instead of what it *should* do. Further, much of the research guiding the medical simulation community is not grounded psychological theory. Thus, medical educators and system designers have not taken advantage of the vast amount of human factors knowledge that already exists in areas such as perception, cognition, attention, stress, workload, human error, and training (Scerbo, 2006).

The discipline of human factors has made significant contributions to safety in other high-risk domains in large part, through the use of simulation technology. Simulation systems have been used to create laboratories for studying behavior with potentially hazardous technology/conditions by removing or minimizing the risks involved. At present, the medical community is focused on simulation-based training systems. In the future, however, medical simulators must move beyond representing individual procedures to include environmental conditions, alternative equipment/instrument designs, team dynamics, organizational factors, and cultural issues. In addition, training systems must be merged with imaging, medical information, telemedicine, Internet, and robotic systems to allow physicians to consider alternative diagnoses and treatments and to experiment with different therapies or rehearse procedures before committing to a course of action. Significant improvements in safety are unlikely to be realized until all facets of the health care system can be simulated enabling human factors researchers to study scientifically the practice of medicine in an environment that no longer puts patients at risk. Realization of this vision will necessitate changes to the educational system to support multidisciplinary training and collaboration among engineers, psychologists, physiologists, nurses, technicians, and doctors across the medical specialties.

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