

Simulation-based team training: Crisis Resource Management and the Use of Emergency Manuals in the OR

Instructor's Guide

Goals of Resource

The purpose of this training is to provide an introduction to teamwork skills in an operating room setting while specifically familiarizing OR team members with why, when and how to use emergency manuals. Both Crisis Resource Management (CRM) skills and appropriate use of cognitive aids support the ultimate goal of assisting trained clinicians in delivering effective and efficient care to patients during critical events.

Educational Objectives

After completion of the training, participants will be able to...

1. List 3 important CRM principles, each with an effective technique for implementing to improve teamwork
2. Identify the location(s) of the emergency manual in the OR
3. Identify 3 critical events for which the participant is able and willing to prompt team use of an emergency manual.

Introduction and Discussion

Crisis Resource Management (CRM) includes teamwork skills along with dynamic decision-making skills, with significant overlapping interaction between them. Combined with good training and judgment, CRM skills help healthcare providers deliver appropriate management to patients during critical events (1). Figure 1 shows the interacting key CRM skills visually, along with bulleted details for each.

One of these key CRM skills is “use of cognitive aids”. Simulation-based studies have shown that operating room teams deliver known best practices during critical events more effectively and efficiently when consulting accessible information on the management of specific critical events (2-4). Emergency manuals (EMs) are context-relevant sets of cognitive aids, such as crisis checklists, in this case tailored specifically to perioperative critical events, though conceptually applicable for all fields of healthcare (5).

Successful implementation of emergency manuals (EMs) is dependent on not only the existence of a well-developed resource, but also on familiarity with format, a shared understanding of EM utility, easy clinical access, and integration into the institutional culture. As a result, training on why, when, and how to use EMs is

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essential to the effective adoption and implementation of EMs in any OR quality improvement initiative. Evidence from other industries and from the impact of culture of safety on healthcare outcomes suggests that all individuals on the team who participate in patient care should be involved in training and empowered to suggest EM use when appropriate (6). Simulation-based training provides an effective, immersive, method of team-based training in this context, combining EM use with other CRM skills.

The overall goal of this training program is to introduce all OR staff to why, how, and when to use EMs and to familiarize them with a newly introduced Emergency Manual as a resource for both education and clinical care when appropriate. Effective EM use supplements but does not replace: prior knowledge, good judgment, immediate actions, appropriate decision-making and teamwork. Presenting in situ simulations of relevant OR critical events allows OR staff an opportunity to utilize the EM in their native work setting with realistic conditions, while practicing complementary teamwork skills.

List of all resources included:

- A. Instructor's Guide (this document)
- B. Supplies List
- C. Set up List
- D. Facilitator's Notes
- E. Simulation Scenario Stems
 - a. Case 1: PEA Cardiac Arrest
 - b. Case 2: Malignant Hyperthermia
 - c. Case 3: Refractory Hypotension
- F. CRM Poster and/or Handout (Circle Diagram)
- G. Poster describing Use of Emergency Manual in the Operating Room
- H. Assessment of Emergency Manual Implementation (Evaluation Form)

The latest version of the Stanford Emergency Manual can be downloaded for free at <http://emergencymanual.stanford.edu>. It was developed by the Stanford Anesthesia Cognitive Aid Group (SACAG).
http://emergencymanual.stanford.edu/about_us.html

The global Emergency Manual Implementation Collaborative (EMIC) provides resources for why, when, and how to implement and use emergency manuals effectively. See <http://www.emergencymanuals.org>.

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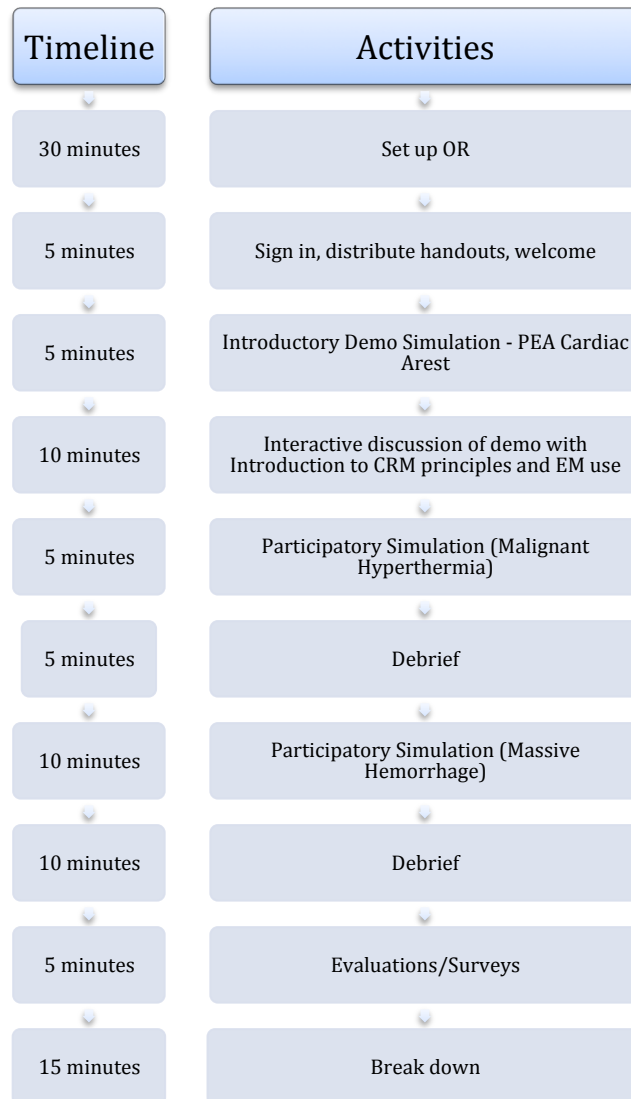
Overview and How to use each resource:

The training session is designed to be conducted in 50 minutes (plus 5 minutes for evaluations) with approximately 30 minutes of setup time and 15 minutes of breakdown time. Ideally, the session should take place *in situ* in an operating room with all materials and equipment available as they would be for a surgical case. If an operating room is not available, a geographically close simulation room, or even a conference room, can be substituted if it can be set up with realistic operating room equipment. Note that either alternative will decrease the similarity to participants' actual OR environment, may increase participant 'transport' time, and if using a conference room will increase the setup time.

The session is composed of simulation-based exercises, a didactic component, and discussion/debriefings.

Please use the **Supplies List** provided to prepare needed session materials prior to the training. Also included is a **Setup List** to aid in staging the OR for the didactic and simulation-based components of the training session.

This 55-minute training timeline, plus set-up and take-down provides an overview:



We found this brief training timeline to be successful in our OR learning environment; it was tested and worked repeatedly with excellent feedback from participants. See key challenges section below for more details.

At the beginning of the training, the facilitator introduces participants to the purpose of training and agenda. This pre-brief also includes the ground rules for simulation, including the need for a safe learning environment that respects confidentiality, and a focus on formative learning rather than evaluation. It is vital to share the importance of participant engagement and tell them what to expect from simulation -- the scenarios are supposed to feel *real enough* to engage in their usual roles and team communication. We ask participants to actively *suspend disbelief*, acknowledging that if they look for the non-real aspects, such as the plastic mannequin, they will find them. Similarly, an overview of what the simulated environment can and cannot do helps set participants' expectations, e.g. how to

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make phone calls (we asked them to mime a phone with their hand and then say exactly what they would actually say).

An introductory demo simulation helps to engage participants right away, even before talking about the concepts. They appreciated witnessing some relevant elements of team communication in a crisis, the use of an emergency manual, and demonstration of a “reader role.” In the format of ‘debriefing’ this demonstration, the facilitator provides an introduction to Crisis Resource Management (CRM) and the framework for use of emergency manuals prior to the participatory simulations. Please see the **Facilitator’s Notes** for a detailed description of all session elements.

To assess the impact of the training on learner attitudes and knowledge, we developed a standardized evaluation form. The questions were developed in consultation with the Stanford Center for Medical Education Research and Innovation (SCeMERI). The form is designed to be distributed to all participants immediately following the training session. The survey incorporates a retrospective post-intervention Likert scale-based self-assessment to evaluate awareness of, familiarity with, and willingness to use the Emergency Manual during clinical situations. This retrospective pre-post method has been previously described and shown to be effective for program evaluation in the context of faculty development (7). Participants should be instructed to answer as they would have before (“retrospective pre”) and after (post) the training using the same metric. For program evaluation, participants are also asked to rank the course in terms of meeting stated objectives, the faculty’s mastery of the subject, the appropriateness of the use of simulation, the applicability of the topic, and the learning environment on a scale of 1 (low) to 5 (high). The Stanford University Institutional Review Board (IRB) determined this project to be exempt from review due to quality improvement and all data were de-identified.

Conceptual Background

This training was developed for operating room staff and teams in order to introduce participants to CRM principles and the use of an emergency manual in a perioperative environment. Participants are ideally from multiple professions, including attending physicians, nurses, scrub technicians, anesthesia technicians, residents, and medical students. Even if groups need to be trained separately, for scheduling reasons, it is worthwhile to expose all team members to these concepts and to use faculty facilitators to act in the complementary roles.

Practical Implementation Advice

See the Facilitator’s Notes for detailed flow of training session. Below are some practical tips we learned from our institution’s training sessions.

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Suggested Personnel:

We found that at least two trained personnel are needed for regular successful implementation of this training, and up to two additional personnel as actors to play roles of other team members. One person, the “Facilitator,” leads the training and is primarily responsible for: introducing the training in the beginning, describing each scenario (as needed), and facilitating the debrief session. One person, “Assistant,” is primarily responsible for setting up and breakdown the materials, ensuring that all the required materials are in working order, and working the SimMan vitals during the scenarios. The following people, playing “Confederate” (actor) roles in the simulation, elevate the learning experience. In the scenarios, we have outlined a minimum of two “Confederates” (anesthesiologist, surgeon), with the first demonstration scenario ideally also including a circulating nurse and a resource nurse, the latter two of which may be filled by training participants. In our experience, having a surgical or other medical/nursing representative helped lend credibility to the scenario and the subsequent debrief, especially as it related to comparing to real life circumstances.

Setup and Teardown Time:

Because these scenarios are run in a functioning operating room, it is advisable to find a short window of time early in the day before real OR cases commence, during protected participant time and OR space such as Grand Rounds or in-service trainings. To minimize the impact on day-to-day operations of the OR, we worked to make our setup and teardown as quick as possible.

To do so, we had all our equipment on rolling carts, ready to pull into the room and then remove immediately after the training. When we came into a room, we would do the following:

- Carefully set aside any clinical equipment and supplies, label them as such, and replace them with our simulated tools. Make sure that all simulated tools and supplies (including simulated medication syringes) are clearly labeled as “FOR SIM ONLY” to avoid mixing with real OR supplies.
- Replace the suction canister and tubing with our supplies so that the fake blood would drain into our own canisters.
 - Because we used very simple fake blood (water with red food coloring) we were able to collect and reuse the same blood for all of the training scenarios without it spoiling.
- At the end of the training, return all clinical surgical and anesthesia equipment to their original setup and remove all simulated supplies, approximately 15 minutes.

Evolving Setup and Technology

In the early trainings, we used a full human patient simulator, e.g. Laerdal SimMan 3G. Due to accessibility, setup/teardown time, and cost issues, we soon scaled down to the following:

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- We replaced the SimMan 3G with a simple CPR mannequin and used pillows to fill out the body-form under the drapes. Given the chosen scenarios, participants did not need to rely much on either physical exam or procedures, so only immersive vital signs, contextual props, and actors were used to create “realistic-enough” scenarios.
- We hung a tablet (in this case, an iPad) directly in front of the real patient monitor and used that to display the simulated vitals generated by the SimMan software. The specific vitals for each case (starting vitals and trending vitals) are provided in **Resource E. Simulation Scenario Stems**.
- For easy vital signs options, of which we used a mix: Laerdal SimMan software for patient monitor is free, though only for PC:
<http://www.laerdal.com/us/ProductDownloads.aspx?productId=6>. There are many Apps for easy portable vital display, including waveforms as well as audible and realistic pulse oximetry tones. For one good example, see SimMon website: <http://castleandersen.dk/apps/simmon/> or search AppStore for “SimMon”
 We have no financial relationship, but we have given feedback to improve this particular app over the years. In its current iteration, we find SimMon to be very user friendly (though limited in capabilities compared to more comprehensive products) and use it frequently ourselves to enhance teaching in many in situ or “mobile” contexts outside of simulation centers.”

A primary lesson learned was that the vital-signs monitor (including the audible pulse oximetry) and a realistic OR setup were key components to providing sufficient levels of realism. In turn, participant buy-in from OR staff allowed immersive practice for important aspects of patient management during critical events. In these scenarios, the mannequin’s capability for procedural intervention was not being used and it was primarily used as a draped body-form, so did not require a sophisticated and expensive mannequin. The lower cost and simpler setup was very successful for meeting the learning objectives. This is entirely in keeping with the concept that simulation is a technique, not one specific technology, and fit well within the 11 dimensions to consider when planning a simulation (8).

Interactive and rich focused debriefings emerged, focusing on effective emergency manual triggers and use as well as teamwork and dynamic decision-making skills. There was a high level of participant engagement despite the relatively low-tech simulation. Given relatively large groups, we asked observers to take notes (See Resource Document F for CRM notes page) during scenarios regarding effective or ineffective use of emergency manuals and CRM principles. Note-taking increased attention during simulations and successfully encouraged observers to take a more interactive role during debriefing.

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Training Modifications:

We suggest the training methods described above, however, the training itself can be adapted for institution-specific use in the following ways or more, depending on institutional resources and experience:

- The materials presented here do not require a full simulation center to be effective at teaching effective EM use and CRM skills, as described previously. Although this training recommends using experienced facilitators and simulation personnel, the learning objectives can still be met with more basic set-up. See the global Emergency Manual Implementation Collaborative website www.emergencymanuals.org and <http://emergencymanual.stanford.edu> for further resources, including implementation tips, references, and trigger videos for use during trainings. We suggest partnering with key personnel of the target learning group, such as nursing educators if training nurses, and present the training materials together.
- If equipment or timing are more limited, the individual scenarios themselves (without the equipment) can also be role played at noon conferences or team meetings, using nametags for roles, and verbal scenarios, to show effective use and gain familiarity with the EM. In this circumstance, we recommend that all participants have an opportunity to flip through and review the EM each time the scenarios are presented. An overview of the EM structure and some sort of ‘treasure hunt’ to find detailed information can easily be presented.
- Our average participant size per training was 12 total including nurses and other OR staff members. While we expect this to vary across sites, we encourage institutions to consider limiting the number of participants per training to encourage participation opportunities. This can easily be scaled up or down (e.g. break up 36 people into 3 groups of 12 with a small group facilitator and go through each scenario). Our goal in initial pilot program was to train as many participants as possible to expose a large number of OR staff to the EM as a resource. Another “train the trainer” model is to train key nursing and OR staff leaders initially, and have them share the information and key components of the training at staff meetings, in-services, or other educational settings.

Success and Limitations

We successfully implemented the simulation training curriculum presented here in our institution’s operating rooms. Trainings were performed in parallel with the placement of two physical copies of the Stanford Emergency Manual in each OR as well as providing electronic access to all staff. Between December 2012 and April 2013, we ran 9 single-session training modules for inter-professional OR staff. In total, 126 staff participated in the training curriculum, including 64 nurses (51%), 30 surgical technicians (24%), 15 operating room assistants (12%), 12 anesthesia technicians (9%), and 5 staff members from other operating room roles (4%). Following the training sessions, familiarity with the existence and format of the

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Emergency Manual increased significantly ($p < 0.001$). Participants reported a greater willingness to use the Emergency Manual for pre-crisis educational review and as a resource for debriefing ($p < 0.001$). Additionally, participants reported a significant increase in willingness to suggest the Emergency Manual for use during rare, refractory, and complex events, including willingness to act as a “reader” ($p < 0.001$). Participant satisfaction with the sessions was high, with many qualitative responses expressing desire for more trainings of this type. Additional information on curricular outcomes can be found in Goldhaber-Fiebert 2015, in press (9).

The key challenges of utilizing this resource are institutional buy-in, followed by logistics. Of note:

- Emergency manual implementation requires initial interprofessional leadership buy-in and input. From there, plans for accessibility and familiarity can proceed. Of note, vital elements will likely interact. E.g. At first, EMs were placed in our ORs near anesthesia area, then during early trainings nurses requested their own copies to further facilitate familiarity and use. The training described in this MedEdPORTAL submission was pivotal in positively nudging institutional culture and staff awareness. We noticed significant increases in familiarity with the EM among nurses who had yet to receive training, suggesting that accessibility and word-of-mouth from trained colleagues enhanced their awareness of the resource. Leadership, in turn, was impacted to continue implementation efforts by the positive feedback from staff.
- Scheduling of OR time may prove difficult and is best accomplished with institutional buy-in and collaboration with all operating room and hospital quality improvement initiative stakeholders.
- Inter-professional learner time is often scarce and difficult to coordinate. We were able to partially address this at our institution by using protected OR staff time that was already devoted to education. We are working towards coordinating full team trainings of all relevant professions together. In addition, parallel educational efforts on the same concepts for each single or mixed-discipline group support a common language and increase cultural acceptability of using these skills during patient management. For example, at our institution we have a long history of protected simulation time for anesthesia residents, including intensive exposure to CRM principles and emergency manual use. Growing educational efforts for anesthesia attending physicians, surgeons, medical students, etc. use simulation and other techniques are synergistic with these OR staff trainings.
- The timeline is extremely compact, as mentioned above, in order to utilize existing protected learner time. Many simulation-based courses are hours long with more time for longer scenarios and in-depth debriefings. The first author regularly teaches such all-day courses, as well as training simulation instructors. Given the challenge and opportunity of a short, less than 1 hour educational time-slot for OR staff and OR availability, it was well worth adapting course structure and techniques in order to immersively expose OR staff to techniques for both teamwork and emergency manual use during critical events. While it is

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well-tested in this short format, the same material could easily expand into a longer time-slot, e.g during a nursing in-service day, and we would recommend using any additional time to expand debriefings and potentially add scenarios.

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