



# Managing Surgical Emergencies through Simulation Education: Patient Exsanguination



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## BACKGROUND

- OR emergencies such as fire, electrical outage, anaphylaxis, and exsanguination are infrequent, yet high risk events that require communication and team work. Consequently, beginning in July 2010, the Penn Medicine Clinical Simulation Center (PMSCS), 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.
- This is a weekly, one-hour, multi-departmental training on crisis management procedures in the event of a patient exsanguination. Each session includes up to twenty-four participants from PeriOp Nursing, Support Staff and Perfusion, as well as physicians from Anesthesia, Surgery, Otorhinolaryngology, Gynecology, Oral surgery, and Orthopedics.

## MATERIALS and METHODS

- Since July 2010 approximately 423 staff members have been trained on one or both scenarios, OR Fire with Power Outage and Anaphylaxis with Cardiac Arrest. Beginning in June, 2011, PMSCS has trained 32 physicians/residents and OR staff on a patient exsanguination scenario.
- Up to twenty-four participants arrive at the Center for training. They are unaware of the topic of the current simulation session. They are told their patient is a 32 year old pregnant female with multiple trauma, divided into groups of six team members plus a trained moderator and directed into a simulated operating room equipped with SimMan3G. A "trauma bay nurse" (confederate) provides a standard patient hand-off report, notes a deteriorating patient and draws staff attention to occult bleeding partially concealed by a cervical collar. Participant responses to the event are recorded on PMSCSs integrated AV system.
- After the initial "cold" session, staff attend a didactic which includes specific roles and mitigation steps for each in the event of an OR exsanguination. They debrief on the recorded initial sessions with the goal of improving teamwork and communication. The OR scenario is repeated "warm" with additional time for debriefing and session evaluation.
- At the conclusion of the session, participants evaluate the session, including their "pre" and "post" session understanding of their role. PMSCS staff review the recorded sessions and annotate if/when each of the steps listed above is performed and the time required to do so is compared in the pre- and post didactic training. The participants' pre- and post- session understanding is analyzed.

## Time To Perform Mitigation Step

Mitigation Step	Median Duration COLD (sec)	Median Duration Warm (sec)	Median Change in Time to Perform Step (sec)	Median Percentage Reduction in Time to Perform Step	P
Raise Room Temp to 80 F	107	40	-67.0	62.6%	<0.05
Activate Exsanguination Protocol	124	39	-82.0	68.2%	<0.04
Reposition Patient (LAD)	250	68	-156.0	72.8%	<0.004
2nd Official Person Check Blood	258	97	-124.0	62.4%	<0.03
Announce "Mom is the 1st Patient"	337.0	53.0	-297.0	84.3%	NS

TABLE 1 - Median time interval to perform five mitigation steps in a simulated OR exsanguination. "COLD" times occur during initial scenarios. "WARM" times occur during the repeated scenario following a didactic lecture. Paired t-test was utilized to demonstrate statistical significance pre- and post- didactic.

## Number of Mitigation Steps Performed

Number of Steps Performed	"COLD" Scenario	"WARM" Scenario
0 out of 5	0%	0%
1 out of 5	17%	0%
2 out of 5	0%	0%
3 out of 5	50%	17%
4 out of 5	17%	17%
5 out of 5	17%	67%

TABLE 2 - Out of 5 steps required in the exsanguination scenario, percentage performed in the "Cold" versus "Warm" scenario.

## RESULTS

### Self-reported Knowledge Pre & Post Training

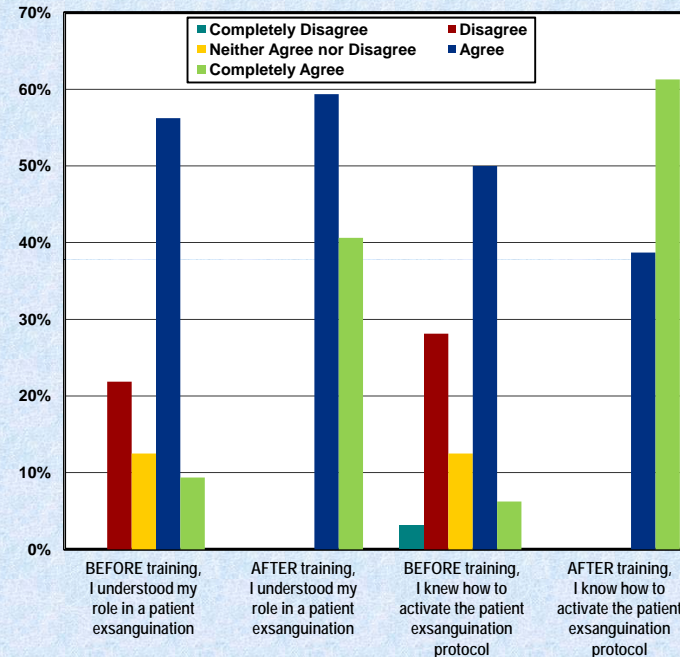


TABLE 3 - Participants self-reported understanding of their role and how to activate the patient exsanguination protocol prior to and following training.

### Summary of Results

- Participants pre- and post-training self-reported understanding of their role in an exsanguination and how to activate the exsanguination protocol increased from 66% to 100% and 56% to 100% respectively and 100% felt the training was relevant to their practice.
- Prior to and following the training participants were asked the proper 1) patient positioning and hand placement for CPR compressions in a pregnant patient and 2) room temperature during a patient exsanguination. The percentage of correct responses increased from 67% to 94% and 78% to 97% post-session for each question.
- Following the didactic, teams performed a greater median number of mitigation steps (3.0 vs. 5.0) than during the "cold" scenario and did so more quickly ( $P < .05$ ). In addition, 83% of participants performed at least 4 steps after the training, compared to 34% prior to the training.

## CONCLUSION

- Preliminary data demonstrates that team training is an effective means to train staff on how to respond in the event of an OR emergency.
- Additional studies with this group are required to examine the retention time of lessons learned in team training.