

PRACTICES OF HIGH RELIABILITY TEAMS: OBSERVATIONS IN TRAUMA RESUSCITATION

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This paper reports findings on some of the practices adopted by teams based on interviews and observations of teams working in trauma resuscitation. This study was conducted at a level I trauma center over a period of six months. Although analysis of interview transcripts is on-going, these practices can be tentatively organized into several general themes: learning and trusting other roles, sharing responsibilities, ensuring team awareness, and being adaptive. In particular, even though membership of teams in trauma resuscitation is fluid and dynamic, by sharing the overall responsibilities for the well-being of the patient, the teams are able to resist many failure factors.

The demand for safe operation in high risk industries has led researchers to study how to prevent accidents, why certain organizations have perceived good safety record, and what are the root causes of serious accidents. The high reliability organization theory (La Porte, 1996), for example, proposes a list of characteristics of high reliability organizations in terms of internal processes of an organization, organization's culture of reliability, and external relationships with monitoring and regulatory entities. Despite the difficulties in defining what constitutes a high reliability organization (Rochlin, 1993; Eisenhardt, 1993), the field study on aircraft carriers reported by Weick and Roberts (1993) provides insightful answers to the question of "why a million accidents waiting to happen but almost none of them do" (p. 357) on aircraft carriers. Such an approach of understanding why certain organizations are resistant to failures is complementary to the one of understanding why systems fail (c.f. Reason, 1990; Perrow, 1984). The recently heightened public interest in patient safety in healthcare has brought the topic of safe operation into the forefront of research community.

If safe operation in organizational context has been much studied, our understanding of teams in these organizations has been scant. Recently a proposal was made to characterize safe operation at three levels: individual, team, and organizational (Carthey, et al, 2000). In this proposal, individuals, teams and organizations are measured by a list of "behavioral markers." For example, at team level, these markers consist of experience, technical skill, redundancy, adaptation, team leadership, communication, and coordination.

In this paper, we postulate a set of practices that teams in trauma resuscitation follow and that lead to failure-resistant performance. In particular, we examine these practices against factors that seem to induce teams to perform sub-optimally. In the setting where our observations were made, the teams have fluid membership; a primary mission of the teams is to train some members while on the job; task load is unpredictable and fluctuates considerably over time.

METHODS

The Setting and Teams

Our study setting was the patient admission area of a major urban Level-I trauma center. Patients who suffer trauma are brought to this area initially for evaluation, stabilization, and diagnosis. If needed, definitive treatment is carried out in other parts of the center. Usually a team of nurses, physicians, and technicians work together to accomplish this task. Depending on the overall workload in the patient admission area and available personnel resources, two to 10 or more people are involved in the initial care of the patient. Often the patient's injuries and conditions are unclear when the team first sees the patient. The patient condition can change rapidly and unexpectedly. Occasionally there is great time pressure for the team to work rapidly.

As part of a teaching hospital the trauma center is staffed partially with physicians who are in training (residents and fellows) and usually stay for one to several months in the trauma center. So the membership of a resuscitation team changes over time due to the turnover of training staff. However, the membership of a resuscitation team is dynamic and fluid primarily due to the following reasons. A resuscitation team usually

consists of people who are from different specialties, each of which has its own rotation patterns. For example, a surgeon who works on one shift with a nurse may work with a different nurse on the surgeon's next shift. The surgeon may work with different nurses from one patient's resuscitation from the next as well, since there are several nurses who take turns in participating patient admissions. Even during the resuscitation of one patient, team membership may change as a result of changing task demands for this patient or for other patients nearby.

Interviews and observations

To gain insight into how teams function with such dynamic and fluid membership, under pressure and facing uncertainties, and apparently with reliable performance, we observed resuscitation teams in action during about 50 patient admissions and conducted semi-structured interviews with about 23 care providers from different backgrounds (nursing, trauma surgery, anesthesiology, and medical technical support).

Detailed notes were made during observations of patient resuscitation. At the end of each case, observer(s) wrote a short description of the case observed and made comments on the impression of the case. Interviews usually lasted 30-60 min. A set of lead questions was posed to the interviewees. These questions included:

1. Can you give us an idea of how you function/collaborate/organize with others in your specialty (function), i.e. those who perform the same job duties/roles as you?
2. How do you function/collaborate/organize with others in the team during a patient admission? What do you depend on? What does the term "team" mean to you?
3. People have specific roles at the shock trauma center. Can you describe a situation where this division of roles/functions negatively affected teamwork? Positively affected teamwork?
4. In regards to the rules of the shock trauma center: do you think that there are certain aspects of those rules that positively or negatively influence teamwork?
5. How do you deal with unexpected events? What about overload?

The interviews were tape-recorded and transcribed.

Our current analysis focused on the period of time from the first radio call, informing the trauma center of a patient transport, through initial diagnosis, resuscitation, and treatment, until the patient is moved to either the operating room, intensive care unit, or discharged. We were interested in those caregivers who

were directly involved in the trauma resuscitation and final disposition of the patient. These people included physicians, nurses, and technicians. The findings below reflect a preliminary data analysis and theoretical analysis. In particular, we examined how team members interacted to ensure the safety of the patient and to resist potential failures.

FINDINGS

Team members in ensuring highly reliable, failure resistant performance used a wide range of practices. We will attempt to delineate these practices into the following themes.

Learning and trusting other roles

Trauma resuscitation team members come from varied educational, professional, and experiential backgrounds. Each team member learns his or her own role in the coordination of trauma resuscitation, as well as those of other team members. Role education takes place through formal and informal means. Formally, team members learn the roles of others in their professional education. Informally, team members learn team member roles by observation and inquiry in the work environment.

In addition, these roles may vary between institutions, and requires an adjustment on the part of team members when changing institutional affiliations:

"Right now we do have another person that's from another place on our team. I guess for a surgery person, you're not sure what their trained for and you tend to watch them more carefully before you trust them with more responsibility or you test them with responsibility to find out how good they are. I did have an outsider one other time and he was just not very strong, he just could not get it together. He didn't quite pull his rank and get the work done."
[Chief resident]

A chief resident is a physician in senior training position. The same person further explained the process of role learning when prompted by the interviewer's question of "How do you find that out?"

"A little test. You observe their behavior. You observe the procedures. Was there any problem with that? How confident were they when they did that? How enthusiastic is he? Does he come to the operating room when I'm doing a case to say 'hey I want to come and help.' Kind of evaluate like that."

Every July residents and fellows (who have finished residency training and are for their final, optional specialty training before becoming an attending physician) start their new level of training,

usually at a new hospital unit. An attending surgeon pointed out the potential threat to performance reliability due to the July transition with fresh new training personnel:

“When you have a new team, like in July, they’re not sure what to do.... A lot of people show up at the trauma but they just sort of stand around and they’re not sure what to do. And I think that’s sort of a problem. That’s when I come in as a coach and guide them and teach them how to put the team together. So I don’t think that there has been any major that has gone wrong because of that early July syndrome, but I certainly think that it has the potential to if someone is not there who is experienced who can guide them to do things quickly.”

The accumulation of formal and informal education allows the team member to anticipate what other team members will do in any given situation. Knowledge of team roles is extremely important in a large trauma center where individuals rotate through frequently; team members may have no prior knowledge of each other as individuals. As one surgeon points out:

“You can go to the operating room five minutes after you meet somebody”.

With knowledge of team member roles in trauma resuscitation, the team can work together smoothly and efficiently. The interviewees noted that the highly specialized nature of team member’s roles easily allows team members to predict member activities in any given situation. An anesthesiologist describes an example of this:

“If the patient is bleeding furiously after we put a chest tube in, we want to collect that blood and transfuse it right back in the patient, we need a special collection device to do that. The trauma tech will go and get the equipment to do that”.

Highly shared responsibilities

The teams were found to hold a distinction between task distribution and responsibility distribution. As one of the surgeons put it: “I am policing everyone in the team” while he has his own role in terms of tasks during a resuscitation. With the patient’s well-being as the ultimate goal for everyone, team members expressed that they share the responsibility to ensure failure resistant performance.

“[H]aving the nurses being very experienced in trauma, and the anesthesiologists are checking on them too, then you have the resident team checking on the patient. I think that it’s sort of a checks and

balances system, you’re always picking up things, there are so many people looking in on the patient and focusing on different aspects of the patient’s care.” [Chief resident]

Members of a team made efforts to keep track of tasks of fellow members, not only for the purpose of articulating one’s own contribution to the team but also to check on each other. Here are examples of how highly shared responsibilities by everyone in a team manifest. When a physician inadvertently contaminated her gloves, a nurse pointed out and prodded the physician to replace it. When a training staff was putting in her first intravenous line, several members of the team monitored the process carefully. As another practice in ensuring fail-safe performance, almost everyone attempted to get first-hand information about the patient as opposed to completely trusting reports by others.

Ensuring team awareness

Another practice we observed was ensuring team awareness of each other’s task status and patient conditions. Members in training positions were often encouraged to verbalize major landmarks in the resuscitation process. When a patient condition was critical, important information was often broadcasted, such as patient’s blood pressure, oxygen saturation, or X-ray results, or when operating room ready or tracheal intubation completed. While not all the information broadcasted was pertinent to every group member, this method allowed each member to glean the data applicable to their role and anticipate the actions of others related to their knowledge of another’s role. In other words, each person will know approximately what action another will take given particular information. Therefore, not only do team members have an understanding of the role of others, but through this knowledge can predict their team members actions based on any given situation.

Group checking is another way to ensure team awareness when members verbally question the whole team. A trauma unit nurse described one example of group checking, where group members checked if the operating room charge nurse was aware that a patient needed surgery:

“She may just say, did anybody tell the OR? At that point, someone will say, I’ll go back and let her know, or, I can page her, or I’m walking back there now, I’ll let her know”.

One member of the group may ask another about the status of a particular task, or the member may ask the whole group.

Adaptive teams

For a number of reasons, such as the unpredictable nature of trauma resuscitation, team members were observed to monitor closely each other's activities. Such intensive monitoring was cited as a basis for anticipatory task articulation and for pacing one's own activity.

"Watch this gentlemen in Bed 4 over here. I heard him say he's short of breath and heard him say he's having chest pains. Then also they want to do the EKG and they say, 'Let's get these films over and get the EKG knocked.' Then he again said he's having chest pains again. So I said, 'Do you want do the EKG, before I come in?' I don't want them feeling like I'm trying to get in there and knock them out of the way. I want to know that I'm gonna play as part of the team. If they want to get an EKG first, I think this patient needs the EKG before he needs the other X-rays. ... Especially when he's not having any pelvis pain. They said, yes, they want to get the EKG first so I went away and went over to start the other admission while they're getting the EKG. You learn to read things when you've been here a little while." [X-ray technician]

Interviewees expressed the need to be aware of the ongoing activities of others to judge whether they could perform their own activities concurrently or if they should assist others to complete their tasks. We observed that it was more the rule than the exception that team members performed tasks concurrently. Often, one person might be inserting an intravenous catheter, another applying an oxygen mask, while another was taking a blood pressure reading. However, there is only so much space around a patient's body and access to the area an individual needs to complete their task may be blocked. Monitoring others' activities could be a strategy to coordinate the limited access to the patient.

A significant part of the practices utilized by the teams we observed was to balance the two potentially conflicting goals: teaching (training residents) and performing (caring for the patient). How to achieve the balance of the two goals was highly dependent on the experience level of the team (usually reflected by the time of the year), the experience level of an individual, and the patient condition. Since training occurs while on the job, the attending physicians bear the responsibility of ensuring high reliable performance even a task is performed by a team member for training purposes.

"It's dependent on which fellow or chief resident is there, I may be more or less on their backs. In July, when all of the sudden everybody is a year smarter,

I'm a lot more likely to really be there than the end of June, or the end of May." [Attending Surgeon]

"So if it's an experienced doctor that I can trust, I do very little in terms of intervening, he can just do everything himself. I just will stand back and make sure everything is appropriate. If it is a more junior person, he might need a lot more guidance, so I often may end up actually doing more of the interviewing of the patient or examining the patient and directing the care of the patient." [Attending surgeon]

"Each day, I may behave a little bit differently depending on how uptight I am too, but I try with young healthy patients to give [residents] more latitude. With people who are sicker, I often warn them ahead of time that I'm going to have a very quick whistle on this one if you don't get it right away, I'm going to have someone else do it or I'm going to do it myself. By and large, the residents understand this." [Attending Anesthesiologist]

The practice of being adaptive in achieving the goal of teaching contributed to reliability in performance. Another manifestation of being adaptive is when workload fluctuates dramatically. The team members were trained to reconfigure their team structures to meet the demand of changing workload:

"So if you have a multiple accident and have three patients coming in, you don't have the benefit of the full team. For our team, it's fairly automatic to split up an upper and a higher --- you don't want to leave two interns admitting a sick patient; you want to put a third year and a first year or a second year and a third year.... I think the more senior residents are more used to keeping an eye on that." [Chief Resident]

Adaptive practices were also reflected how an individual changes his or her role in a team:

"The main responsibilities depend on what the circumstances are. Our goal in the TRU is airway management. It could be expanded ..., depending how busy. ... say it's Tuesday morning, and five or six members there, ... one patient comes in and five people jump on him... Take that's scenario on Saturday night at two o'clock in the morning with five admissions within 10 minutes with five team members there. Now you have one person for each patient, so you have a second year resident taking care of someone who has been shot four times. At that point, the anesthesia providers have a little more responsibility for the patients for what's going on for the patient in the TRU, with resuscitation of

the patient, so it's an allocation of resources."
[Certified Registered Nurse Anesthetist]

"Talked about starting the IV in and it's usually the nurse when the nurse has time, but it can be anyone. It can be one of the residents, and we have a whole team of people ready; it could be a resident or a medical student or anyone. It's rarely me although I will start the IV if no one is available...."
[Attending surgeon]

"As a surgeon, if I go over the patient and suddenly the patient is in shock and a blood transfusion is urgent, I will just grab the nurse or whoever is there at the time and try to get the blood to the patient. If it's absolutely urgent, I'll go over to the refrigerator and grab the blood myself and give it to the nurse. A lot depends on urgency also." [Attending surgeon]

DISCUSSIONS

Our initial analysis of data collected led us to the preliminary set of practices describing how trauma teams maintain failure resistant performance. To ensure reliability, teams are found to adhere to practices that reduce the likelihood of performance failures. These practices include: learning and trusting other roles, sharing responsibility, ensuring team awareness, and being adaptive. The teams in trauma resuscitation apparently are resilient to many failure-inducing factors, such as constantly shifting team membership, fluctuating workload, and potentially conflicting goals between training on the job and performing. Understanding in detail how such resilient teams function should provide us with insight at ever detailed level into high reliability organizations.

Our current efforts are only a first step in analyzing the data collected and in formulating a set of descriptive characterizations of high reliability teams. Much work needs to be carried out in comparing the findings in the current medical domain with those from other domains (such as emergency control rooms, Artman & Waern, 1998). In particular, the phenomenon of highly reliable operation needs to be understood at individual, team, and organizational levels (Carthey et al, 2000). The collaborative activities of medical teams can provide an opportunity for studying how team members, through their interaction with each other,

perform highly reliably, or "create safety" (Cook et al, 2000). The intricate patterns of interaction, although with much nuances, require detailed examination.

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