



# Crisis Resource Management Among Strangers: Principles of Organizing a Multidisciplinary Group for Crisis Resource Management

W. Bosseau Murray, MD,  
Patrick A. Foster, MB. ChB.

Simulation Development and Cognitive Science Laboratory, Departments of Anesthesia, Nursing and Surgery, Pennsylvania State University College of Medicine, 500 University Avenue, Hershey, PA17033, USA

*Patient safety depends on the skills, vigilance, and judgment of trained individuals working as members of a clinical team that includes anesthesiologists, surgeons, nurses, and technicians. Now, as never before, safe outcome depends both on better knowledge and better management. This requires organization of caregivers, who may be strangers from diverse disciplines, into teams.*

*One can drill an individual to work safely alone. One can rehearse a series of scenarios with small groups (who regularly work together) to improve performance. But what does one do with an unrehearsed group, called together in an emergency from several different disciplines, usually including Anesthesia. These people may not know each other, their roles, their special skills, and may even be hazy about each other's goals. Rapid organization of such an ad hoc team becomes a critical priority where patient safety is at stake.*

*The way by which such an ad hoc team from several disciplines can rapidly be helped to function effectively together is by teaching all the "strangers" the principles of Crisis Resource Management. These principles are not as well-presented in a written text or lecture format, as one cannot introduce the sense of urgency that emotionally charges and changes the impact. We believe the best teacher is experience gained in a realistic simulated environment using a model driven, full human simulator. This simulated environment is safe for both patient and trainee. © 2001 by Elsevier Science Inc.*

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Address correspondence to Dr. Murray at the Simulation Development and Cognitive Science Laboratory, Departments of Anesthesia, Nursing and Surgery, Pennsylvania State University College of Medicine, 500 University Avenue, Hershey, PA 17033, USA. E-mail: wbmurray@psu.edu

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## Introduction

Once upon a time, before the specialty emerged, anesthesia could be provided by almost anyone in an operating room. Anesthesia was performed by a single individual working in isolation. Today, the Anesthesiologist is part of a team and contributes to the full scope of perioperative patient management, involving a variety of trained personnel, using a complex range of equipment and drugs.

In the operating room, teams come together from Anesthesia, Surgery,

Nursing, and technical personnel (anesthesia, respiratory, monitoring and perfusion technicians), in a suitable environment, to provide efficient and safe patient care. Groups from each of these specialties forming the “surgical team” regularly work together, and develop, in good institutions, perhaps adequate management skills for common emergencies. The activity takes place in correctly planned and maintained critical care environments: the operating room (OR), emergency room (ER), and intensive care units (ICU).

Quite a different approach is needed when people from different disciplines are brought together by chance under unusual circumstances, to manage an unexpected crisis for which they may never have been prepared. The first basic principle here is to try to form this group of strangers into a functional group wherein all participants can contribute their particular skills. This team-forming does not usually succeed due to a lack of a unified framework of behaviors that all participants understand and follow.

For example, organization and team experience of the critical care groups are of little value when emergencies arise in unexpected places<sup>1</sup> outside the OR, ER, and ICU where no experienced groups are available. Those on the scene must cope. Such people may not know each other or what each can do. There exists neither delegation of tasks nor a defined set of responsibilities. Those brought together by accident must attempt to form some sort of team structure to be effective.<sup>2,3</sup> Although they may struggle to form a team, physicians and nurses don’t walk away from responsibility for acute care, they try their best. It is here that the principles<sup>4</sup> of Crisis Resource Management (CRM) (see *Table 1*) are important in organizing a group of people to form a coordinated team. Such people may never before have met, may have no idea what the skills of the others are, may even be in unfamiliar surroundings, and find themselves in an emotionally charged situation. The principles of CRM are:

- establishing leadership and support for the leader
- recognizing specific functions of a leader
- the importance of communication
- the need for continuous reassessment
- the use of all available resources
- avoidance of fixation of ideas and goals, and
- consideration of personality traits for optimal group performance.

### Imprinting CRM Principles

Before discussing these points in detail it is worthwhile considering how they should be imprinted, because they must be firmly imprinted if they are to be applied in the hopefully rare occasions when one must cope with an unexpected crisis without losing one’s cool.

Is an expensive full-scale human simulator necessary to fully imprint the CRM principles? A good speaker, in lecture format, may convey the concepts of CRM effec-

**Table 1.** The Key Concepts of Crisis Resource Management CRM

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<b>Roles</b>
<b>What is a leader?</b>
Steps back and manages an event
Sets clear goals
Organizes the team
Delegates responsibility
Distributes work appropriately
<b>What is a follower?</b>
Assumes assigned responsibility
Feeds back event management data
Provides task and cognitive support
“Owns” delegated problems
Roles can be exchanged
<b>Communication</b>
Address people directly—introduce yourself
Declare an emergency—urgency, not panic
Establish your communication paths
Use nonjudgmental comment
Close the loop—give feedback
<b>Global assessment</b>
Step back—physically and mentally
Step back to see the whole picture
Verbal review of patient and situation
• Avoids fixation errors
• Provides clarity of ideas
• Generates new ideas
<b>Support</b>
Asking for help when needed is a sign of maturity, not of weakness
Incremental help may be called
What sources of help available?
When and whom to call for help
Type of help—advice, hands-on, specialized
<b>Resources</b>
Prepare for anticipated needs—special carts, memo sheets
Understand the infrastructure
Know how support systems work
Internal and external (think “outside the box”)

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Adapted from Reference 1 and a CRM Instructor Course at the Boston Simulation Center under the leadership of D Raemer.

tively. Nevertheless these will likely need reinforcement at regular intervals, as with ACLS.<sup>8</sup> Some CRM concepts can be taught using less comprehensive simulators. For instance, a flat-screen-based computer program Anesthesia Simulator Consultant (ASC, Anesoft Corporation Anesthesia & Critical Care Software, Court Issaquah, WA)<sup>5</sup> can teach a resident to consider multiple possibilities and think of a wide range of differential diagnoses (think “outside the box”). However, it is typically used by a single individual to hone crisis management skills. Group dynamics are lacking. Another example of a simplified simulator is ACCESS.<sup>6</sup> Although simulators such as ACCESS can be used for training the management of simple crisis events, it is not model driven (*i.e.*, the operator sets the monitored parameters such as blood pressure, heart rate, rhythm, *etc.*) and therefore the system lacks the subtleties and complexities of the physiologic, model-driven, realistic full human simulators.<sup>4</sup>

With the high fidelity simulators, it is easier for participants to “suspend disbelief” and “buy into” the simulation scenario.<sup>7,8</sup> We believe that when, after small group discussion of the principles of crisis resource management, this same group is immediately exposed to simulation in a realistic environment with a high fidelity simulator<sup>1</sup> that is real enough to involve the participants personally and emotionally in a group interaction, stronger imprinting takes place. The simulation should be of sufficient complexity and duration (Table 2) such that the CRM teaching objectives (see Table 1) are demonstrated and documented. The performance of the participants is video recorded and replayed during a debriefing session that follows immediately. Video footage, in which real aircraft accidents are re-enacted in a flight simulator, is used to demonstrate nonadherence to CRM principles.<sup>4</sup> The participants readily participate in discussing the CRM principles and learn to apply the concepts, principles and terminology. After this introduction, individual members are then asked to comment on what they have seen and on their own performance in light of the principles already discussed. All comments by the session leader are supportive, nonjudgmental, and the video record is never replayed to the group’s peers.

Such personal involvement in a full-scale simulator, recreating an almost real-life situation, evokes physical (e.g., tachycardia) and emotional responses in the participants. It also brings the realities of the emergency situation home to participants better than any lecture could. This has been the universal comment of CRM trainees (anesthesia, surgery and internal medicine residents, as well as nurses) at our institution<sup>\*,2,3</sup> (see Table 3). Many go back into their niche in the medical community with almost a sense of mission to spread these “new” ideas, because their training in managing emergencies has never included anything like this. They should carry with them clear concepts on the principles below.

### Leadership

The first person arriving on the scene of an unexpected crisis must do everything: decide what’s wrong and what to do about it, find information about the patient, send for help (e.g., extra hands, drugs, equipment). As helpers converge the initiator becomes, *ipso facto*, the leader. The several tasks needed for case management can now be shared: cardiovascular and respiratory support, repeated checking of vital signs, calling for special tests, setting up intravenous infusions and monitoring lines, the controlled use of drugs. The group members become the sensors and effectors for the leader who is the central control. Now the leader stands back, physically and mentally, to avoid direct involvement in such tasks that will detract from an assessment of the overall picture.

\* Murray WB, Schneider AJL, Yodfat U, et al: ACLS megacode training and testing with the METI simulator. STA Annual Meeting, Tucson AZ, January, 1998.

Meanwhile each group member, *via* the initiator-leader, is informed of the circumstances, the physical findings, their interpretation, the chosen treatment plan. Group members must understand each other’s function; usually this is not necessary in a group that has worked together before, but when strangers come together it is essential. Group members must understand what their and the others’ tasks are, what each is doing, and what each is finding, how each can help the other.

Obviously, good communication is essential in fusing the newly met individuals into a group, promoted by good leadership. Regular feedback to the leader allows this person to stand back and view the situation overall, which would be impossible if distracted by involvement in specific tasks. A leader should encourage dialog by discussion with the group of his/her interpretation of the clinical findings and whether treatment should be modified.

One expects a response to a management plan. Regular repeated checking of physical signs is mandatory to confirm the desired response or to modify treatment if indicated. There are situations when the original diagnosis is wrong and management that is based on it leads into more trouble. Rechecking and re-synthesizing the physical signs means going back to the beginning to seek other possible interpretations using the combined knowledge of the group. The *idée fixe* can be dangerous. In a crisis it may be convenient and reassuring to adhere to a preconceived notion about the diagnosis. Not having to think about other causes leaves the team with one less problem to tackle in a situation that presents multiple competing and simultaneous demands. One can recognize three patterns as ideas solidify:

- This and only this can be the problem. (“I am never wrong!”)
- The problem must be anything but this.
- Everything is all right. The monitors are wrong. No need to recheck the whole story.

As the case evolves, new signs appear, and those missed initially become dominant. Always, even if all appears to be going right, one should regularly recheck the data leading to the diagnosis, with special emphasis on the contrary data that seemed not to support the initial diagnosis.

It may happen that from the group another person emerges as a possible leader. The guiding principle is simple. The person best capable of managing the crisis should be the leader, regardless of hierarchy, social status, or gender. Let the person best skilled for the job do it. Above all, do not jeopardize the patient by disputes within the group. When it becomes necessary to change the leadership, the leader may hand over, or the follower requiring full attention of the team may request control. For instance, when the predominant problem of respiratory resuscitation has been resolved (e.g., intubation completed), and urgent surgical management becomes the priority (e.g., to stop a newly discovered major bleeder), all team members must clearly be informed.

### Supporting the Leader

Group members need to work with each other as well as with the leader in a dedicated effort toward patient support. If allotted a task, do it; leave other problems to other people. Accept that the leader knows the overall picture. It could be that others appear to need help; those able to help should always inform the leader.

Should an allocated problem prove difficult, announce this to the leader, wherever possible with an alternative solution. Group members may see the problem facing them in a different light, so that ongoing discussion must continue; even the leader may be swayed by a different perspective about the problem in hand. But never should this discussion lead to open disagreement and confrontation; all comments should take the form of noncritical suggestions. Open disagreement is destructive of group cohesion, so that argument and recrimination must wait until the crisis is under control.

### Communication

This is the web that binds a group, spun by the leader. To make the silk strong and sticky here are some suggestions for any leader:

- From bystanders and others discover as much as possible about the victim, asking them to seek information about general history, details of current treatments or known allergies, and names of treating physicians.
- Introduce yourself to any participant who comes to help: who you are, who they are, the circumstances of the crisis, the physical signs, tentative diagnosis, present treatment goals.
- As each succeeding participant appears, repeat the same introduction so that everyone knows the others, and knows about the status of the patient.
- Clearly define the task allotted to each. Do this concisely and in "military style" requesting whoever is to do the task to repeat it to prevent misunderstanding.
- Talk to the group. Clarify what you are doing and ask them to do likewise. People carry out certain routines so often that these become almost habit, not to be commented on. For instance, team members placing tourniquets on the limbs (as per routine, and, without informing anyone) to obtain venous access may occlude blood flow to the pulse oximeter or cause false blood pressure readings. Under these circumstances, it is important for the others to know that the blood pressure, the heart rate, and any other monitored response may change.
- Encourage discussion of the treatment. Ask for ideas and advice. Use the total knowledge base of the assembled group.
- Calling for assistance: There may come a stage when it appears that management lies beyond the skills of the group. A call for help is a sign of good judgment and wisdom, not of stupidity or weakness. One should avoid the attitude of "we can manage this without *interference*."

Personal pride is less important than patient welfare and may be injured more if an avoidable disaster follows.

The call for help does not limit one to one's own department in a large hospital. "Thinking in a box" is to be avoided: take help from wherever it may come. If other resources are available, use them. Use your colleagues with special expertise. The intensity of the call for help should be tailored to the urgency of the situation:

1. Asking advice on the best way to handle a problem;
2. Request standby help should the present situation become out of hand;
3. An urgent call for help: "we're losing this battle, we need you now".

Communication is an essential requirement for those supporting a leader. Those who have special skills must inform the leader. If a task proves difficult or impossible, but there is an alternative solution, suggest this. The suggestion should be in the form of "owning the problem," not as a criticism of the leader. Instead of replying "you've given me something to do that is unreasonable/impossible," a reply such as "I'm not able to do this" or "I can't get readings out of this monitor" is preferable. The notion should be: You, the leader, gave me this job and it's my problem. I'm sorry I can't get it done, but can I suggest an alternative?

Personality traits also need consideration. They may influence interactions with the leader; they may aid or hinder the fusion of a group, and are often influenced by local culture and custom.

When talking, describe what you're doing, what your findings are, or your ideas for a different solution. Nothing is too trivial in an emergency provided it does not interfere. The rest of the time you will be listening.

Idle noise is an anathema to good communication. Unnecessary conversation and comments during a crisis should be avoided; radios should be silenced; the leader should reassert full control whenever team members start their own small group discussions; all information should come to, and from, the leader.

In Anesthesia, CRM has been accomplished as part of resident training<sup>8</sup> at some institutions. Small groups of residents are taken through routines for managing a variety of known problems, some not uncommon, such as respiratory or cardiac arrest. Where feasible the various disciplines likely to be involved in any problem should train together. For instance, nurses (ER, ICU, PACU), surgeons and anesthesiologists can be trained in CRM principles using the natural (usual) sequential arrival of personnel (nurse, primary service, anesthesiologist) at the scene of the crisis.<sup>5</sup>

Where not feasible due to scheduling or space problems, different models are needed. For instance, internal medicine personnel are trained in CRM principles in isolation. However, due to the generic nature of the training in CRM principles, they can readily recognize, fit into and function effectively when they encounter a leader exhibiting strong CRM leadership behavior (*Table 1*).

Given the Institute of Medicine (IOM) Report<sup>9</sup> on the numbers of deaths due to errors in the United States and

it's recommendation for simulation training, we believe that "error training" will likely be mandated within the next few years and simulator-based CRM will be one method of accomplishing this. The costs of such training, while high, pale in comparison to the human cost to society of these deaths (which are said to be equivalent to several fully loaded Jumbo jets crashing per month). Institutions with simulators can develop their own scenarios for training. Institutions without simulators can partner with those that have simulators.

We recommend that every division and department in a hospital train their personnel in CRM principles so that they may better handle unrehearsed emergencies with strangers and learn the art of quickly bonding into an effective team. This can best be handled by bringing together individuals from different specialties to take part, as a group, in managing simulated crises. In this very realistic environment they learn and practice the basics of CRM teamwork with sufficient imprinting that it stays with them over an extended period of time.

The strength of crisis resource management training is that although one doesn't know what material one may have to work with, one knows what must be made out of it. One can trust in having the skills to do it, with followers who have the skills to support the leader fully so that the team of strangers can function effectively.

## References

1. Good ML, Gravenstein JS: Anesthesia simulators and training devices. *Int Anesthesiol Clin* 1989;27:161-8.
2. Murray WB, Proctor LT, Henry J, et al: Crisis Resource Management (CRM) training using Medical Education Technologies Inc. (METI) simulator: the first year *J Clin Monit* 1999;15(3-4): 237-8.
3. Murray WB, Proctor LT, Henry J, et al: Increasing the "hot seats" for crisis resource management (CRM) training: planned sequential participant entry. *Anesthesia Education* 1999;17(2):6.
4. Gaba DM, Howard SK, Fish KJ: *Crisis Management in Anesthesiology*. New York: Churchill Livingstone Publishers, 1994.
5. Schwid, H.A, O'Donnell, D: The anesthesia simulator-recorder: a device to train and evaluate anesthesiologists' responses to critical incidents. *Anesthesiology* 1990;72:191-7.
6. Byrne AJ, Jones JG: Responses to simulated anaesthetic emergencies by anaesthetists with different durations of clinical experience. *Br J Anaesth* 1997;78:553-6.
7. Kurrek MM, Fish KJ: Anaesthesia crisis resource management training: an intimidating concept, a rewarding experience. *Can J Anaesth* 1996;43:430-4.
8. Schneider AJL, Murray WB, Mentzer SC, et al: "Helper"—A critical events prompter for unexpected emergencies. *J Clin Monit* 1995;11(6):358-64.
9. Kohn L, Corrigan J, Donaldson M (eds). *To Err is Human: Building a Safer Health System*. Washington: National Academy Press, 1999.

## Appendix 1: A Typical CRM Session

The participants (usually 2-3 nurses, a surgery resident, an anesthesia resident) are invited to the Anesthesia Library

(set up as a lecture room). Using an overhead, built-in LCD computer projector, the participants are introduced to the CRM program and the objectives are stated. The confidential nature of the training session is stressed and a confidentiality statement is signed. The participants are told that they are to act as locums and per diems in a new hospital. They are given a brief overview of the facility and invited to visit a ward in the new hospital to examine the equipment and meet a patient.

They proceed to the Simulation Lab, which is set up as an ICU room for a "null scenario" where nothing unexpected happens. They examine the "patient" (simulator) and are given an opportunity to palpate the pulses, listen to the heart and lungs, examine the crash cart and code equipment, etc. They are told that the patient is developing respiratory failure and needs to be intubated. This gives the participants an opportunity to see how the drugs are administered and how the simulator responds in real time to physiologic events. The intensivist (an actor/instructor) takes over the management of the patient and the group returns to the library (waiting area).

During the next 6 minutes, the simulation lab is changed to a very simple ward area outside the radiology suite. The ICU monitoring equipment is removed and only the crash cart remains. The nurses are requested to transport a patient from the radiology suite to a ward. (The other participants remain in the waiting area). On arrival in the newly set up simulation area, the patient initially is stable but soon deteriorates and develops respiratory failure. A radiology technician (actor/instructor) is frantically trying to talk to the patient, who recently was quite awake and responsive. A radio is blaring in the background. The frantic radiology tech becomes even more frantic and is not of much use as a source of information. A radiologist (actor/instructor) arrives, is calm but not of much use either. A director is behind the one-way-glass in the control room and is continuously in contact with the actors *via* wireless headsets. A technician controls the computer controlling the simulator.

When the nurses call for help, the primary service physician (surgery resident) is called. The actors temporarily leave the room to enable the interaction between the nurses and the new arrival (transfer of leadership from nurses to surgeon) to be demonstrated and evaluated. The tech and the radiologist have given several clues and pieces of information and the point is to demonstrate how many of these were actually "heard" by the nurses. The two actors return to the room and create further chaos. Now it is the turn of the surgeon to try to "control" the frantic tech and the interfering radiologist.

When the patient develops further problems and further desaturation, the anesthesia resident is called. Again the actors leave to document how much information (or not) is given to the new "leader." One of the problems is a nonfunctioning piece of equipment. It is instructive to see how many times all the participants try to fix the equipment and not one is looking after the patient. Finally the patient stabilizes and an intensivist takes over the case again.

The participants are then given a lecture on CRM

principles with many examples from real life of problems that occurred. A video, produced in a flight simulator, is viewed. The events are based on a real aircraft accident. The participants are invited to discuss the behaviors of the aircraft crew using the several principles of CRM they have just learned. The atmosphere is quite supportive and participants readily join the discussion. The participants then view their own video which is stopped at specific points and the participants do much of their own debriefing under guidance of the instructor. With their newly found CRM skills, they readily identify behaviors that can be changed next time. (Instructors are careful to avoid terms such as right or wrong; terms such as what will you do differently next time are encouraged.)

During the video debriefing, 3 distinct "hot seat" periods and 3 handover events are available for discussion and analysis - the nurses functioning on their own and acting as joint leaders, hand leadership over to the surgeon who becomes the leader, followed by handing over to the anesthesiologist who assumes leadership. Finally the anesthesiologist has to hand over to the intensivist. The participants are quite excited during the debriefing as they, for the first time, develop a framework to think about the chaos at most "Code Blues" and their previous inability to do anything about it.

Following the session, all participants are invited to complete a questionnaire which explores their perceptions of the training session. The comments are used to refine and adapt future sessions.

## **Appendix 2: Feedback (Anecdotal) Examples of Applications of CRM Principles**

### *Case 1: Patient with a Cardiac Arrest in the Recovery Room*

I had a patient who developed a cardiac arrest in the recovery room (PACU). I acted as the leader, stood back as I was taught, and did not get caught up in doing tasks that would take my attention away from seeing the big picture. I felt very comfortable managing the crisis, and could tell the physician what had happened up to the arrest, what my thoughts were and what the team had accomplished up to this point. Many of the recovery room staff thought this was the best managed cardiac arrest in their experience.

### *Case 2: Patient with a Cardiac Arrest in the General Ward*

I went to a patient in a ward room after a Code Blue call. There were 23 people in the very noisy and chaotic room. I asked, as CRM taught me: 'Who is in charge?' There was only silence. I said "I am in charge. You do this. You do this. You do that. You get out of the room." Quietness ensued and everyone had a task and managed it quickly and efficiently. For the first time, I felt confident that I was doing the right thing during a crisis.