



Fire in the Operating Room as a Model for Comparing Simulation and Lecture Training



Jonathan W. Fraser BA, Gregory Motuk BSN, Natalia Martinez-Acero MD, Gretchen Kolb MS, Josef Luba BS Noel N Williams MD, Kristoffel Dumon MD, Andrew S. Resnick MD

Penn Medicine Clinical Simulation Center, Department of Surgery and Department of Perioperative Services, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania

BACKGROUND

- It is difficult to compare simulation training with other learning methods and it is unproven that simulations are worth the large time and financial investment. Simulation training has become increasingly integrated into graduate medical education and is required in many specialties. Thus it is necessary to ensure that the investment of time and financial resources generates improved learning over traditional didactic lectures.
- OR emergencies are infrequent, yet high risk events, that require communication and team work. Consequently, beginning in July 2010, the Penn Medicine Clinical Simulation Center (PMSCC), in cooperation with the Hospital of the University of Pennsylvania (HUP), Departments of Surgery and Perioperative Services, and Safety Management, developed a series of surgical simulations aimed at improving preparedness and patient outcomes in the event of uncommon OR emergencies.
- Approximately 450 PeriOp nurse, staff and residents from OB/GYN, Anesthesia, Surgery, ENT, OMFS, and Orthopedics have participated in an OR Fire scenario with improvements observed in timeliness of response as well as self-reported confidence and role recognition in the event of an OR fire. Simulation training consists of a naive simulation followed by a debriefing session with all of the participants.
- To demonstrate that the effectiveness of this training is due to the simulation and not the didactic component alone; 46 surgical interns undergoing OR fire training were divided into simulation-based and traditional lecture-based trainings.

MATERIALS and METHODS

- Participants were split into two groups, each containing four teams of residents for a one-hour training on OR Fire Safety. Both groups completed a ten question written test to assess basic OR fire safety knowledge and confidence prior to training.
- Learners either received training via participation in a simulated OR fire with a post-session debriefing ("simulation group", n=22) or a PowerPoint lecture ("lecture group", n=24). The same content was provided to both groups.
- Both the lecture and simulation groups participated in a post training OR fire simulation. Participants in the simulation were assigned team roles (scrub nurse, surgeon, anesthesiologist, etc.) and entered an OR equipped with a SimMan 3G.
- Following a time out, electrocautery cued a confederate to activate a smoke machine hidden beneath the OR table. Time from the appearance of smoke (t=0) to performance of four key response steps (call fire, call for help, remove drapes, shut off gases) was measured to gauge the efficiency of the team's reaction.
- Finally both groups were given a self assessment (5 point Likert-type scale) of their knowledge of response steps, risk factors and team roles in the event of an OR fire and completed the same ten question test administered at the start of the session to measure improvements.

Results: Time To Perform Mitigation Step

Mitigation Step	Lecture Training		Simulation Pre Training		Simulation Post Training		Pre vs Post Simulation Training		Post Simulation vs Lecture	
	Median Duration (sec)	% Groups Completing Task	Median Duration (sec)	% Groups Completing Task	Median Duration (sec)	% Groups Completing Task	Time (sec)	p-Value	Time (sec)	p-Value
Called Fire	7.50	100%	3.00	100%	4.50	100%	1.50	0.2635	-3.00	0.0770
Called for Help	23.50	100%	53.33	75%	5.00	100%	-48.33	0.0260	-18.50	0.0039
Remove Drapes	32.75	100%	26.00	25%	8.50	100%	-17.50	N/A*	-24.25	0.0512
Gas is Turned Off	40.25	100%	32.33	75%	11.00	100%	-21.33	0.0420	-29.25	0.0305

TABLE 1 – Median time interval to perform mitigation steps and percent of groups completing the mitigation steps in a simulated OR fire. A Paired one tailed t-test was utilized to demonstrate statistical significance between pre and post simulation times, while an unpaired one tailed t-test was used to compare post simulation training with lecture training times.
*A p-value could not be found for removal of drapes before and after simulation training due to only one group attempting the task during their naive simulation session.

Participant Comprehension of Role in OR Fire Pre and Post Training

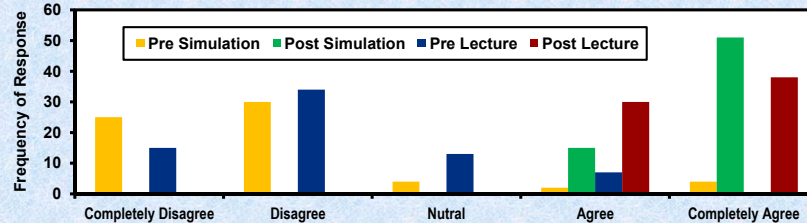


FIGURE 1 – Participants self-reported responses, answered on a 5 point Likert-type scale, of their role understanding pre and post training. Responses were gathered on a survey administered after the one hour training session. Displayed are the frequency of responses to the questions: 1) I understand my role in the event of an OR Fire. 2) I understand the response steps required in the event of an OR Fire. 3) I understand the risk factors for an OR Fire and how to prevent them.

SUMMARY of RESULTS

- Incoming surgical interns (n=46) participated in OR Fire training during a surgical skills boot camp at the Penn Medicine Clinical Simulation Center. This included all interns in the Department of Surgery and surgical subspecialties.
- The "simulation group" improved in length of time to perform necessary steps in the fire protocol (p < 0.05) from their initial to final simulation, similar to previous data. In their post session OR fire simulation, the "lecture group", performed all steps but at a significantly slower rate than the "simulation group" (p < 0.05). (TABLE 1)
- Self-reported understanding of response steps, risk factors and role in the event of an OR fire increased significantly for both groups following training (FIGURE 2B), however the "simulation group" improved significantly more (p < 0.05) (FIGURE 2C).
- Prior to training, interns scored similarly on a pre-training test (61% vs. 62% correct responses with no significance determined by a one tailed unpaired t-test, FIGURE 3). Following training, interns in the "simulation group" scored significantly higher than those in the "lecture group" on the same test (93% vs. 82% correct responses, p < 0.05).

Pre Simulation and Lecture Training Survey Responses

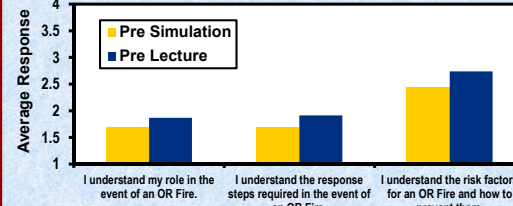


FIGURE 2A – Responses to a post training survey containing questions answered on a 5 point Likert type scale. FIGURE 2A displays self reported understanding before the interns received their respective training. An unpaired one tailed t-test demonstrated no significance (p>.05) between the two groups. Thus these groups are considered homogeneous before any training.

Self Assessment of Simulation Training

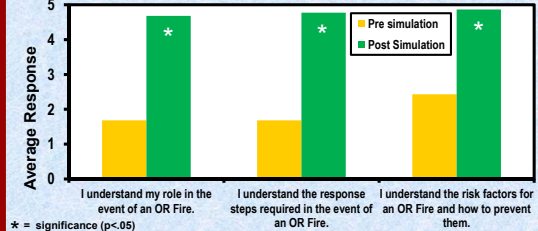


FIGURE 2B – Responses to a post training survey containing questions answered on a 5 point Likert type scale. FIGURE 2B displays self reported understanding before and after the interns received simulation training. Intern confidence measured with a 5 point Likert type scale. Significance measured via a paired one tailed t-test.
* = significance (p<.05)

Post Simulation and Lecture Training Survey Responses

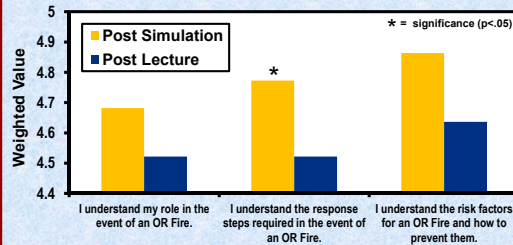


FIGURE 2C – Responses to a post training survey containing questions answered on a 5 point Likert type scale. FIGURE 2C displays self reported understanding after the interns received their respective lecture of simulation trainings. Significance determined via an unpaired one tailed t-test.
* = significance (p<.05)

Quiz Scores

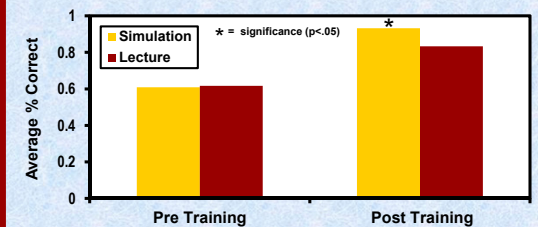


FIGURE 3 – Quiz scores collected pre and post training. Before training there is no significance found between the two groups quiz scores with a one tailed unpaired t-test indicating a homogenous testing group. Post training however, interns receiving simulation training scored significantly higher than those with lecture based training.
* = significance (p<.05)

CONCLUSION

- This study demonstrates that OR fire safety training via a simulation followed by structured post-session debriefing, improves: 1) Response times in a simulated OR fire 2) Scores on tests relating to OR fires and 3) Self-perceived educational benefit, than a traditional lecture approach. As shown in previous studies on simulation training (Acero et.al.1)
- This study also suggests simulation training is a more effective training method than traditional didactic training.
- Further studies are required to assess the retention of each of the measured improvements in this study.

1. Acero NM, Motuk G, Luba J, Murphy M, McKelvey S, Kolb G, Dumon KR, Resnick AS. (2012 Aug 16). Managing a surgical exsanguination emergency in the operating room through simulation: an interdisciplinary approach. Journal of Surgical Education 69(6):759-65. <http://www.ncbi.nlm.nih.gov/pubmed/23111043>