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Results from a simulation based medical team training curriculum utilizing an observational learning model

Douglas E. Paull, Laura J. Hoeksema and Linda Williams

Corresponding author: Douglas E. Paull douglas.paull@va.gov

Department: Veterans Health Administration National Center for Patient Safety, 24 Frank Lloyd Wright Dr., Lobby M, Ann Arbor, MI 48106-0486

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Abstract

Objective: To evaluate learning outcomes following an observational simulation-based team training curriculum.
Methods: Crew resource management teamwork techniques were taught to an audience of 86 residents and 19 faculty members. A simulation scenario (hypoxia in operating room) utilizing five volunteers demonstrated the techniques. Audience members utilized a validated observational tool, the Clinical Teamwork Scale, to rate teamwork. Debriefing with the audience followed. Next, volunteers, who had observed the first scenario, were solicited to participate in a second scenario (hypoxia on the medical floor). Prior to the beginning and at the conclusion of the training, audience members completed a Self-Efficacy for Teamwork Competency Scale survey.
Results: There was significant improvement in confidence among observers of the scenarios among all eight items on the teamwork survey following simulation training, average 3.77 to 4.37, $p<0.01$, on a Likert scale of 1 to 5. There was an increase in overall communication on the clinical teamwork scale between the first and final simulation scenario, 5.29 to 6.44, $p < 0.01$, on a scale of 1-10.
Conclusions: Simulation-based medical team training, utilizing an observational experiential learning model, is associated with improvements in measurable teamwork and communication skills.

Keywords: Learning outcomes, simulation and teamwork.

Article

Introduction

The use of simulation-based training is effective in teaching both technical (Butter, McGaghie, Cohen et al., 2010; Wayne, Barsuk, O'Leary et al., 2008; Barsuk, McGaghie, Cohen et al., 2009) and teamwork and communication skills (Kuduvalli, Parker, Leuwer, & Guha, 2009) among medical students, residents, and staff in healthcare. Simulation offers participants the opportunity to learn and practice new skills in a safe environment without the concern of harming patients. The use of simulation at various points in the professional development of physicians enhances safe and effective healthcare. Simulation plays an important role in undergraduate and graduate medical education (Wayne, Butter, Siddall et al., 2006a; Rosenthal, Adachi, Ribaudo et al., 2006; Blum, Powers, & Sundaresan, 2004).

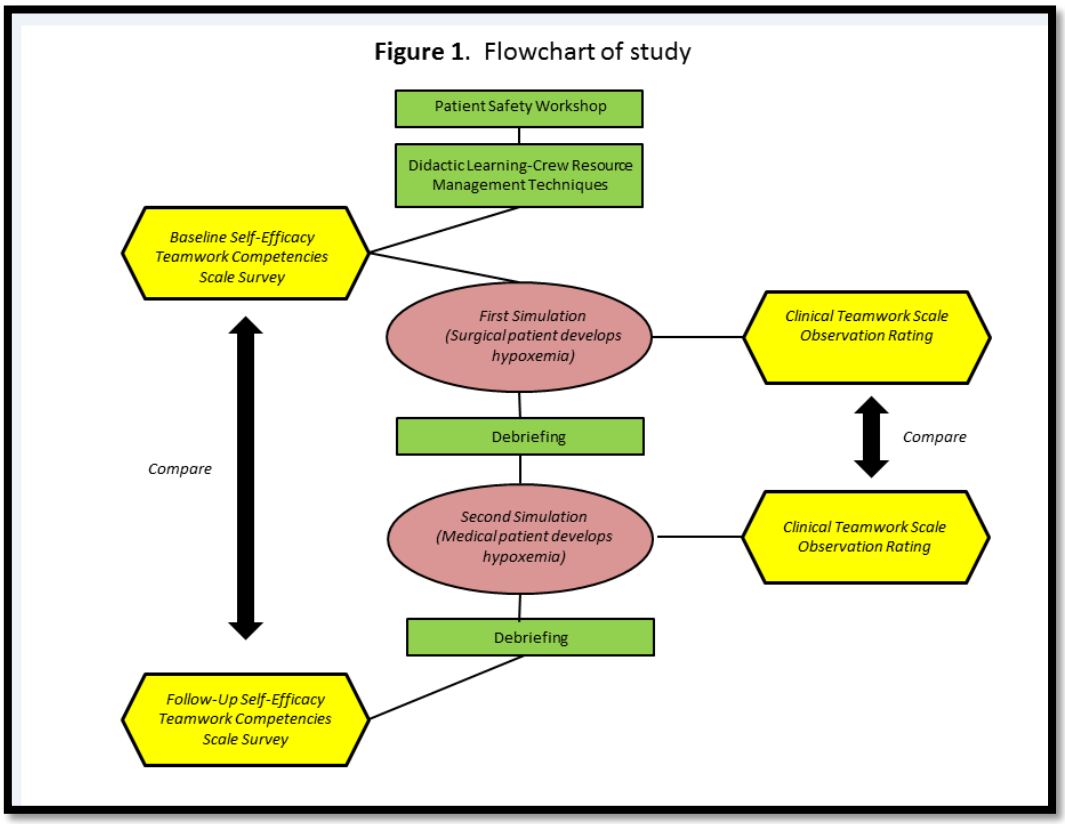
Simulation as a training technique offers advantages to didactic learning including opportunities to practice the same procedure multiple times, the development of skills related to managing complications while in a controlled environment, and immediate feedback regarding performance (Issenberg, McGaghie, Petrusa et al., 2005). It also provides opportunities to develop, practice, and reflect on teamwork and communication skills (Robertson, Kaplan, Atallha et al., 2010). But simulation, especially high-fidelity simulation (HFS), has some drawbacks which prevent it from being implemented more widely. A simulation scenario involves only a few participants, making it impossible to reach a large audience in the short amount of time that is often allotted for this type of training. HFS can also be costly in terms of time, money, and personnel.

Observational learning, or demonstration-based learning, is defined as "the process of acquiring knowledge, skills, and attitudes through viewing examples of performance (Rosen et al., 2010). Observational learning, as compared to experiential learning, has several potential advantages, especially when large numbers of people need to be trained in a limited amount of time. Observational learning allows for a large group of individuals to observe their colleagues in a simulation scenario. This allows for contemplation and provides opportunities to develop reflective skills (Plack & Greenberg, 2005). The purpose of this study was to evaluate learning outcomes among residents following a team training curriculum where large numbers of residents, equipped with an observational checklist, watched several of their peers immersed in a HFS designed to trigger and demonstrate teamwork and communication techniques.

Methods

Design. The study design was quasi-experimental. The intervention was a team training didactic curriculum followed by a series of two simulation scenarios observed by a large group of learners equipped with an observational checklist of teamwork and communication behaviors. The didactic portion of the curriculum included discussion of topics such as patient safety, high-reliability organizations, human factors, teamwork, communication, and Crew Resource Management principles (e.g. "speaking up" and situational awareness). The study was conducted prospectively. The study deployed mixed methods research design. Quantitative survey data was obtained after the didactic curriculum but prior to the first simulation and then again after the second simulation debriefing. During each of the two simulation scenarios, learners observing from their seats, rated the teamwork and communication behaviors demonstrated by the team of 4-5 volunteer learners immersed actively in the simulation.

Learning outcomes of the observers could be compared before and after simulation observation of teamwork and communication skills. In addition, teamwork performance in the second scenario involving learners who had observed a simulation, could be compared to performance in the first scenario among learners who had not previously observed a demonstration of the teamwork and communication behaviors. A flow diagram of the study protocol is depicted in Figure 1. The study met the requirements for exemption by the VA Ann Arbor Research and Development Committee and Institutional Review Board (2009-010044).



Setting. The Veterans Administration (VA) National Center for Patient Safety (NCPS) conducts Patient Safety Curriculum/Graduate Medical Education Workshops. Workshops have been previously described in detail for both faculty and residents (VA, 2015). Workshops are multidisciplinary, interactive, and cover a number of topics in patient safety including human factors engineering, root cause analysis, and team training. Team training is based on *Crew Resource Management* (CRM) principles and has been supplemented with simulation (Dunn et al., 2007). The logistics of a one day workshop precluded experiential simulation for each participant. NCPS local facility faculty developed a curriculum in which several teams of volunteers participated in CRM simulation scenarios while colleagues observed, with everyone taking part in instructor-facilitated debriefings following each scenario.

Participants. The workshop included 105 participants (n=86 residents, n-19 faculty) at a single large academic VA healthcare facility. The majority of residents were in their first (n=49) or second year (n=27) of training and represented multiple fields including medical and surgical specialties.

Data collection. Simulation training was preceded by a teamwork and communication learning module consisting of didactic material describing CRM communication techniques (e.g. situational awareness, assertiveness, workload distribution). Participants completed the baseline *Self-efficacy in Teamwork Competencies Scale* survey following the didactic module but prior to the first simulation (Paige et al., 2009). The survey was repeated at the completion of the entire Workshop, following the second simulation scenario and accompanying debriefing.

The first scenario involved an operating room team consisting of volunteers playing five roles (attending surgeon, surgical resident, anesthesiologist, circulating nurse, and certified scrub technician) conducting a checklist-guided preoperative briefing followed by a simulated laparoscopic Nissen fundoplication. During the procedure the simulated patient develops a left tension pneumothorax, a crisis serving as the trigger for teamwork and communication skills Volunteers for this simulation scenario were from the surgical disciplines.

The other learners (audience members) completed the *Clinical Teamwork Scale* observational tool, rating teamwork, communication, leadership, situational awareness, and decision-making (Guise et al., 2008). Both the volunteers and audience participated in a debriefing of the simulation scenario. A subsequent 15 minute break allowed NCPS faculty to ready the second simulation scenario.

The second scenario involved a medical team consisting of four new volunteers - Emergency room (ER) resident, medical resident, nurse, and respiratory therapist. The patient is admitted with congestive heart failure and chronic obstructive pulmonary disease and develops a pulmonary embolus. Once again, observers completed the *Clinical Teamwork Scale* tool and everyone participated in the debriefing. The triggers and opportunities for evaluable CRM teamwork and communication tool demonstration were similar to those occurring in the first simulation scenario. For example, volunteers were faced with a crisis involving some level of confusion, prompting use of situational awareness tools to "step back" and re-evaluate the situation. Volunteers were also subjected to some challenge to communication where "speaking up" and assertiveness using curricular techniques was required.

Data analysis. Pre and post *Self-efficacy in Teamwork Competencies Scale* survey scores and first and second simulation scenario *Clinical Teamwork Scale* results were compared using a two-tailed, paired Student t test. A p value less than 0.05 was considered significant.

Results

Survey results. Baseline *Self-efficacy in Teamwork Competencies Scale* surveys were completed by 69 of the 105 Patient Safety Workshop participants for a response rate of 66%. Follow-up surveys, following the conclusion of all training, were accomplished by 44 learners for a follow-up survey response rate of 42%.

Self-Efficacy in Teamwork Competencies Scale survey scores improved across all eight domains as a result of the simulation training, Table 1. Overall, survey scores improved 16% from a mean pre-training value of 3.77 to 4.37 post-training ($p < 0.05$) with a range of improvement of 9% to 35%. Participants reported that the simulation scenarios were similar to events they face in real life and were effective in teaching teamwork and communication, 4.05 and 4.19, respectively, out of a possible maximum score of 5.0 on a Likert scale. Confidence improved in the use of CRM techniques though the respondents/observers had not actually performed in a simulation scenario.

Table 1. *Self-Efficacy in Teamwork Competency Scale* scores before and after simulation training.

Item	Pre	Post	% Change
Before I accept a patient in transfer from another clinical area, I communicate effectively with team members to ensure we . . .			
1) Have a common understanding of the patient's condition	3.67	4.48	22
2) Have a common understanding of the specific goals to be achieved in caring for this patient	3.24	4.37	35
During the care of the patient, I . . .			
3) Use specific communication strategies to confirm that messages are received and the content is accurately understood (i.e. closed-loop communication)	3.78	4.45	18
4) Interact with others to manage the workload effectively	3.77	4.47	19
5) Use strategies to effectively promote team cohesion and effective work interactions	3.95	4.43	12
When you are part of a patient care team at your hospital, how often do you believe each of the following characteristics are present within your team?			
6) All team members are committed to performing as a highly effective team.	3.95	4.30	9
7) The team has a shared understanding of its plan of action	3.91	4.30	10
8) When faced with challenges, members use a team approach to respond to situations	3.95	4.35	10

P < 0.05 pre vs. post, all items (#1-8), two-tailed, unpaired Student t test. N=74 pre and N=41 post completed surveys submitted.

Adapted from "High-fidelity, simulation-based interdisciplinary operating room team training at the point of care", Volume 145, Paige JT, Kozmenko V, Yang T, Paraqi Gururaja R, Hilton CW, Chauvin SW, Pages 138-146, Copyright (2009), with permission from Elsevier

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Observation results. Sixty participants submitted a completed Clinical Teamwork Scale observational tool for the first scenario (57%) while 38 submitted completed forms for the second scenario (36%). Clinical Teamwork Scale scores for teamwork performance were better among first scenario observers who became direct participants in the second scenario compared to scores from first scenario participants, Table 2. Composite Clinical Teamwork Scale scores improved 29% from 5.30 to 6.86, on a scale of 0-10, $p < 0.05$.

Table 2. *Clinical Teamwork Scale* Scores Before and After Observational Learning

Clinical Teamwork Scale Item	Pre	Post
Overall teamwork	5.33 ± 1.8	6.65 ± 1.9
Overall communication	5.29 ± 1.9	6.45 ± 1.8
Orient new members	5.37 ± 2.1	6.66 ± 1.7
Transparent thinking	5.43 ± 1.9	6.94 ± 1.6
Directed communication	4.61 ± 2.4	5.97 ± 2.1
Closed-loop communication	5.34 ± 1.8	6.65 ± 1.9
Overall situational awareness	5.21 ± 1.9	6.92 ± 1.7
Workload distribution	5.54 ± 1.8	6.92 ± 1.7
Avoiding fixation error	5.36 ± 1.7	6.55 ± 1.8
Overall decision-making	5.21 ± 1.9	7.26 ± 1.4
Prioritization	5.37 ± 1.8	7.16 ± 1.5
Overall leader/helper	5.25 ± 1.8	7.13 ± 1.7
Role clarity	5.03 ± 1.8	6.92 ± 1.9
Perform as leader/helper	5.32 ± 1.8	7.23 ± 1.6
Patient friendly	5.71 ± 2.1	7.23 ± 1.7

Data expressed as mean ± standard deviation. $P < 0.05$, unpaired, two-tailed, Student t test, pre vs post, for all 15 pre vs. post comparisons. N=62 pre and N=38 post completed observational tools submitted

From the Guise JM, Deering SH, Kanki BG, Osterweil P, Li H, Mori M, Lowe NK. 2008. Validation of a tool to measure and promote clinical teamwork. Simul Healthc 3: 217-223. Promotional and commercial use of the material in print, digital or mobile device format is prohibited without the permission from the publisher Wolters Kluwer Health. Please contact lwwjournalpermissions@wolterskluwer.com for further information

Discussion

We demonstrated improvement in self-reported confidence in utilizing CRM techniques as well as in teamwork and communication skills following an observational learning model. The training provided included preparatory, concurrent, and retrospective tasks to give individuals opportunities to engage during every aspect of the simulation, even if they were not active participants (Rosen et al., 2010). Preparatory tasks included didactic teaching, role playing and interactive exercises demonstrating CRM techniques as well as completion of the baseline *Self-Efficacy in Teamwork Competencies Scale*. During the simulation, observers completed the *Clinical Teamwork Scale* observational tool. Retrospective tasks included completion of the follow-up *Self-Efficacy in Teamwork Competencies Scale* and the instructor-facilitated debriefing of participants and observers which provided opportunities to come to a common understanding of what occurred with input from the perspectives of both the participants and the observers.

Time constraints of a one day workshop prevented each of the participants from having an experiential simulation experience. Since these constraints in graduate medical education are common, it is

important to evaluate more efficient and cost-effective methods of training such as observational learning which allows for many more participants to be involved in the training sessions (Rosen et al., 2010).

Limitations. Our study had several limitations. The study occurred on one day at a single medical center which limits its generalizability. The use of the *Clinical Teamwork Scale* by audience member observers as opposed to standardized scorers for each scenario may have introduced variability and bias into the study (Sevdalis et al., 2009). However, we felt that it was important for the observers to engage in the reflective process through scoring the teamwork and communication of their colleagues during the scenario in addition to participating in the post-simulation debriefing (Plack & Greenberg, 2005). Although some studies have shown retention of procedural skills over time (Barsuk, Cohen, McGaghie, & Wayne, 2010; Wayne et al., 2006b), it is unclear if the improvement in both self-efficacy and observed teamwork skills will be sustained (Kuduvalli et al., 2009). Finally, the follow-up survey response and the second scenario observation rates were less than baseline rates.

Conclusion

Although further research is needed, it appears that observational learning which involves preparatory, concurrent, and retrospective tasks as discussed by Rosen et al. (2010) with facilitator-led debriefings may be a suitable alternative method for teaching CRM techniques to large numbers of residents in short periods of time.

Disclaimer: The views expressed this article are those of the authors and do not necessarily represent the views of the VA or U.S. Government.

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