

Resuscitation Team Organization for Emergency Departments: A Conceptual Review and Discussion

L.B. Mellick*¹ and B.D. Adams²

¹Department of Emergency Medicine, Medical College of Georgia, Augusta, Georgia 30912, USA

²Department of Clinical Investigation, William Beaumont Army Medical Center, 5005 North Piedras Street, El Paso, TX 79920, USA

Abstract: In this article we discuss code or resuscitation team organization. The goals of this article are to define the questions surrounding code team organization and structure, discuss how organization can make a difference, review resuscitation systems and processes, and discuss aspects of team structure and performance. Issues of team performance include teamwork, leadership, communication and safety.

INTRODUCTION

“And as it is Appointed unto Men Once to Die, but after this the Judgment:” Heb 9:27 KJV

Whether the resuscitations occur in academic hospitals with level 1 trauma centers, rural hospitals, or long term nursing facilities, code team organization beyond a rudimentary level is often lacking. While some organizations have formalized their team structure, training schedules or team protocols are less common.

Increasingly, both the medical literature and resuscitation training materials emphasize code team organization [1-6]. Even though some health care providers remain skeptical and question the value of teamwork [3, 7], the building evidence strongly supports code team organization as a worthwhile endeavor [8-14].

In the hospital setting resuscitative care is typically delivered by a variable number of individuals who almost always function within a team structure. The interventions of resuscitation are carried out by human agency and the quality of the resuscitation process is dependent on the agents delivering the care. Unfortunately, the agents delivering resuscitative care are vulnerable to error, fatigue, and distraction [15], and teamwork is a learned skill that does not occur naturally [16-20]. And, the quality and speed of care delivered during the resuscitation process can make a difference in patient outcome [12, 13, 21-25]. Examples include the decay of depth and rate of chest compressions over time that is reflected in patient morbidity and mortality [26-28], and the degradation in survival with delays in defibrillation of just seconds [22, 26-28].

This review necessarily focuses on resuscitation in the emergency department of the patient arriving *via* EMS. However, most aspects of team performance and communication described here are generalizable to both pre-hospital and to inpatient settings [7, 29].

*Address correspondence to this author at the Department of Emergency Medicine, Medical College of Georgia, 1120 15th Street, Augusta, Georgia 30912, USA; Tel: (706) 533-2931; Fax: (706) 364-2611; E-mail: lmellick@mcg.edu

MAKING A DIFFERENCE

Time and Outcomes

In resuscitation literature the data is unequivocal: faster delivery of life saving interventions improves survival. A well organized EMS system saves lives [30-32]. We also know that the best survival rates occur in casinos and airline flights, not jogging paths or hospital lobbies [33-36]. Beneficial evidence of a timely team resuscitation in cardiac arrest as well as other critical conditions including trauma, stroke and sepsis is also strong [11, 13, 29, 37-40]. So the system response seems to matter more than the actual location [41-44].

Team Focus and Errors

The systematic approach to a critically ill patient by a team competent group of nurses and physicians preserves a team's focus and prevents errors [45, 46]. Disagreements over procedures, confusion over team leadership, organizational chaos or demeaning comments represent poor team dynamics and can cause a team to lose focus. Team leaders often do not (or will not) follow basic protocols [47-49]. Medical errors tend to occur more frequently in stochastic environments or when team dynamics and communication are flawed [18, 50-53].

Patient Safety

The impact of code team organization on safety for both the patient and team members is an important consideration [27]. The research performed by the MedTeams project demonstrated improved patient safety in the emergency department setting [3]. Patient safety can be improved by specific organizational steps [18, 54-56]. The growing trend of dedicated in-hospital cardiac arrest teams has demonstrated benefit, especially when systems are designed to alert teams to pre-arrest warning signs [57, 58].

Stress Management

A code potentially induces healthcare provider stress and may independently degrade performance [52, 59, 60]. Job satisfaction and longevity are directly linked to levels of

work place stress [61-63]. With the code team, processes and procedures that are organized, disciplined and controlled are generally less stressful to the participants [60, 64-66]. The resuscitation team leader sets the tone for the team and prevents unnecessary stress levels [49].

Family Presence

In the context of increasing family presence, we have visitors and observers with highly emotional agendas and stakes. Despite depictions of chaotic resuscitations on television, the public's perceptions of cardiopulmonary resuscitations remain unrealistic [67, 68]. Family members deserve to see a highly synchronized and disciplined pit crew at work [69, 70], and we should strive for resuscitations that function with no evidence of team dysfunction.

RESUSCITATION PROCESSES

Burkle and Rice first described the team process perspective [71]. The team perspective of a medical or trauma resuscitation involves at least seven phases. Each phase encompasses temporally important priorities for the resuscitation team.

Anticipation Phase

During this phase the data provided to the hospital by the paramedics is received and analyzed. Subsequently, the team is gathered, leadership is established, duties are delegated, the equipment is prepared and checked and the team members position themselves in readiness for the arrival of the critically ill patients.

Entry Phase

This involves the exchange of vital signs obtained by the paramedics just prior to their arrival. Additionally, there is the orderly transfer or exchange of the patient to the emergency department stretcher. The hospital resuscitation team members obtain baseline assessments of the patients A-B-C's. The paramedics provide a concise history and new vital signs are obtained.

Resuscitation Phase

The team assesses the patients "A-B-Cs" (performs a primary survey) and carries out urgently indicated resuscitative interventions. Strong physician and nursing leadership are important during this phase. There should be one dominant voice and information is continuously provided to the team leadership. Vital signs are documented at least every five minutes and procedures and medication administration are accomplished. The secondary or anatomical survey is accomplished and when the patient's condition does not improve the physiologic survey is repeated. Effective communication between the team members and leadership is an important component of this phase.

Maintenance Phase

During this period of time the major assessment and resuscitative procedures have been accomplished. Continued stabilization of the patient is performed and intravenous lines and inserted catheters and tubes are stabilized. During this phase the team's "adrenaline rush" begins to subside as the most critical interventions have been accomplished. This is a vulnerable time period for the patient. A conscious effort to

maintain the team's attention during this phase is an important responsibility of the team leadership.

Family Notification Phase

This is not a single point in time. In fact, the notification process continues throughout the resuscitation process. The resuscitation team designates at least one member to be a liaison with the family. Frequent, honest status reports and information updates are important to family members and should be carried out with sensitivity [72-75]. This is accomplished whether or not the family is physically present in the resuscitation room.

Transfer Phase

This phase does not necessarily occur at the end of a resuscitation. The potential for delays in necessary emergent care can occur if the transfer process is not managed efficiently. Remembering to arrange for transport late into resuscitation may not be efficient management of the patient's medical or surgical problem.

Critique Phase

Every resuscitation scenario is different and encounters unique problems. The patient care delivered and the team's interdependent performance should be critiqued as soon as possible after resuscitation. This allows maximal educational benefit from the process and prevents repeated inefficiencies with future patients. To varying degrees all resuscitation teams sustain emotional traumas following resuscitations and the process can be cumulative [65, 76, 77]. Debriefing or defusing processes can also occur during the critique phase that allows team members to begin to manage personal grief reactions. This process has been formalized as the critical incident stress debrief (CISD) borrowed from the disaster medicine experience [65, 76-78].

JOB AIDS FOR CODE TEAMS

Industries requiring high precision commonly utilize "job aids". Job aids can be checklists containing specific task elements for which accuracy and oversight prevention are mandatory. A classic example of a job aid is the preflight checklist used by airline pilots. The most common example of a job aid already used widely in resuscitation settings is the "ABC" (Airway-Breathing-Circulation) mnemonic for establishing patient resuscitation priorities. Other potential resuscitation job aids would be a room preparation checklist (See Fig. 1) or a wallboard (See Fig. 2) describing team member positions around the bed. Job aids may organize task priorities, standardize activities, prevent inadvertent oversights, allow faster and more thorough completion of tasks and reduce cognitive load [79-81]. They prevent leadership distractions or task drift, ensure a consistent structure to the resuscitation process and decrease team stress. Job aids transfer resuscitation processes from deliberate cognitive processes to automatic reflexes [79, 82, 83].

There are other useful job aids besides checklists. Documents such as a contemporaneous trauma resuscitation record can increase the efficiency of documentation. Template order forms for critical diagnoses improve compliance with evidence based guidelines and patient outcomes [39, 84, 85]. Dry erase boards hung on the resuscitation room wall can assist with documentation of the prehospital history or

IDENTIFICATION OF TEAM MEMBER ROLES
<input type="checkbox"/> Documentation Nurse: Room preparation checklist, documentation, medication mixing, procedure trays, stays with patient. <input type="checkbox"/> Lead Nurse: Team preparation prior to arrival, delegates orders through RN from code team captain, traffic control, LEFT Nurse [Chest tube placement, peritoneal lavage, airway clearance], second to leave <input type="checkbox"/> Circulating Nurse: RIGHT nurse [Intravenous line, draws blood, medication administration, NG, Foley placement, urine dip], first to leave <input type="checkbox"/> Technician: Places patient on monitors, performs manual BP, foley placement, EKG, Prep for procedures
AIRWAY, BREATHING
<input type="checkbox"/> Appropriate sized ventilation bag on bed <input type="checkbox"/> Oxygen ready: humidified oxygen for pediatric patients <input type="checkbox"/> Suction on and ready <input type="checkbox"/> Appropriate size suction catheters available <input type="checkbox"/> Airway equipment checked and at bedside – estimate ETT size for children <input type="checkbox"/> Broselow tape on bed – pediatric patients <input type="checkbox"/> Rapid sequence intubation tray at bedside <input type="checkbox"/> End tidal CO ₂ assessment equipment at bedside <input type="checkbox"/> Pulse oximeter at bedside and ready
CIRCULATION
<input type="checkbox"/> Manual and automatic BP cuffs at bedside <input type="checkbox"/> CPR backboard – available as needed <input type="checkbox"/> Heat lamps – available as needed <input type="checkbox"/> Intravenous lines stripped [2] – one line on Level I warmer <input type="checkbox"/> CPR stepstool – available as needed <input type="checkbox"/> ACLS drugs – available as needed <input type="checkbox"/> Appropriate size infusion catheters – available as needed <input type="checkbox"/> Cardiac monitor on and event recording ready <input type="checkbox"/> Defibrillator on: appropriate size paddles [peds, adult, internal] – external pacer pads <input type="checkbox"/> Call for blood if needed [Give ETA of patient if available]
DISABILITY
<input type="checkbox"/> Otoscope bulb functional <input type="checkbox"/> Appropriate size soft restraints at bedside
EXPOSURE
<input type="checkbox"/> Trauma scissors – available as needed <input type="checkbox"/> Towels or warmed blankets to cover patient after secondary survey accomplished <input type="checkbox"/> Heat lamps – available as needed
MISCELLANEOUS
<input type="checkbox"/> Bedside hematocrit and glucose monitors <input type="checkbox"/> Appropriate size foley catheter – available as needed <input type="checkbox"/> Appropriate size NG tube – available as needed <input type="checkbox"/> Mayo stand at bedside <input type="checkbox"/> Additional personnel paged [as needed]
...THINK AHEAD...
<input type="checkbox"/> Are the appropriate invasive procedure supplies readily available??

Fig. (1). Room preparation checklist.

individuals responsible for team role assignments [81]. Posters containing reference information can be strategically placed on resuscitation room walls. Pediatric resuscitation drugs, the Glasgow Coma Scale, and ACLS algorithms are examples of information that are often posted. The roles, duties and locations of specific team members can also be displayed as a wall chart. Such a chart is especially useful in training center settings where team members regularly rotate.

Another important job aid is the Broselow[®]/Hinkle Pediatric Resuscitation System. The Broselow Tape is becoming a standard piece of equipment for most emergency departments. This tape allows the application of preset drug calculations and equipment sizes using an estimate of the child's weight based on the child's length. This system quickly and

accurately estimates a child's weight, calculates drug doses and guides equipment size selection [79, 86].

Well thought out systems for equipment organization and display are also valuable to code team organization. The room location for equipment storage can affect resuscitation team efficiency. Minimize impediment of the floor space around the patient (especially near the head) by maximizing the use of overhead storage, x-ray, and outlets. Display airway equipment in a semi-open format on an airway wall-board placed at the head of the resuscitation bed. Many other equipment display options are available. Equipment cupboards with glass doors or open equipment carts allow easy visibility and access of supplies. Ergonomic design of resuscitation equipment from drug storage to defibrillator pads will definitely impact overall team efficiency [20, 87, 88].

Concurrently, the lead nurse who under ideal circumstances is in continuous communication with the team captain should be located on the patient's left and across from the physician team leader. The location of other team members is dependent upon which procedures are being performed. The documentation nurse is typically stationed within eye contact and auditory proximity (which prevents having to request information) at a writing station or table. If a supply cart is located immediately behind and a drug cart nearby, the documentation nurse can simultaneously assist with equipment and medication distribution. A wallboard can effectively direct the team members to their room locations as well as prompt concerning the duties of their assigned role (See Fig. 2).

Compared to the academic medical center the rural emergency department will have different resources [48, 98, 99]. In smaller emergency departments the team captain is often responsible for the airway and the performance of other time and attention consuming procedures. In this setting the need for preplanning and team organization is even greater and it in no way diminishes the need for code team organization. Smaller hospitals can create emergency department response teams to augment personnel resources and allow team management of critically ill patients [12, 23, 90].

Increasingly, modern hospitals pre-designate specific wards or teams to help perform specific therapeutic and sometimes resuscitation functions. Examples include CPR team, Trauma Team, Chest pain units [CPU], cardiac care units (CCU) and more recently Rapid Response Teams [10, 37, 108]. Because many resuscitations occur after admission to the hospital, the team roles of CPU, CCU and RRT are essential to satisfactory patient outcomes. The general principles of emergency department teamwork and team organization should be applicable to these specific units as well.

Cultivate Team Climate and Resolve Conflicts Constructively

Effective resuscitation team performance can be visualized as an auto racing pit-crew. The effective resuscitation team shares with the auto racing pit-crew the characteristics of well defined leadership, clearly identified responsibilities, specific role delineations, an emphasis on efficiency and speed, expert accomplishment of individual roles, team performance and dynamics, adequate training and preparation, well delineated priorities and an appropriate number of team members. Team dynamics of a pit-crew also include performance as a unified, concerted and harmonious effort that is carefully choreographed for flawless timing.

A team's mission should not be distracted by internal competition and team energies should be directed to the common external goal. Unfortunately, the resuscitation setting is often the place where different specialty cultures interface. Anesthesiologists, surgeons and emergency physicians participating in the care of the same patient can experience barriers to team unity due to specialty rivalry, sense of entitlement, or differing style of communication [52, 89].

Resuscitations are potentially emotionally and intellectually demanding settings. Because of these performance demands, mistakes in team ambiance sometimes occur. Angry tantrums do little to improve patient care or increase team efficiency and effectiveness. The team leader is primarily

responsible for establishing a healthy team ambiance. On occasion, it is appropriate for a team leader to dismiss an inappropriate team member from the resuscitation suite.

Apply Problem Solving Strategies

Conduct Situational Planning

The team leader should involve the team in the planning process prior to the patient's arrival. A brief review of the expected resuscitation procedures, protocols and required resources should be accomplished. A room preparation checklist may also be used to insure that standard preparation steps have been accomplished (See Fig. 1).

Apply Decision Making Methods

Team members must insure that the team leader has all pertinent clinical information. At the same time the physician leader of the resuscitation must not hesitate to engage team members in decision making; asking for direction or suggestions when necessary.

Engage in Error Avoidance Actions

Communication techniques that promote error avoidance such as the "check back", the "call out", the "hand-off" and the "two challenge rule" are used. With the check-back system the receiver of a verbal order is required to repeat that order and receive verification before a drug is administered. The "call out" is a request for information input by the team leader. The "hand off" rule is turning over leadership responsibility whenever indicated such as when a procedure is performed by the team leader. The "Two Challenge Rule", a technique borrowed from aviation, is also used by the team when necessary. With the "Two Challenge Rule" team members are responsible for questioning all actions that might place the patient at risk. A challenge is voiced at least twice to assure it has been heard. The receiver must acknowledge the challenge and offer an explanation for the action in question [5].

Monitoring the teamwork process also protects against errors. Cross monitoring of team member actions should be ongoing and observed deviations from the established protocols are challenged. The process of cross monitoring allows a common situational awareness to be developed [5, 81]. This allows recognition of impending errors as well as better-coordinated activities. The team should be immediately alerted to errors and corrective actions must be advocated for and rapidly taken.

Communicate with the Team

Ongoing and effective communication by the team allows its members to establish a common reference and understanding of patient and operational issues [89]. Team members continually feed information to the team leader, who analyzes, makes decisions and responds back with further direction. When giving directions or orders, the team leader assigns responsibility as well. Calling orders out without assigning responsibility produces one of two non-productive responses; too many team members respond or no one responds. An effective resuscitation team also communicates through non-verbal as well as verbal methods [61, 78, 109]. Characteristics of good team communication techniques are listed below.

Characteristics of Good Team Communication

- The team has a clear chain of command and communication focuses on the team leader
- The leader effectively applies the team resources and gives consistent guidance to the team
- Team leader nurse receives orders from team captain and delegates them to team members
- No communication barriers caused by the team's hierarchy or chain of command
- Team leader recognizes his/her interdependent relationships with other team members
- Orders given directly to individuals, addressed by name along with eye contact
- Speed of communication is important to code team control
- The team leader is the team pacemaker
- Clarity and efficiency of communication
- Appropriate loudness or decibels of speech
- Effective non-verbal communication occurs because individuals follow sequential protocol, anticipate and monitor the team leader and other team members
- Team leaders encourage questions and suggestions
- Team leader has continuous conversation with the team providing current information
- Team has common operational framework and vocabulary

Execute Plans, Cross Monitor and Manage Workloads

Avoid circumstances that increase the risk of error or decay in team performance. Team members are responsible for requesting assistance when task overload exists or offering teammates assistance when they become aware of overload situations. Physician and nurse leadership are responsible for insuring that the workload within the team is balanced [81]. If team members assist team members, clinical errors caused by individual overload, stress or distractions will be reduced.

Primary and Secondary Triage

The team leader establishes, prioritizes and directs the therapeutic plan for the patient. The team leader solicits and considers individual team member observations and assessments. With this information the team captain initiates adjustments in patient care in a real-time fashion. Additional resources are obtained as needed. When the patient's condition deteriorates, the team returns to the "ABCs".

Maintain Situational Awareness

Situational awareness is a responsibility of the entire team, and all team members strive to maintain an overall awareness of the resuscitation process. As part of that process the team leader should provide an ongoing and clearly stated report of the process so that the team is kept abreast of each stage of the resuscitation. For example, "We are now starting the secondary survey and the C-spine films are back and are negative." All team members monitor the actions of

others on the team for compliance with protocol, equitable workload distribution and errors of omission or commission.

Improve Team Skill

Engage in Informal Team Improvement Strategies

Even in a busy emergency department setting the critique phase of the resuscitation process can be accomplished and can prove to be a valuable training experience [71]. Debriefing or personal defusing, especially utilizing the critical incident debriefing system can also occur during the critique phase allowing team members to manage personal grief reactions [61, 65].

Engage in Formal Team Improvement Strategies

Advanced life support training using mock codes can improve team performance and ultimately even survival outcomes [91, 110, 111]. Actual training utilizing realistic code team organization is an important component of any ALS program [112]. A code organization committees or similar entity can be another important improvement strategy.

Training and Mock Codes

Mock codes are an ideal tool for resuscitation team training. There should be two areas of focus for mock code training. The first is the standard "megacode" in which ATLS and ACLS clinical scenarios are practiced and reviewed [113, 114]. A broad spectrum of resuscitation situations involving simulated patients of varying ages and conditions should be incorporated [113]. Alternatives to intravenous access and difficult airway management are included in this training. The second area of training emphasis is code team organization. While formal systems for teaching the clinical aspects of resuscitation are common, training in code team organization tends to occur much less frequently. Attention to both aspects of training is important.

Code Organization Committee

There are several formats that allow effective administration of code team organization. Administrative management of code organization can be accomplished in subcommittees of hospital trauma, CPR, morbidity and mortality committees, or emergency department QA committee meetings [112, 115]. While there are many universal issues, resuscitation team planning should be accomplished in the context of each individual hospital following the Utstein guidelines [113, 114, 116].

Code Committee Activities

- Organize the ED resuscitation team process
- Define team membership or composition
- Establish team member credentialing and training criteria (ACLS, ATLS, PALS, etc).
- Plan specific team roles and assignments
- Review any team performance problems (Not QA)
- Interface with team members who fail to understand team dynamics
- Identify quality assurance issues and refer to appropriate QA committee

- Plan and orchestrate training activities
- Supervise training
- Establish documentation standards according to the Utstein template
- Supervise new equipment procurement and training
- Oversee equipment stocking and display
- Identify and correct logistical and supply problems
- Interface with other services or departments when necessary
- Identify areas for resuscitation research
- Institute training in notification of next of kin
- Create code organization benchmarks
- Establish benchmarks for timeliness of admission or transfer
- Seamless movement of patient within the institution
- Prehospital educational role

CONCLUSION

In this article the case for a greater focus on code team organization has been presented. Lack of organization may result in unwanted consequences for others. While it may be “appointed unto men once to die” it is possible that a second opportunity may be afforded to more patients if their resuscitation teams arrive sooner, are better organized and are more efficient in their delivery of life saving interventions.

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