Surgical Team Assessment Training: improving surgical teams during deployment

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Abstract

BACKGROUND: Simulation and team training are accepted as critical patient safety strategies to improve team performance and can help achieve better outcomes. Standardized and realistic drills conducted by skilled physicians and nurses who demonstrate consistent use of principles which enhance communication and teamwork increase the likelihood of improved clinical outcomes.

METHODS: Two, 4-member surgeon/nurse teams traveled to 8 Army surgical resuscitation medical treatment facilities in Iraq during July and August 2011. At each site, a new program called Surgical Team Assessment Training was introduced and implemented to 220 military personnel. Two multi-patient scenarios were designed to test resuscitative and operating room medical decision-making, communication, and co-ordination of care. In addition, 2 hours of didactic instruction emphasized principles of TeamSTEPPS applied to emergency and operating rooms during care of patients with multiple, complex traumatic injuries. Anonymous surveys were completed by participants following the training.

RESULTS: Participants were significantly more likely to rate this training as very helpful following training compared with their opinion before participation (53% vs 37%, \( P < 0.05 \)). Seventy-seven percent felt that it would improve overall patient outcomes, 78% said it would likely contribute to saving lives in combat, and 98% felt it should be provided to military Emergency Medicine and Surgical residents.

CONCLUSIONS: Surgical Team Assessment Training can be successfully implemented in an austere, hostile environment and improve trauma team function by incorporating simulation training models and TeamSTEPPs concepts. Expansion of this program for predeployment and resident training is currently under investigation based on the extremely positive responses.

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The current and future landscape of healthcare in the United States focuses on outcomes with an emphasis on patient safety at all levels. This focus is present at the national, regional, and local levels through programs such as the Surgical Care Improvement Project and the National Surgical Quality Improvement Project, as well as organizations like the Joint Commission and the Accreditation Council for Graduate Medical Education. Despite our best efforts, surgery-related safety concerns remain problematic. Summary data compiled by the Joint Commission between 2004 and 2012 reflect an overall sentinel event rate for surgery-related procedures (anesthesia-related event, operative/postoperative complication, unintended foreign body retention, wrong patient/wrong site/wrong procedure) of 36% of all reported sentinel events. Additionally, wrong patient/wrong site/wrong procedure events accounted for 34.7% of all surgery-related sentinel events in 2012, increasing from 31% in 2011 to 29% in 2010. Although safety concerns are inherent to the surgical field because of the presence of complex procedures, increasing technology, personnel turnover, and increasing demands for efficiency and cost effectiveness, our goal is to create the safest environment possible.

Teamwork has been shown to be important for maintaining a culture of safety. In fact, risk-adjusted surgical morbidity has been found to be directly related to levels of teamwork including communication and collaboration within surgical teams. Evidence has shown that when infrequent team behaviors were demonstrated, patients were more likely to experience death or major complications. In a deployed combat environment, factors contributing to team degradation are magnified because of constantly changing missions, varying degrees of experience, limited or fluctuating resources, high personnel turnover, and increased degree of injury. The importance of teamwork and maintaining a culture of safety while deployed cannot be over-emphasized.

TeamSTEPPS is an evidence-based teamwork system aimed at optimizing patient outcomes by improving communication and teamwork skills among healthcare professionals. This program was developed by the Department of Defense (DoD) Patient Safety Program in collaboration with the Agency for Healthcare Research and Quality and is based on many of the principles found in aviation crew resource management (CRM). CRM, applied to the operating room (OR), has been demonstrated to increase the use of preoperative checklists and promote a culture of safety. Although implementation and application of TeamSTEPPS has been evaluated in the United States, its potential to affect patient safety has only recently been investigated in a combat theater of operations, with promising results.

Using the principles of TeamSTEPPS, Surgical Team Assessment Training (STAT) was developed to evaluate existing trauma systems either in garrison or on the battlefield through the use of standardized trauma simulation scenarios and enhanced team-training instruction. Actual trauma scenarios form the basis of STAT to optimize training and evaluation. This form of instruction is based on the premise of the Army motto: “train as you fight.” Combat trauma often occurs in chaotic, austere environments with limited personnel, resources, and complex injury patterns not experienced in civilian trauma centers. Each level of care for the injured war fighter requires an immense degree of cooperation and teamwork to rapidly evacuate to higher levels of care. This complex environment serves as a backdrop for STAT design to truly simulate combat injury scenarios and provide unique opportunities for evaluation and assessment of the trauma team. The purpose of this article is to describe implementation of a new educational simulation and team-training program (STAT) in a combat theater and describe staff perception following training.

**Methods**

**Course design**

The STAT course is a multidisciplinary team-training program that teaches teamwork and trauma-specific resuscitation roles to deployed physicians, nurses, medics, OR technicians, and other medical support personnel using trauma simulation scenarios. Founded on the principles of TeamSTEPPS, the course targets various types of learners through a combination of didactics, hands-on simulation-based training, video review, and evaluation. The course begins with a morning session of 2 trauma simulation scenarios followed by a video review and an after action review (AAR) where formal evaluations are discussed. After the morning session, a structured 2-hour didactic session on STAT principles is delivered. To practice what was learned, a second trauma simulation scenario consisting of a mass casualty situation takes place. This afternoon session is followed by a video review and an AAR. Finally, participants are asked to complete a course questionnaire.

**Didactics**

The didactic session consists of a 2-hour interactive lecture given between the morning and afternoon trauma simulation scenario sessions. This lecture serves to introduce the 5 core principles of TeamSTEPPS: team structure, leadership, situation monitoring, mutual support, and communication while incorporating them with STAT, which focuses on caring for the injured war fighter in the austere combat environment.

**Simulation scenarios**

Twenty trauma scenarios were created from the Baghdad Combat Support Hospital (CSH) trauma patient database. The scenarios were supported with actual radiologic data in the form of X-rays and computed tomography scans, as well as pertinent laboratory data provided in real time.
during case evolution. Medical moulage application to simulated casualties enhanced realism. Activation of the trauma system occurred through normal communication channels with limited data regarding the number and severity of injured to mimic real combat evacuation scenarios. Two trauma scenarios were completed in the morning session. The afternoon session consisted of a single more complex mass casualty scenario with 3 to 5 more severely wounded casualties in an attempt to overwhelm existing trauma assets.

Feedback

Formal feedback for all Level II Forward Surgical Team (FST) and Level III CSH units was provided. The subjective feedback comments centered on the following phases of patient care: prehospital, arrival/triage, initial resuscitation, OR, recovery, and evacuation.

Feedback for the initial triage and resuscitation phases were provided using a standardized system developed at the Army Trauma Training Center in Miami. The first page (Fig. 1) of the form focused on the prehospital phase in regard to facility-wide notification of the incoming trauma, patient administration division, and ancillary support services. The second page (Fig. 2) of the Army Trauma Training Center form focused on the arrival triage and initial resuscitation phases. Critical sections in this evaluation included the following: defined trauma team roles, specific provider tasks as defined by Advanced Trauma Life Support principles, and critical team concepts (structure, leadership, situation monitoring, communication, mutual support). Feedback was accomplished through an AAR.

Once the patient moved from the resuscitation phase, a Surgery Brief Guide (Fig. 3) was used through the OR to recovery phases. This form was modeled after an existing one used for elective surgery at Madigan Army Medical Center. The form uses a universal protocol-based checklist to improve communication among anesthesia, nursing, technician, and surgeon. It contains a preoperative checklist, a postoperative checklist, an intraoperative critique, a recovery/intensive care unit (ICU) handoff, and a follow-up section to close the loop on issues identified during the case.

All deployed trauma units were provided STAT instruction and feedback in the country of Iraq during July and August 2011. The teams consisted of 1 board-certified surgeon, 1 trauma nurse, and 1 medic. The surgeon was placed in charge of the simulation and the nurse was responsible for documenting written feedback for the trauma team, which was used to craft the AAR. The medic was responsible for teaching each team medical moulage techniques to improve realism for each simulation. Summary AARs were sent to all units describing the evaluation with respect to items to sustain, items to train, and all observational comments (Fig. 4).

After action review/video debriefing

AARs were conducted with 100% of the participants immediately following the simulation scenarios and lead by
A team of 4 multidisciplinary, multiservice evaluators trained in, and experienced with, combat casualty care and team training. Key areas analyzed were TeamSTEPPS core principles found to be integral to improving patient outcomes.3 The instructors and participants reported on team structure (defining your team, establishing a team leader, identifying and executing team roles), leadership (planning approach, problem solving, using resources), communication (closed loop, using call-outs and check backs, performing clear hand-offs), and mutual support (providing oversight, resolving disagreements, using of time-outs). In addition, each AAR included a review of the evaluations and video captured during the simulations. These tools are used to illustrate the presence or absence of teamwork behaviors during the resuscitations and to identify strengths and weaknesses. Additionally, the afternoon AAR contrasted the morning and afternoon scenarios, highlighted improvements, and discussed strategies to incorporate STAT.

Questionnaires

Upon completion of the course, each participant was provided an on-line questionnaire to assess perceived effectiveness of training (Fig. 5). Professional role, number of deployments, and previous teamwork training were queried. Questionnaires also assessed team use of checklists following the course, the utility of the course, and suggestions for improvement. Specifically, survey questions included single-choice selections from the following choices for questions related to team activities before and after STAT: yes, always; yes, some of the time; yes, rarely; no, never. Survey questions which addressed the individual’s perception of the value of STAT were rated by a 5-point scale: not valuable at all; somewhat valuable; neutral; valuable; very valuable. Questions regarding the participant’s perception of the likelihood of trauma team training to improve outcomes or save lives were also rated by a 5-point scale: not likely at all; somewhat likely; neutral; likely; very likely.

Statistical analysis

Data were analyzed using Student t test and chi-square test where appropriate and a P value of less than .05 was considered significant.

Results

Two hundred twenty deployed personnel from Forward Surgical Teams and CSHs were trained and subsequently offered participation in an anonymous on-line survey which
comprised 15 questions following STAT. Sixty-one trainees (28%) completed the survey: 11 physicians, 3 nurse anesthetists, 3 physician assistants, 22 nurses, 9 medics, 5 OR technicians, and 8 other medical support personnel. Forty-nine percent of respondents (29/61) were on their first deployment, 31% (18/61) were on their second deployment, and 20% (12/61) had deployed 3 or more times.

All participants were queried regarding previous formal teamwork training in either TeamSTEPPS or other teamwork training. Forty-two percent (26/61) had previous training in TeamSTEPPS, 30% (18/61) had other teamwork training, and 28% (17/61) had no prior teamwork training. Approximately one third (22/61) of participants surveyed felt that this course would be “very valuable” before completing STAT. However, after the course, statistically significantly more respondents felt it was “very valuable” compared with before the course (53% vs 37%, P < .05) despite more than 70% of all respondents having previously trained in a formal
teamwork course. Seventy-seven percent reported that it would improve overall patient safety and outcomes. Seventy-eight percent reported that it would likely contribute to saving lives in combat. Moreover, 95% advocated that STAT should be provided to surgical teams before deployment, including nurses and medics working in the emergency and ORs, scrub technicians, and military emergency medicine and surgical residents. Most importantly, 61% stated that STAT changed the way their team performed simulation for trauma training during deployment.

Comments from respondents focused on praise for the high quality, realism, and difficulty of the simulation scenarios. Others valued the ability to apply TeamSTEPPS in a practical manner (forcing reassessment of team dynamics), the ability to identify weak spots in the system, receiving instant feedback with the ability to “see themselves” through the use of video during the AAR, applying a standardized approach to OR communication, and the use of the preoperative brief and postoperative debrief tool. Suggested areas for improving STAT included incorporation of intensive care unit and ward scenarios, implementing STAT prior to deployment, and teams performing regular drills using this curriculum. For most teams, the number one concern voiced was minimal co-ordinated teamwork training and instruction before deploying into the combat zone. Participants linked this issue to a fragmented timeline of rotations for deploying doctors, nurses, and medics in both the reserve and active components.

**Comments**

STAT, a new educational simulation and team-training program, implemented in a combat theater improved team
member’s perception of communication and subsequent performance of clinical drills in a group of deployed OR personnel. In addition, based on participant feedback, TeamSTEPPS training, as implemented in the STAT curriculum, was felt to likely improve overall patient outcomes and save lives. The feedback also indicated that it should be offered to both surgical and emergency residents, as well as all surgical team members, before deployment.

Improved communication in the OR is a prerequisite to reducing adverse outcomes. Lingard et al.\(^\text{10}\) in his 2004 study, found communication failures in up to 30% of team exchanges and up to one third of these resulted in effects that compromised patient safety. In addition, Mazzocco et al.\(^\text{3}\), in a study of surgical team behaviors and patient outcomes, showed that surgical teams who fail to share information, either intraoperatively or during handoffs, are more

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**Figure 5** Survey tool questions.

1. What is your professional role at this time? Physician/Nurse/Medic/OR Technician/Other
2. Please indicate how many times you have been deployed (including this deployment). 1/2/3/4/5/\(>5\)
3. Have you had formal teamwork training prior to this deployment in either of the following categories? TeamSTEPPS/Other teamwork training
4. If you had training other than TeamSTEPPS, please indicate what course you attended.
5. Prior to participating in this course did your team:
   a. Use a standard preoperative checklist
   b. Use a standard postoperative checklist
   c. Use a standard postoperative debriefing tool
   d. Use OR case preference lists
6. Following participation in this course does your team now:
   a. Use a standard preoperative checklist
   b. Use a standard postoperative checklist
   c. Use a standard postoperative debriefing tool
   d. Use OR case preference lists
7. Prior to participating in this course, how valuable did you feel this course would be for your team/you personally?
8. Following your participation in this course, how valuable did you feel this course will be for your team/you personally?
9. Please answer the following questions about the trauma team training:
   a. How likely do you feel this training is to improve overall patient outcomes?
   b. How likely do you feel this training is to save lives?
10. For each of the following groups, please indicate whether or not you feel that they should have this type of training:
    a. Surgical teams prior to deployment
    b. Surgical residents in training
    c. Emergency medicine residents in training
    d. Nurses and medics working in the ER
    e. Nurses and medics working in the OR
    f. Scrub technicians
11. For each of the following groups, please indicate how important you feel that the trauma team training program is for:
    a. Surgical teams prior to deployment
    b. Surgical residents in training
    c. Emergency medicine residents in training
    d. Nurses and medics working in the ER
    e. Nurses and medics working in the OR
    f. Scrub technicians
12. Has this course changed the way your team now performs simulations for mass casualty exercises?
13. What did you find most valuable about this course?
14. What did you find least valuable about this course?
15. Do you have any suggestions for changes for future courses?
likely to have their patients experience death or major complications. In an analysis of communication breakdowns resulting in surgical patient injury, Greenberg et al. demonstrated that breakdowns are equally likely to occur in the preoperative (38%), intraoperative (30%), and postoperative (32%) phases of care. Interestingly, he also reported that the prevalence of emergency cases was higher than expected when examining a set of 60 cases that resulted in a surgical malpractice claim. Combat surgery is nearly always performed under emergent circumstances, suggesting that communication errors may actually be more likely to occur in the preoperative or intraoperative settings during combat.

Interdisciplinary collaboration also improves clinical outcomes. Davenport et al. in a 2007 study on reported levels of communication and collaboration within surgical teams, emphasized the importance of physician’s coordination and decision-making roles on surgical teams in providing high quality and safe care. This observation was confirmed by their data which demonstrated surgical teams whose members reported that higher levels of communication and collaboration between providers had decreased risk-adjusted morbidity.

The only published randomized trial evaluating the effect of teamwork training on preventing adverse outcomes was performed in labor and delivery and demonstrated no difference in adverse clinical outcomes between the groups. However, there was likely a significant Hawthorne effect since improvements in clinical outcomes were seen in both groups. In addition, the teamwork trained group demonstrated a clinically, and statistically significant, shorter decision to incision time for urgent cesarean delivery. This difference suggests that team training did improve coordination of care as well as provide a more rapid and effective response to an emergent clinical situation. Other areas where improvements in clinical outcomes have been demonstrated with better communication include the following: the ICU care, during neonatal resuscitation, and following recognition of shoulder dystocia. Discrepancies in perception of patient safety and teamwork exist among OR personnel. Gore et al. observed that implementation of CRM in the OR improved perceptions of patient safety among resident physicians and nurses, while attending physicians perceived no difference. In addition, using a standardized and validated questionnaire, Makary et al. found that physicians most often rated teamwork as good, while nurses perceived teamwork as only mediocre. Differences in perception between caregivers may be assessed using the Safety Attitudes Questionnaire which can assist in defining focused interventions for improving patient safety. Use of this questionnaire to evaluate STAT should be considered to determine if this method of team training affects teamwork perception between caregivers in the OR.

Combat surgery, by nature, is complex and requires the coordinated effort of multiple providers, both credentialed and noncredentialed, who typically forward deploys to form a functioning surgical team or unit. To establish such a team, the Armed Forces deploy individuals who come together to make up the unit and often these individuals have not previously worked together. At other times, unit members are well known to each other providing an opportunity to train together before deployment. The constitution of deploying units varies considerably based on the mission, and between the individual branches, of the DoD.

It is imperative that all units, regardless of their composition and predeployment familiarity, function well and expertly apply the standard principles of triage and lifesaving resuscitation and surgery in a timely and highly coordinated manner. Individual skill sets are critical and unit cohesion and efficiency may quickly develop after the individuals begin to work together in the heat of battle while supporting one another and looking beyond their own individual strengths and weaknesses. How rapidly this occurs in actual practice varies from unit to unit based on multiple factors, which may be difficult to quantify such as leadership, esprit de corps, and personal motivation. Ideally, each unit arriving in theater should be ready, and able, to treat the sickest casualty immediately upon arrival on station. DoD Trauma Registry data suggest that there is no significant degradation in clinical outcomes of patients cared for at the start of a unit’s deployment compared with later in that same unit’s deployment (verbal communication from former Joint Trauma System Director COL G. Costanzo, August 2011). Overlap of the OR staff from one unit to the next, and simulation-based team training, may help protect against degradation in clinical outcomes during these transitions.

Simulation training can also help guide best practices for patient safety and is an important addition to the TeamSTEPPS curriculum. Procedural skills simulations have been shown to be effective in reducing patient errors. For example, learning laparoscopic cholecystectomy surgery on virtual reality simulators led to a reduction in predefined errors on patients when compared with conventional instruction. Mannequin-based simulation is much more difficult to validate; however, multiple prospective trials are currently underway to evaluate the impact on patient safety and, as an important additional program, STAT should be evaluated for similar effects.

Limitations to this study include that approximately 70% of participants had some type of formal teamwork training before participating in STAT, and completing the questionnaire, which may have biased their response. We speculate that this may have contributed to the lower than anticipated post-STAT participant perception, as STAT may not have been as extensive as their previous training. Conversely, it is also possible that participants rated the effectiveness as high based on their lack of, or dissatisfaction with their previous, team-training experience. In addition, only 28% of eligible respondents completed the survey tool compromising the general application of our results. Surveys were completed within 45 days of the training. Prospective paper-based surveys were not given
immediately post-training because permission to perform this survey was not obtained until after training at all sites had been completed. Finally, the lack of objective data and measures of improved proficiency, or subsequent patient outcomes, in these units is acknowledged. Future studies must evaluate these critical outcomes in deployed surgical units who undergo STAT.

Although combat surgery is performed in austere environments with limited resources, many of the principles and practices learned in theater can be applied to other settings. Based on the work presented here, the DoD is encouraged to consider further study of STAT for the predeployment phase of both units and individuals. In addition, consideration should be given to applying this training to medical units from other government and civilian agencies who have a role as first responders to a civilian natural or humanitarian disasters, since STAT may be scaled for a variety of unit sizes and the clinical scenarios may be modified to include casualties more typical of natural disasters or humanitarian crises.

Rigorous training emphasizing individual, and some team, skills is already performed in collaboration with the DoD at civilian trauma centers across the United States such as the Army’s Ryder Trauma Training Center in Miami, the Navy’s Trauma Training Center at the University of Southern California, and the Air Forces’ Center for the Sustainment of Trauma and Readiness Skills programs. STAT could also serve as a means of reinforcing training offered at the various predeployment civilian trauma emersion sites when provided in theater.

The next phase of study should focus on development of specific clinical metrics that could measure if STAT “in situ” training improves clinical outcomes, just as previous work in the delivery room found that “in situ” drills for shoulder dystocia events resulted in better coordination by teams and a reduction in neonatal birth injuries. 

Alternatively, surrogate measures for improved clinical outcomes to consider could include the number of times a circulating nurse leaves the OR to retrieve equipment not specifically anticipated at the onset of surgery. Ultimately, however, the clinical outcome of the patient is the most critical measure and must be the principle outcome of interest.

Regardless of the method used to teach principles of teamwork and improve team dynamics for the benefit of the patient, ultimate success or failure relies directly upon clinical leaders adopting and implementing the knowledge and attitudes of high performing teams. In most instances, this leadership is the responsibility of the primary surgeon who must ensure that the environment is one that permits a flattened hierarchy and the critical techniques and strategies of high performing teams including leadership, structure, situation monitoring, communication, and mutual support are consistently implemented and demonstrated by team members, especially the team leader.

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