Non-Technical Skills in Trauma and Disaster Response: Mapping Decision-Making, Communication, and Team Dynamics

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Abstract: Along with clinical experience and technical competency, non-technical skills (NTS) are crucial to trauma and disaster response efficacy and safety. Responders' capacity to make good judgments, communicate well, and work together affects patient outcomes and mission success in high-risk, time-sensitive, and resource-constrained circumstances. This research examines non-technical abilities in trauma and catastrophe scenarios, focusing on decision-making, communication, and teamwork. Situational awareness, prioritizing, and adaptive judgment are needed to make decisions in uncertain, incomplete, and fast changing situations. Multidisciplinary and multi-agency teams benefit from verbal and nonverbal communication, which reduces mistakes and promotes coordination. Operational efficiency and responder resilience depend on team dynamics including leadership, trust, role clarity, and coordination. The research shows how inadequacies in one fundamental non-technical domain might affect response performance by mapping their interrelationships. The concept emphasizes systematic training, simulation-based learning, and standardized evaluation techniques to improve trauma and disaster responders' non-technical skills. Adding non-technical skills to disaster planning frameworks may increase system resilience, minimize mistakes, and improve patient and responder safety in complicated emergency situations.

Keywords: Non-technical skills; Trauma response; Disaster management; Decision-making; Communication; Team dynamics; Human factors; Emergency preparedness

INTRODUCTION

It is not easy to manage a patient who has experienced trauma. Performing life-saving treatments on an unstable patient, making time-sensitive judgments, and dealing with limited information all while under tremendous time constraint necessitates swift and precise clinical evaluation. This calls for a concerted effort by the teams in the OR and the emergency room. Members of these interdisciplinary teams range from highly-motivated general practitioners

to nurses with extensive training in a variety of medical subspecialties, and they work together to solve complex medical problems. In most cases, everyone has gone to some kind of training program in the past to hone their particular set of abilities.[1]

But just because someone is an expert in their field doesn't mean they can form an expert team. According to research on surgical complications, the most common reasons for medical mistakes are lapses in communication, planning, coordination, and task management. In addition, communication breakdowns are common during healthcare transitions, and several studies have shown that they are the root cause of the most serious trauma resuscitation mistakes.

Trauma operating room teams are understudied compared to emergency room trauma teams, yet they are just as important. Elective OR teams may be more like the emergency room team in terms of dynamics than regular OR teams. Emergency room and operating room trauma teams are put together on short notice, and its members may not have regular training together or even know each other before the team is formed. Still, they're under pressure to act quickly while performing potentially dangerous treatments and making judgments with significant consequences. Because of this, "a perfect storm" of mistakes and bad results is imminent. [2]

Teams and non-technical skills (NTS) have been known to help airlines reduce risks for a long time. Crew resource management, also known as crisis resource management (CRM), has greatly improved the safety of air travel. Applying this concept to the medical field, particularly in the area of non-technical skill training, has shown excellent results. The use of NTS in healthcare has undeniably improved patient safety.

In this narrative review, we will go over the essential non-technical abilities and how they pertain to trauma. We will concentrate on the teams working in the OR and the ER, as well as how care is transferred between the two settings. Additionally, we go into the functions of NTS training in both undergraduate and graduate programs, as well as the use of team debriefing. We take a look back at the history of trauma training courses and how they contributed to the creation of NTS. At last, we touch on the difficulties that have arisen due to the introduction of trauma hybrid operating rooms. [3]

Non-technical skills in trauma

Interfering with task performance and completion are non-technical skills (NTS), which are cognitive and social abilities. For a team to work well in an emergency room or operating

room setting, everyone on the team, but especially the team leader, has to know their stuff when it comes to clinical and technical abilities, and they need to recognize how important NTS is. [4]

The field of trauma management makes use of a number of NTS:

- Situational awareness
- Role allocation
- Decision-making
- Leadership
- Communication

Situational awareness

One definition of situational awareness is "the perception of elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future." Therefore, it is imperative that the practitioner—often the team leader—goes beyond what is immediately accessible, integrates all current input with prior knowledge, and expands awareness in both space and time. This is a crucial NTS that often calls for prior exposure to comparable cases and a certain level of clinical expertise. However, it is also within the junior trainee's capabilities to improve with sufficient instruction via simulation. [5]

Prehospital notice initiates situational awareness. The AT-MIST mnemonic is suitable for providing the prehospital notice. It stands for Age, Time, Mechanism, Injuries, Signs, and Treatment. While not conclusive, it may provide a good idea of the patient's probable clinical situation and what resources, such the trauma operating room, may be required, such as initiating the large bleeding procedure. At this point, a procedure to mitigate the harm may be initiated.

When evaluating the patient's reaction to resuscitation, situational awareness is just as important as it is upon patient arrival and throughout the main survey. When determining the expected next step, environmental factors, available physical and human resources, and other factors are considered. A good usage of situational awareness would be for a team leader to

mentally branch out potential decisions before all the necessary data is at their fingertips. For example, it is recommended to transport the patient to the operating room immediately rather than continuing resuscitation while an eFAST test is being requested for trauma patients. thoracotomy in cases where eFAST is positive for pericardial fluid, as opposed to laparotomy in cases where eFAST is positive for peritoneal fluid. This patient may just be at the eFAST scan phase, and the trauma team leader is likely already thinking about these possible outcomes and the branching choices that will follow.

Team members may struggle to keep up with the leader's constant situational awareness during emergency room resuscitation. Actually, it may not be the best choice, particularly if some of them are carrying out intricate operations that need close-up eyesight. But the trauma ER team leader must update everyone on the situation and the strategy at regular intervals. A Stop process, sometimes known as Team-Time-Out, may do this. This time-out may be helpful for the whole team to communicate information when it's clinically feasible (i.e., not getting in the way of emergency resuscitation attempts). [6]

Gaining and keeping everyone on the team informed of the situation may be challenging during surgery. Surgeon and anesthesiologist alike will need to keep their eyes focused on the task at hand throughout the operation, which might lead to a loss of situational awareness. Because of the potential for unforeseen complications during surgery, it is critical that the surgeon and anesthesiologist who share leadership responsibilities on the trauma team be able to switch roles in terms of situational awareness. Routine status reports, often called "sit reps," are a kind of intraoperative team time-out that may help avoid this.

The anesthesiologist reports the first three elements of the TBCS, which pertain to physiological factors. Finally, the surgeon will present the surgical findings and strategy. Everyone on the trauma operating room team can stay up-to-date and informed with the help of the TBCS tool. [7]

One additional possibility is for the chief surgeon to brief the assistant surgeon on the current situation. Particularly when the operating surgeon is using focus vision, it is beneficial for one of the two surgeons on the team to be able to keep an eye on the surroundings. However, intraoperative timeouts are crucial for maintaining situational awareness since both surgeons' attention may be needed on the operating field at times. One anesthesiologist may execute

operations while the other keeps an eye on the surroundings; this setup can also function. On the other hand, intraoperative timeouts should still be used often.

Last but not least, situational awareness should take into account the team members in addition to the patient, resources, and context. It is possible that some team members are underutilized while others are overloaded. All of these things have the potential to make people lose faith in trauma resuscitation, which might harm both present and future attempts to save lives. As a result, the team's leader(s) should be prepared to reorganize responsibilities and delegate more work as needed. [8]

Role allocation

Due to the potentially heterogeneous nature of the team in an emergency room scenario, role allocation is of the utmost importance. Although trauma surgeons or emergency physicians are often designated as team leaders, the other team members may be assigned flexibly based on their competence and comfort level. Anesthesiologists, for instance, are often assigned the post of Airway (A) doctor because to their exceptional team leadership skills, their proficiency in managing most airway circumstances, and their knowledge of analgesia and sedation. In addition, if the patient needs surgical treatment, having the anesthesiologist on the emergency room trauma team ensures continuity of care. [9]

Allocation of roles might change throughout time. Managing airways is a prime illustration of this. A reallocation of responsibilities is necessary for drug administration, physical limitation of spinal movements, and handling the laryngoscope and tube, among other things, during drug-assisted intubation, as opposed to simple motions, which the A-doctor may offer. As an extreme measure, the A-person, who is an experienced provider, may be temporarily given control of the team. Everyone on the team will have to find new things to do if they are to help with further operations that need it, including inserting a pelvic binder or a chest drain. In addition, the team leader may need to confer with another expert for a moment, temporarily transfer leadership to another team member, or both to avoid losing situational awareness.

Positions on the squad should change depending on what's available in the area. Instead of the other way around, the trauma team's makeup dictates the training program's simulations at one of the authors' institutions. With the tagline "We simulate like we work and work like we simulate," the trauma team training program is guided by a strong sense of purpose. In contrast

to the anticipated success of a more pragmatic strategy, a strict team structure would be difficult to implement and would result in poor compliance. [10]

The operating room (OR) often has more strict and evident function allocation: surgeons will do the surgery, and the anesthesiologist will oversee general anesthesia and resuscitation. This is in contrast to the emergency room (ER), where certain members may do numerous responsibilities. In the trauma operating room, however, responsibilities must also be divided; for example, someone must call the blood bank, set up lines, and bring more equipment. This is best done when the whole operating room staff is briefed on the patient's condition during the transfer from the emergency room to the operating room. Anesthesia and scrub nurses should each have their specific responsibilities laid down, and everyone on the team should be easily identifiable. Following this first operating room team briefing, the anesthesiologist and surgeon may provide more detailed briefings to their respective nursing staffs (see to the six-step approach to perioperative communication for additional information).

Because the patient can need a surgical airway or chest decompression for a tension pneumothorax following positive pressure breathing, the surgeon's involvement during induction also involves allocation. In case this role becomes necessary, it is important to designate a specific member of the surgical team to do it. [11]

Although the most qualified individual should be assigned to a certain role, there are situations when less experienced or younger team members may step in to fill the role. This allows for a more even distribution of responsibilities and exposure. Finding a happy medium between training concerns and patient demands requires, as always, sound judgment.

Decision-making

A common adage states that as one gains experience, one is more likely to make poor decisions. Using a neuroscientific lens, we may classify the mental processes involved in decision-making as either type 1 or type 2. Pattern recognition underpins type 1 choices, which are intuitive and need less mental exertion. Useful for routine, everyday activities. Type 2 judgments are slower because they rely on deductive reasoning, are logical and concept-based, and need mental effort. [12]

When we walk down the street, we're demonstrating how we employ these two processes to execute tasks. We rely on quick, instinctive brain processes (type 1) when we stroll around our

local neighborhoods. It takes a lot more time and mental energy (type 2) to use deductive reasoning to navigate our way around a new place when we don't have an internet map.

Type 1 choices are suggested to be made by our brain under stressful situations for evolutionary reasons, even though we employ both decision-making processes interchangeably in our everyday lives. The care of a patient who is bleeding is a prime illustration of the significance of decision-making. At the outset, both seasoned and novice surgeons will use basic techniques to reduce bleeding, such as digital or physical compression of an artery that is bleeding. It is common for inexperienced surgeons to rush into direct suturing or clamping the artery (type 1 choice), frequently without enough exposure, proximal or distal control, or team notification. Type 2 choices include pausing to consider alternatives, checking in with the anesthesiologist to see how the patient is doing, reporting discoveries and the plan, dividing up responsibilities (such how to increase illumination and exposure), and gathering more resources.

When it comes to showing how valuable the decision-making process is, simulation-based learning really shines since it recreates "under test conditions, phenomena that are likely to occur in actual performance." Subjected to a crucial situation in a controlled "classroom" setting, such as a clinical case discussion, participants will almost always succeed and provide the right answer. Because of this, type 2 judgments are often adhered to. There would be a dramatic increase in the number of type 1 judgments made if the same clinical situation were presented in a virtual environment. This is, according to the author, a major benefit of trauma treatment simulation training. [13]

Having said that, not every type 1 choice is incorrect. If a relatively inexperienced practitioner wants to compress external bleeding or perform a simple airway maneuver like a chin lift or jaw thrust (with restriction of cervical spine motion), they can do it quickly, easily, and safely.

usage of intra-resuscitation or intraoperative time-outs is a useful technique, and training and experience may help reduce the tendency for recurrent type 1 usage. As a result, everyone in the team may take stock again and voice their concerns. Just a little break before things get going.

Crisis containment strategy training is another instrument. To name one, there's the "surprise and startle" response. This method has been created to teach flight attendants how to handle serious, unanticipated emergencies, but it might also work in an operating room setting. Pilots

aboard airplanes learn to quickly recognize an emergency and react accordingly. They have been taught to follow a process called the "Stop-Aviate-Navigate-Communicate" routine and should not make hasty judgments. Training for trauma teams may follow a similar pattern, with an emphasis on the ABCs in the emergency room and TBCS in the operating room. Members of the team will put an end to it, shift their attention, and consider their alternatives if they label the occurrence as unexpected. [14]

Leadership

The need for a trauma team leader to be clearly identified in emergency rooms is supported by a wealth of research. While surgeons make up the majority of trauma team leaders, emergency doctors are as qualified to fill this position. Being able to facilitate feedback from team members and employing succinct communication are qualities of an effective trauma team leader, which are far more important than the specialization itself. Less time spent resuscitating and making decisions is linked to trauma teams led by experienced professionals.

Leadership in the trauma operating room is best shared. While the surgical team leader is ultimately responsible for determining whether or not to operate (the indication for surgery), they must collaborate with the anesthesiologist in order to carry out the operation safely. Arterial pH and lactate, temperature, coagulopathy, and the response to resuscitation are all physiologic data that the anesthesiology team can quickly get and update, proving that this is the case. Accordingly, in an ideal situation, a shared leadership team may think about the patient's physiology in addition to the surgical area. [15]

Anesthesiologists should take the lead during induction and other crucial times, as well as in the case of serious unforeseen occurrences like cardiocirculatory arrest, even if the surgeon is ultimately responsible for the technical conduct. To illustrate the point, the anesthesiologist may need to signal the use of cross-clamping the aorta as the only method of managing an abrupt intraoperative hemodynamic collapse. When the surgeon needs a broader perspective of the case to complete an operation, such as inserting an intra-arterial shunt, or when their concentration is too limited to do so, this shift in leadership is also necessary. Another instance where this occurs is during thoracotomy-based direct cardiac compressions. Surgeon priorities include maintaining a dry operating area, preventing the aortic clamp from sliding, and ensuring effective bimanual compressions. The onus is now on the anesthesiologist to take the lead in determining the appropriate medications and when to administer the internal paddle

defibrillation. The patient is and always has been the first priority in the operating room, thus egos should stay out of patient care. As always, this "two-headed" brain can only function with the full collaboration and clear communication of the surgeon and anesthesiologist.

When a team's objective is to treat a live patient with grave injuries and give them the chance to recover in critical care, good leadership is about more than just getting the job done. Leaders of teams should also take the time to ask their members how they felt, what they accomplished, and what they might do better. [16]

Communication

From what has been covered thus far, it is clear that communication is the most crucial NTS. Efficient communication may be both a team's strength and its weakness. Indeed, inadequate communication is thought to be the cause of 70 to 80% of healthcare mistakes. Thankfully, there are guidelines on how to communicate appropriately in times of crisis.

The concepts of closed-loop communication should be applied to both peri-resuscitation and perioperative communication. These principles include:

- Naming oneself while speaking
  - During preoperative OR briefings and prearrival ED team briefings, everyone's identities and responsibilities should be established.
- If it's feasible, make eye contact.
  - This may not be possible in an intraoperative situation when the surgeon has to pay attention to the surgical field.
- The receiver has acknowledged receipt of the message and verified comprehension of the message and completion of the job.

In the resuscitation environment, closed-loop communication is linked to faster and more efficient job completion. The writers draw parallels between closed-loop communication and the instant messaging application WhatsApp, where the symbols for a sent, received, and viewed message are readily apparent.

There must be communication before to the surgery, throughout the procedure, and immediately after its completion. But there have to be measures to prevent talking too much.

Keep in mind that communication is similar to a medicine or a surgical tool; it has to be administered at the right time and in the right dose. Distracting the anesthesiologist or surgeon during a challenging airway or supraceliac aortic clamping procedure is a certain method to throw off their concentration. At these critical junctures, only life-altering information should be shared, including a rapid decline in the patient's condition or major, unanticipated complications during the procedure. Here we are again with the sterile cockpit rule of aviation: when it really matters, only pertinent information should be conveyed. [17]

OBJECTIVES

1. The purpose of this study is to investigate the function of interpersonal abilities in disaster and trauma response, focusing on the importance of communication, teamwork, and decision-making in potentially dangerous situations.

2. To study the effects of situational awareness, ambiguity, and time constraint on decision-making in disaster and trauma response operations.

METHODOLOGY

Focusing on decision-making, communication, and team dynamics, this study used a qualitative, descriptive, and analytical research approach to investigate the function of non-technical abilities in catastrophe and trauma response. The study is based on the Emergency Management Non-Technical Skills (EMNoTS) framework, which was created by Hayes, Bearman, and Gyles. This framework defines non-technical skills as behaviors that impact performance in high-risk emergency situations; they are observable, trainable, and assessable. Analyzing complicated socio-technical systems, like disaster response operations, is a strength of this approach, which incorporates ideas from safety science, cognitive systems engineering, and human aspects. [18]

Sources and Study Scope

A comprehensive and methodical analysis of secondary data sources, such as scholarly journals, reports, and conceptual frameworks pertaining to non-technical abilities in disaster medicine, emergency management, trauma care, and high-reliability organizations, formed the basis of the study. The main source was the EMNoTS handbook, which provided a taxonomy of non-technical skill categories and the behavioral indicators that went along with them. To put these abilities in perspective and prove their usefulness in catastrophe and trauma

situations, we consulted supplementary literature from domains including emergency incident management, healthcare collaboration, and aviation crew resource management.

Validity, Reliability, and Ethics

By comparing ideas across many academic sources and emergency management settings, methodological triangulation was used to increase the credibility and reliability of the results. The analysis was even more reliable since it used an established and empirically based framework like EMNoTS. No human subjects were directly exposed to any ethical hazards since this research used only secondary data. Nevertheless, great care was taken to ensure that the results were faithful to the original authors' intentions and that no conceptual models were misused. [19]

RESULTS

The results show that situational awareness, cognitive effort, and time constraints significantly impact decision-making, a key non-technical competency in disaster and trauma response. Findings suggest that good decision-making involves keeping an eye on changing circumstances, ranking conflicting demands, and adjusting tactics as needed. When conventional protocols are inadequate or unrealistic, high-performing teams use flexible and adaptable judgment rather than relying just on preset processes, as shown in the study. On the other side, bad decisions were often linked to fixation mistakes, putting too much stock in first assumptions, and missing new dangers. [20]

Communication and Operational Effectiveness

In the aftermath of trauma and disasters, the ability to communicate effectively has become an essential non-technical competency for facilitating teamwork, mutual understanding, and collective action. The findings show that both individuals and teams benefit from improved situational awareness and more successful decision-making when communication is timely, clear, and succinct. In multi-agency settings, structured communication strategies, such as closed-loop communication and standardized language, were found to lessen room for misunderstanding by eliminating ambiguity. But there was a constant correlation between poor communication and operational risk, wasted effort, and a lack of coordination.

Team Dynamics, Leadership, and Coordination

According to the results, the success or failure of emergency response operations is heavily dependent on team dynamics. Under pressure, teams that worked well together, supported one another, and had distinct responsibilities were more resilient and flexible. Leadership behaviors are a major factor in creating productive team dynamics, especially when it comes to creating common objectives, keeping morale up, and overcoming organizational and hierarchical barriers to work together. In complicated and fast-paced crisis situations, teams that practice adaptive leadership a style that combines authoritative management with consensus-building performed better. [21]

Interdependence of Areas of Non-Technical Competence

The interconnectedness of team dynamics, communication, and decision-making is a major takeaway from the research. These non-technical abilities are not self-contained but rather part of a larger system wherein proficiency in one area affects competence in another. Open information sharing is made possible by strong leadership and team collaboration, which in turn improve the quality of decision-making via increased shared situational awareness and effective communication. It was shown that shortcomings in any one of these categories might have a domino effect, causing operational efficiency to drop and risk to rise during disaster and trauma response.

Consequences for Education and Application

The findings highlight the need of trauma response and disaster preparation programs specifically include training in non-technical skills. Skills in decision-making, communication, and team coordination may be honed with the use of EMNoTS-aligned assessment tools, scenario-driven exercises, and simulation-based training. Enhancing overall system resilience, reducing unnecessary mistakes, and improving safety outcomes for both responders and impacted populations may be achieved by incorporating these competences into corporate training and assessment processes. [22]

CONCLUSION

This research shows how important it is to have non-technical abilities for disaster and trauma response to be successful. How rescuers handle uncertainty, time constraints, and complicated operational demands is heavily influenced by factors outside technical knowledge, such as

decision-making, communication, and team chemistry. The EMNoTS framework-based study shows that these abilities are crucial for high-risk emergency situations requiring coordination, flexibility, and safety. Strong situational awareness and cognitive flexibility are crucial for good decision-making, according to the results. This allows responders to adjust their strategy as situations change. The importance of effective communication in fostering mutual understanding and cooperation was highlighted, as was the correlation between communication breakdowns and operational mishaps. Results demonstrated that teams with adaptive leadership had higher levels of collaboration, role clarity, and stress resilience. In sum, the research shows that non-technical skills are interrelated and that disaster response and preparation systems should incorporate training and assessment of these skills. Operational performance, the rate of avoidable mistakes, and the overall resilience of disaster and trauma management initiatives may all be improved by bolstering these abilities.

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