

# Use of Simulation in Performance Improvement



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## KEYWORDS

- Performance improvement • Patient safety • Simulation education • Leadership
- Feedback • Crisis resource management • Team management • Communication

## KEY POINTS

- Despite increased attention and focus, human error and system failures continue to lead to preventable patient care errors.
- Simulation has proven to be an effective educational tool to address medical technical skills, communication skills, and teamwork skills.
- Simulation has recently been used as part of performance improvement strategies for attending physicians and teams.

Despite ongoing attention and efforts to improve patient safety, medical errors persist. In the United States in 1999, the Institute of Medicine (now the National Academy of Medicine) estimated that between 44,000 and 98,000 people die yearly because of medical errors.<sup>1</sup> Recent studies estimate that the true number of premature deaths due to preventable patient harm may be much larger, suggesting that more than 400,000 such deaths occur each year.<sup>2</sup> Although these deaths are at times the result of inadequate medical knowledge and skill, they commonly occur because of inadequate communication and poor management of situation and team dynamics.<sup>1-4</sup> Overcoming these individual and team failures requires dedicated efforts aimed at improving performance and practice.<sup>5-7</sup> Simulation represents one such effort that has found usefulness in training and in maintaining individual and team performance.

## A BRIEF HISTORY OF PERFORMANCE IMPROVEMENT

Early performance improvement efforts can be traced as far back as ancient Greece in the work of Hippocrates and Asclepius.<sup>8</sup> In more recent times, Ignaz Semmelweis<sup>9</sup> is recognized as one of the first physicians to demonstrate significant improvement in patient outcomes after instituting a clinical practice change. While reflecting on the

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practice habits of his colleagues and medical students in the 1840s, Semmelweis noted the lack of hand sanitization after autopsy performance. These same physicians and medical students would then examine pregnant women after merely wiping their hands on their dirty autopsy aprons. Semmelweis's efforts to promote handwashing among his colleagues and medical students resulted in an 80% reduction in maternal deaths.<sup>9</sup>

In the 1910s, surgeon Ernest Codman's "End Result Idea" was introduced in the United States.<sup>10</sup> Codman advocated tracking patient outcomes to determine whether treatment was successful and why treatments failed. His system to prevent future failures mirrored the well-known plan-do-study-act (PDSA) cycles of today. Since then, performance improvement has evolved into an applied science with a more scientifically rigorous approach to learning.<sup>11</sup> A variety of educational strategies have been introduced to address individual and team performance improvement. This article focuses on the use of simulation education as a strategy to improve medical practice, reduce medical errors, and improve patient safety.

### SIMULATION DEFINED

Simulation "is a technique to replace or amplify real-patient experiences with guided experiences, artificially contrived, that evokes or replicates substantial aspects of the real world in a fully interactive manner."<sup>12</sup> Simulation provides an educational opportunity that is immersive and experiential. Simulation can involve many forms, including simulated and virtual patients, static and interactive mannequin simulators, task trainers, screen-based (computer) simulations, and computer games. Simulation has the potential to recreate rarely experienced scenarios, allowing professionals to work in challenging situations with the opportunity to carefully replay or examine their actions.<sup>13</sup> Best practice in simulation education indicates that certain key features and conditions must accompany simulation-based education to allow for optimal learning outcomes. These include simulator validity, feedback, deliberate and repetitive practice, curriculum integration, ranges of difficulty, multiple learning strategies, a controlled environment, individualized learning, clinical variation, and defining outcomes (**Box 1**).<sup>14</sup> When

#### Box 1

##### Features of simulation that contribute to effective learning

Feedback: MOST important, provides opportunity for reflection and practice improvement

Repetitive practice with the use of feedback to allow for deliberate practice

Varying degrees of difficulty needed to allow the learner to progress

Multiple learning strategies should be used

Clinical variation should be appropriate and relevant to participants' practice

Faculty should be able to control the environment

Opportunities for individualized learning should exist

Programs and courses should have defined outcomes and benchmarks

The simulated environment should be realistic

Simulation program should be integrated into a curriculum

*Data from* Issenberg SB, McGaghie WC, Petrusa ER, et al. Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review. *Med Teach* 2005;27(1):10–28.

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