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EVALUATION OF HANDOFF OUTCOMES IN A MULTI-SITE CONTINUUM OF CARE EXERCISE (HANDOFFS)

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14. ABSTRACT

Patient handoffs are a critical element in the chain of care for the injured Warfighter. The importance of the handoff process has been validated in civilian research where improved outcomes have been linked to the use of standardized templates. In the military setting, time constraints, patient complexity, complete handoffs, and environmental factors requires a brief, but effective, communication tool. The Situation-Background-Assessment-Recommendation (SBAR) and Mechanism/Medical Complaint-Injuries/Illness-Signs/Symptoms-Treatments (MIST) techniques meet this requirement but are not always practiced in a non-combat environment. We evaluated the integration of formal training SBAR and MIST into the Center for the Sustainment of Training and Readiness (CSTARS) platform in a "before-after" educational intervention to examine baseline adherence to these handoff techniques and impact of the educational intervention. A total of 73 SBAR and 23 MIST handoffs were reviewed and scored for adherence to their respective technique. Air Force medics showed reasonable adherence to the MIST format for patient handoff with no improvement after the training intervention. Air Force physicians showed significant improvement in adherence to the SBAR format with the training intervention. The inclusion of SBAR training for military medical personnel may improve adherence to a recognized and supported handoff technique to improve outcomes

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1.0 SUMMARY

Patient handoffs are a critical element in the chain of care for the injured Warfighter. The importance of the handoff process has been validated in civilian research where improved outcomes have been linked to the use of standardized templates. In the military setting, time constraints, patient complexity, complete handoffs, and environmental factors requires a brief, but effective, communication tool. The Situation-Background-Assessment-Recommendation (SBAR) and Mechanism-Injuries-Signs-Treatments (MIST) techniques meet this requirement but are not always practiced in a non-combat environment by military medical personnel.

We evaluated the integration of formal training SBAR and MIST into the Center for the Sustainment of Training and Readiness Skills (CSTARS) platform in a "before-after" educational intervention to examine baseline adherence to these handoff techniques and impact of the educational intervention. A total of 73 SBAR (35 pre-training, 38 post-training) and 23 MIST (16 pre-training, 7 post-training) handoffs were reviewed and scored for adherence to their respective technique. Air Force medics showed reasonable adherence to the MIST format for patient handoff with no improvement after the training intervention. United States Air Force (USAF) physicians showed significant improvement in adherence to the SBAR format with the training intervention.

The inclusion of SBAR training for military medical personnel may improve adherence to a recognized and supported handoff technique to improve outcomes.

2.0 INTRODUCTION

Effective handoffs of care are frequently cited as critical for maintaining safety and avoiding communication problems. Transitions in trauma care, like other forms of handoffs, are vulnerable to systems problems and human errors. The importance of handoffs and their potential impact on patient care have been recognized for many years. Collaboration between the Department of Defense (DoD) and the Agency for Healthcare Research and Quality (AHRQ) began in 2003 to develop a systematic approach to handoffs and the training of medical teams. This collaboration led to the deployment of the Team Strategies and Tools to Enhance Performance and Patient Safety, or TeamSTEPPS™, program which is still widely supported in the United States.

Through this program several communication strategies and associated communication tools are emphasized to improve the quality of patient handoffs. The SBAR technique is one designed to communicate critical information that requires immediate attention and action concerning a patient's condition. This was primarily designed to improve communication between providers in a setting where a complete handoff of care is not required, but an emergent or urgent situation may need to be addressed (Figure 1).

Figure 1. Example of SBAR approach to addressing new event

TeamSTEPPS™ incorporates a more thorough technique when there is a transition in care across the continuum where questions, clarifications, and confirmation are incorporated into the communication between providers. The current approach uses the acronym "I PASS THE BATON" (Fig. 2). This more thorough approach is well-suited for the civilian environment which may have less time constraints than those often present during handoffs in the movement and care of the Warfighter such as occur in the tactical setting, mass casualty event, and aeromedical evacuation.

In the prehospital setting and during transition from the field to initial triage and care, techniques such as SBAR and I PASS THE BATON may not be appropriate. To provide a concise summary for these types of handoff, the MIST technique is currently employed by many emergency medical systems (Fig. 3). To date, this has not been formally evaluated for adherence in the military setting.

Figure 2. Elements of the "I PASS THE BATON" handoff technique

M	**Mechanism** or **Medical** Complaint	Name, Age, Sex **Mechanism**: Speed, Mass, Height, Restraints, Number and Type of Collisions, Helmet Use and Damage, Weapon Type **Medical**: Onset, Duration, History
I	**Injuries** or **Illness Identified**	**Head to Toe** Pain, Deformity, Injury Patterns STEMI—12-Lead / Stroke— Cincinnati
S	**Signs** and **Symptoms**	**Symptoms and Vitals** Initial, Current, Lowest Confirmed BP HR, BP, SPO_2, RR, $ETCO_2$, BG GCS: Eyes ____ Verbal ____ Motor ____
T	**Treatments**	Tubes, Lines (Location and Size), Fluids, Medications and Response, Dressings, Splints Defibrillation / Pacing

Figure 3. Elements of the MIST technique for handoff of the injured patient

This project was initiated to evaluate the current adherence of handoffs in a simulated military setting using the CSTARS multi-site training platform. Since the platform includes systematic use of simulation-based training with handoffs at the completion of an exercise, we conducted a "before-after" educational intervention to assess baseline compliance with the MIST and SBAR handoff techniques with and without additional training incorporated into the formal course.

3.0 BACKGROUND

3.1 Prior Work:

The military trauma system is characterized by multiple transfers of care for the most critically injured casualties, at times involving up to 10-handoffs during the movement of a single casualty. After performing initial prehospital stabilization followed by damage control resuscitation and surgery, the casualty may be moved thousands of miles over several days to reach definitive care in the continental United States (US). To date, the military has not developed universal patient handoff requirements, protocols, or training although standardized handoff protocols and training have been shown in the civilian setting to reduce medical errors.[3,9,17-19]

Over the past 14 years, the military trauma system has evolved to rapidly move critically injured patients from the point of injury, to far forward surgery, and onto definitive care within the continental US in a matter of days.[2,4] This trauma system is characterized by multiple levels of care that may incorporate up to 10 handoff events during patient movement (Role 1 to medical evacuation team (MEDEVAC), MEDEVAC to Role II, Role II to Transfer Team, Transfer Team to Role III, Role III to Critical Care Air Transport Team (CCATT), CCATT to Role III theater hospital, Role III theater hospital to CCATT, CCATT to Role IV, Role IV to CCATT, CCATT to Role V). Even more handoffs may occur within each facility, involving transfers between the emergency department, operating room, and intensive care unit. Each handoff event carries the potential for loss of critical information that may contribute to delays in treatment of critical injuries or introduction of medical errors.[1,12,18]

Communication errors are recognized as a major factor in a significant number of patient safety events and medical errors; and in 2007, the Joint Commission established standardization of patient handoffs as a National Patient Safety Goal (NPSG) to improve communication to prevent omissions.[6] NPSG 2E required facilities to implement a standardized approach to handoff communication.[13] This has resulted in a number of programs at the national, regional, and individual facility level to improve the quality of handoffs at all stages of care transition.

In the setting of trauma management, previous investigations found that physicians accurately recalled only 36% of the paramedic verbal report relating to pre-hospital care of trauma patients[15] and that only 73% of key prehospital data points were documented by receiving staff.[5] This loss of information can potentially be reduced though the use of structured handoff training. Work done in civilian hospital settings involving transfers within the hospital, such as from the emergency department to admitting team and from the operating room to the intensive

care unit has been able to demonstrate a reduction in medical errors and adverse events when

structured handoffs are employed by medical personnel.[12,19] In the largest of these studies, [11], 740 pediatric patient admissions were reviewed for the presence of medical errors. Approximately half of these admissions were done prior to implementation of a structured handoff tool incorporating the I-PASS pneumonic (**I**llness severity, **P**atient summary, **A**ction list, **S**ituation awareness and contingency plans, and **S**ynthesis by receiver). The addition of the structured I-PASS elements resulted in a 23% relative reduction in overall medical errors and a 30% relative reduction in the rate of preventable errors. All of this was accomplished without increasing the time required to perform written and oral handoffs suggesting that incorporation of a structured handoff is superior to ad lib behaviors.

In addition to the problems associated with communication, the limited ability to record medical information during patient care in a resource constrained, military, out-of-hospital environment limits the accurate transfer of clinical information. Limitations of prehospital and transport data collection include poor availability of prehospital records from point of injury care[11,14] and competing demands of ongoing patient care during transport. Thus, real-time data are not generally available to the receiving hospital teams at the time of initial patient transfer and evaluation.

Unfortunately, only limited work has been done looking at patient handoffs within the military trauma system. To address the problem of non-standardized handoffs, the USAF Aeromedical Evacuation (AE) system in 2012 implemented the SBAR checklist with a goal of reducing information loss and improving patient safety during the aeromedical evacuation of military casualties.[8] This pre-flight checklist focuses on verifying patient identification, inflight interventions and equipment, and is intended to supplement the medical record to ensure that key information is transmitted and identified tasks are completed. The SBAR method emphasizes a structured verbal handoff, reduction of distractions during the handoff, a written handoff tool, and synthesis/repeat back by receiver. Specifically, SBAR represents crucial steps or types of information like those in the I-PASS algorithm. Information that must be conveyed during a successful patient handoff are Illness Severity (Stable, "watcher," unstable), patient summary, action list and timeline, situation awareness and contingency planning, as well as recapitulation and repeat by the receiver. SBAR is conducted as a verbal report augmented by a written report.

Outside of the aeromedical evacuation system, current Joint Trauma System Clinical Practice Guidelines for transport from the field to the first line of medical care or during interfacility transport of patients between theater medical treatment facilities (MTFs) recommend the use of the MIST handoff report. Similar to other handoff scenarios, transfer from emergency medical service personnel to hospital-based practitioners suffers from the same dropout of information and accuracy.[10,20] To date, the SBAR and MIST handoff reports have not been formally evaluated in a military medical training platform.

3.2 Military Relevance

Implementation of a handoff program with specific handoff training and structured handoffs has resulted in significant reductions in medical errors and preventable adverse events in civilian hospitals. The military trauma system, which involves multiple handoffs of critically injured patients within a short time span, can potentially achieve similar improvements in patient

safety through a focus on patient handoff training. Currently, most military casualty care exercises do not focus on patient handoff events, and providers at different levels of care, including en route care, do not train together to improve patient handoffs with adjoining levels of care. This multi-site training exercise, when combined with a handoff training curriculum and structured handoffs, has the potential to dramatically improve patient safety within the military trauma system. The training program developed in this project can serve as the framework for a comprehensive, joint en route care training system.

The addition of electronic data capture and electronic patient care records to structured handoff training, when available, would likely further improve the transfer of accurate and complete information at the time of patient handoff and may further improve measurable handoff outcomes as well as overall patient safety and contribute to process improvements via input into the trauma registry.

4.0 METHODS

A prospective study of a patient handoff events performed by trainees at the CSTARS platforms was approved using a "before-after" design in an educational setting by the Institutional Review Board at the Air Force Research Labs with Institutional Agreement at the CSTARS sites. Standardized patient simulations (Appendix 1) were incorporated into existing training exercises at the Baltimore and Cincinnati CSTARS sites incorporating initial field care (Baltimore), Role 2 management (Baltimore), and CCATT transport (Cincinnati). Baseline ("unstructured") ability to perform handoffs scored by the MIST (field care) and SBAR (Role 2 and CCATT) report formats was recorded and assessed for adherence to the recommended format with a minimum of 40 handoff events. The CSTARS sites then incorporated standardized training to include video and didactic components focused on these handoff formats (Fig. 4). Trainee performance was then evaluated using the same scoring system after the introduction of the new educational element for subsequent handoff performance. The scoring system was based on included/missed score for each sub-element (Appendix2). The total score was then calculated as the sum of elements included in the handoff for evaluation purposes.

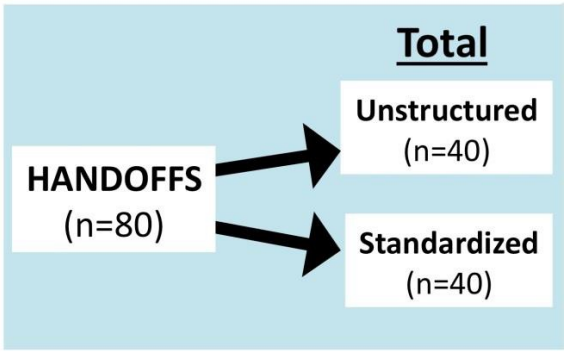

Figure 4. Pre-study determination of minimum number of events to be recorded

Prior to implementation, the CSTARS trauma training sites collaborated to develop a standardized patient handoff curriculum based on the most recent civilian curriculum, the I-PASS curriculum,[17] modified as necessary to include military-specific information including

previously implemented military TeamSTEPPS™ (Team Strategies and Tools to Enhance Performance and Patient Safety) curriculum and to meet military operational requirements for use of SBAR and MIST handoffs. Joint input was obtained from the Joint Trauma System (Defense Trauma Center of Excellence) to ensure adherence to the current recommended standards.

The CSTARS trauma training sites collaborated to develop a dyssynchronous, multi-site continuum of care casualty exercise involving treatment of casualties from point of injury to definitive care with 3 handoff events: 1) field care to Role 2 treatment facility, 2) Role 2 treatment facility to tactical CCATT, and 3) CCATT to Role 3 treatment facility. Standardized exercise casualty scenarios were developed (Appendix 1). The same patients were used at all sites during the exercise to minimize variability in reporting requirements.

For the baseline handoff evaluation, data was collected on unstructured patient handoffs (current standard care) that were video-recorded for review. Trainees performing the initial evaluation and treatment and/or transfer of the patients were recorded during their initial handoff briefing to a CSTARS instructor filling the role of the receiving party. To maximize privacy considerations, all videos were performed with exclusion of the trainees face and identification badge but allowing for audio capture.

Once a minimum of 40 pre-training handoffs were obtained, formal handoff training was implemented at each of the CSTARS training sites. Videos incorporating a description and model handoff for both the MIST and SBAR formats was produced and all trainees were required to watch the video prior to their course. Additionally, a didactic component was integrated into the CSTARS schedule incorporating the video, a short presentation, and discussion session to reinforce the importance of adhering to a structured handoff format. Students were additionally provided hard copy cognitive aids incorporating the handoff elements for each format. All trainees then participated in simulation-based training exercises with the same patient scenarios provided to the pre-training groups. Videos were recorded and saved for analysis.

For the analysis phase, four independent reviewers were used for the MIST reports and three reviewers for the SBAR reports to assess for interrater correlations. The recorded reports were assigned random numbers to mask the pre- and post-training designation to minimize any bias inherent in the review and scoring process for which the reviewers were blinded. No reviews were completed prior to the completion of data collection.

Due to limited preliminary data, the power calculation is based on effect size defined in Cohen (1988).[7] It is expected to have 91% power to detect medium effect size (0.25) difference in each of metrics among three groups under a significant level of 0.05. Additionally, an analysis of the correlation by reviewers was conducted.

Intraclass correlation coefficient (ICC) were used to determine interrater reliability of reviewers' scoring of individual MIST and SBAR items as well all items combined. In the reliability study, all reviewers rated all handoffs and all reviewers were assumed to be selected randomly from a larger population of reviewers. Therefore, the obtained ICCs were computed by

mean-rating, absolute-agreement, 2-way random-effects model with 4 (MIST) and 3 (SBAR) raters across 23 handoff scenarios.

Mean and standard deviation as well as median and interquartile range were used to describe MIST and SBAR scores. To determine if additional training improve performance (as measured by MIST and SBAR scores) or differences exist between sites/course for the SBAR handoffs, repeated measures linear mixed effect models were used. Statistical significance was determined at alpha of 0.05. SPSS version 25 (SPSS Inc, Chicago, IL) was used for data analysis.

5.0 RESULTS

A total of 93 handoff events were captured during the course of the study with 52 pre-training and 41 post-training videos available for analysis. In the pre-training group, this included 17 MIST, 6 SBAR (CCATT), and 29 SBAR (Role 2) handoff events. The post-training group included 6 MIST, 7 SBAR (CCATT), and 28 SBAR (Role 2) handoff events (Fig. 5).

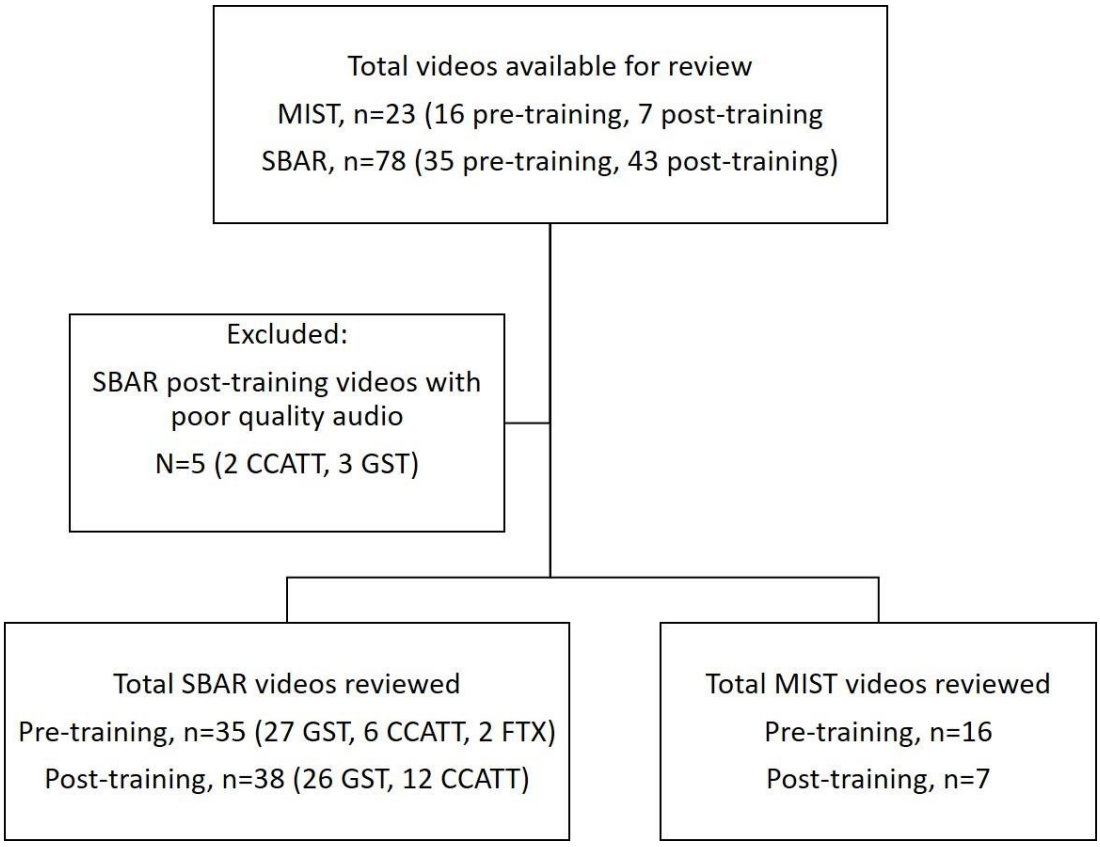

Figure 5. Videos obtained and included in analysis

Analyses of the association between handoff format scores and other variables were conducted using repeated measures linear fixed effect models. The result showed that average MIST score was slightly higher for the post-training group, mean (standard deviation) =4.46

(1.23) vs. 4.39 (1.06) but the result was not statistically significant, p=0.96. There was no statistically significant difference in MIST score for each reviewer between the training groups, p=0.89. However, reviewer 4's average score, was significantly higher than those of the other reviewers, p<0.05(Fig 6).

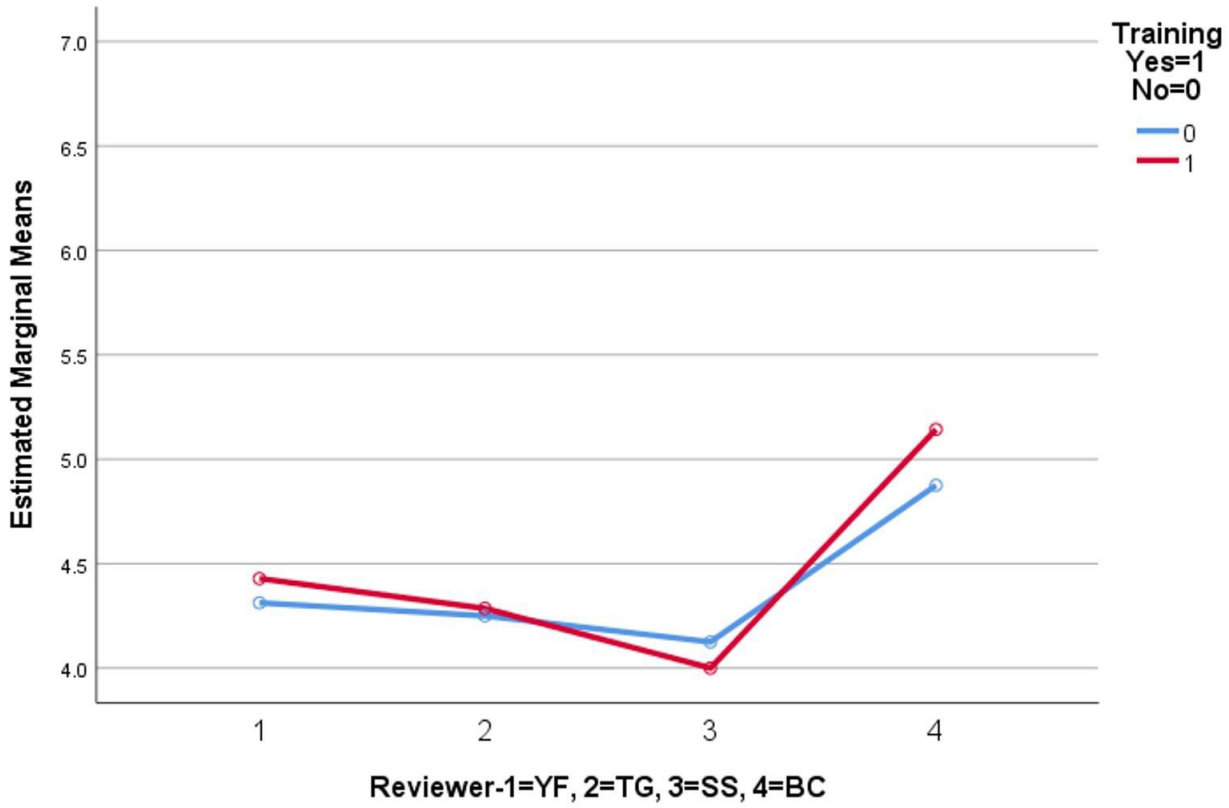

Figure 6. Estimated marginal means of MIST score

With respect to SBAR scores (Fig 7), reviewers scored the post-training group consistently higher than the pre-training group, mean (standard deviation) = 6.12 (2.48) vs 4.92 (1.74), p<0.001 and scored Ground Field Surgical Team (GFST) course lower than field exercise (FTX) and CCATT courses, 5.01 (2.07) vs. 6.95 (2.39) and 5.01 (2.07) vs. 6.50 (1.23) respectively. However, only GFST and CCATT courses differ significantly, p<0.01, and nothing else. With respect to SBAR score differences for site, Cincinnati, scored higher, 6.95 (2.39) than Baltimore, 5.07 (2.06), p<0.001). Pre-training average scores were 4.65 (1.78) and 6.22 (2.05) for Baltimore and Cincinnati, respectively with post-training averages of 5.53 (2.27) and 7.29 (2.49) (Fig 8).

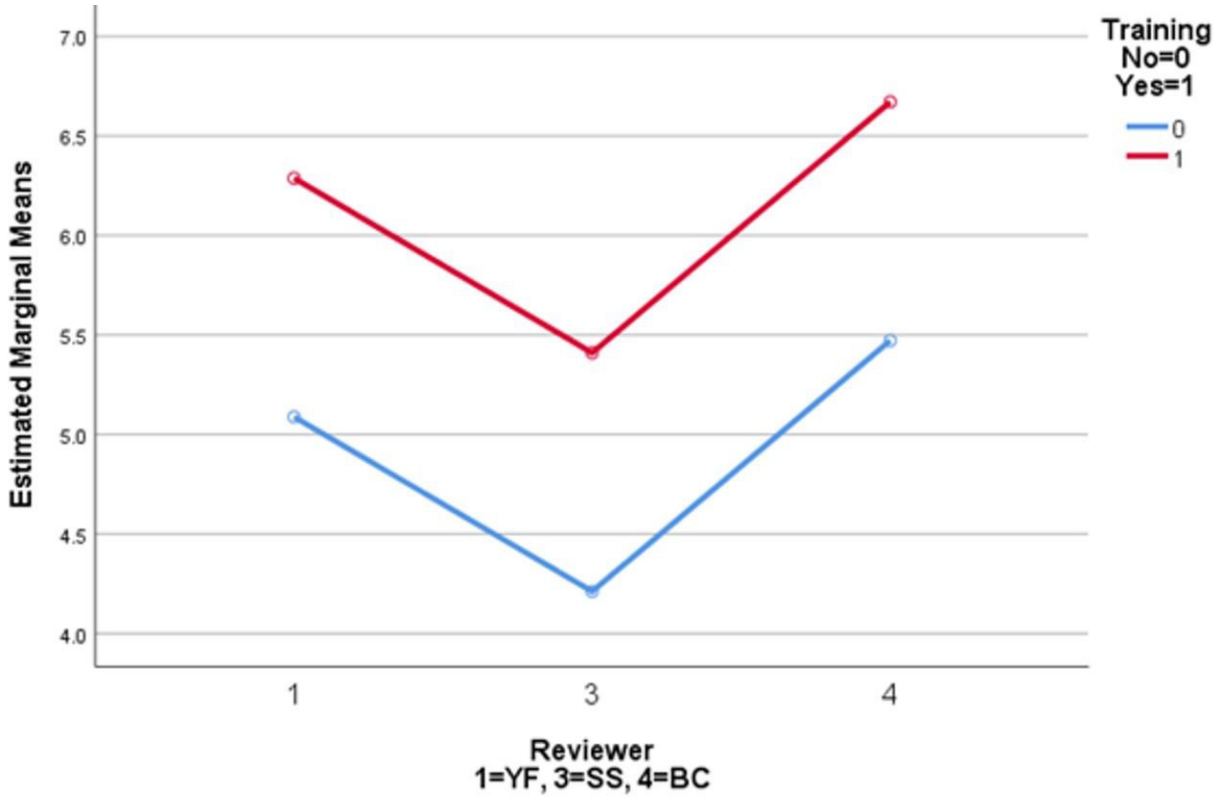

Figure 7. Estimated marginal means of SBAR score

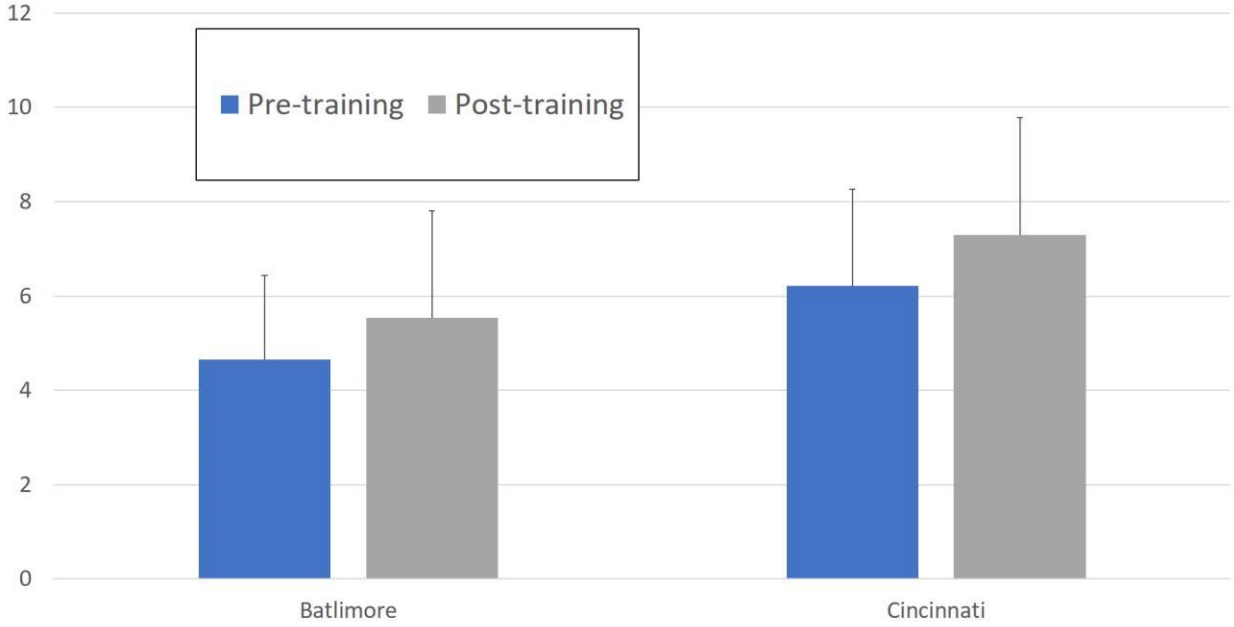

Figure 8. SBAR scores by site (mean ± SD)

ICC (95% Confidence Interval) was 0.89 (0.86-0.91) for all MIST items combined and 0.82 (0.79-0.84) for all SBAR items combined. For both MIST and SBAR scores, the ICC and the 95% confidence intervals indicated good reliability on interpretation scale of <0.5 poor; 0.5-0.75 moderate; 0.75-0.9 good and >0.90 excellent.

Based on a minimum of moderate reliability interpretations, the individual items most consistently endorsed for MIST handoff formats by the 4 reviewers were: Identify patients;0.82 (0.67-0.92), Mechanism of injury or onset of symptoms; 0.94 (0.89-0.97), and Vital signs; 0.83 (0.68-0.92). Therefore, both items under MECHANISM were endorsed consistently by all reviewers, none of the item under INJURY were endorsed consistently. Under SIGNS, only vital sign was endorsed consistently. Finally, for MIST, reviewers were not consistent in their scoring that all interventions were listed under TREATMENT (Fig 9).

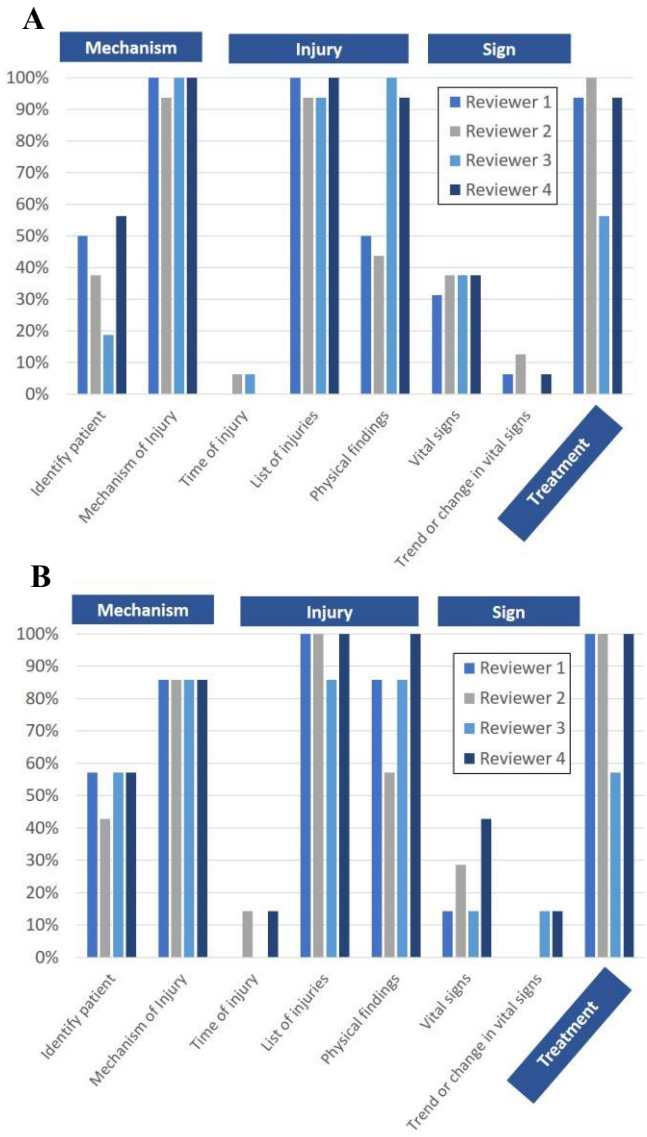

Figure 9. A) Pre-training scores by reviewer for MIST evaluation; B) Post-training scores by reviewer for MIST evaluation

For SBAR scores, the individual items most consistently endorsed for handoff formats by the 3 reviewers were the following: S2-Identify patients; 0.70 (0.53-0.81), B1-Past medical history; 0.86 (0.80-0.91), B3-Allergies; 0.89 (0.84-0.93), AS2-Vital signs and monitors; 0.71 (0.56-0.81), AS3-Critical lab values; 0.82 (0.73-0.88), Act; 0.75 (0.64-0.84), and Rep; 0.74 (0.62-0.83) (Fig 10).

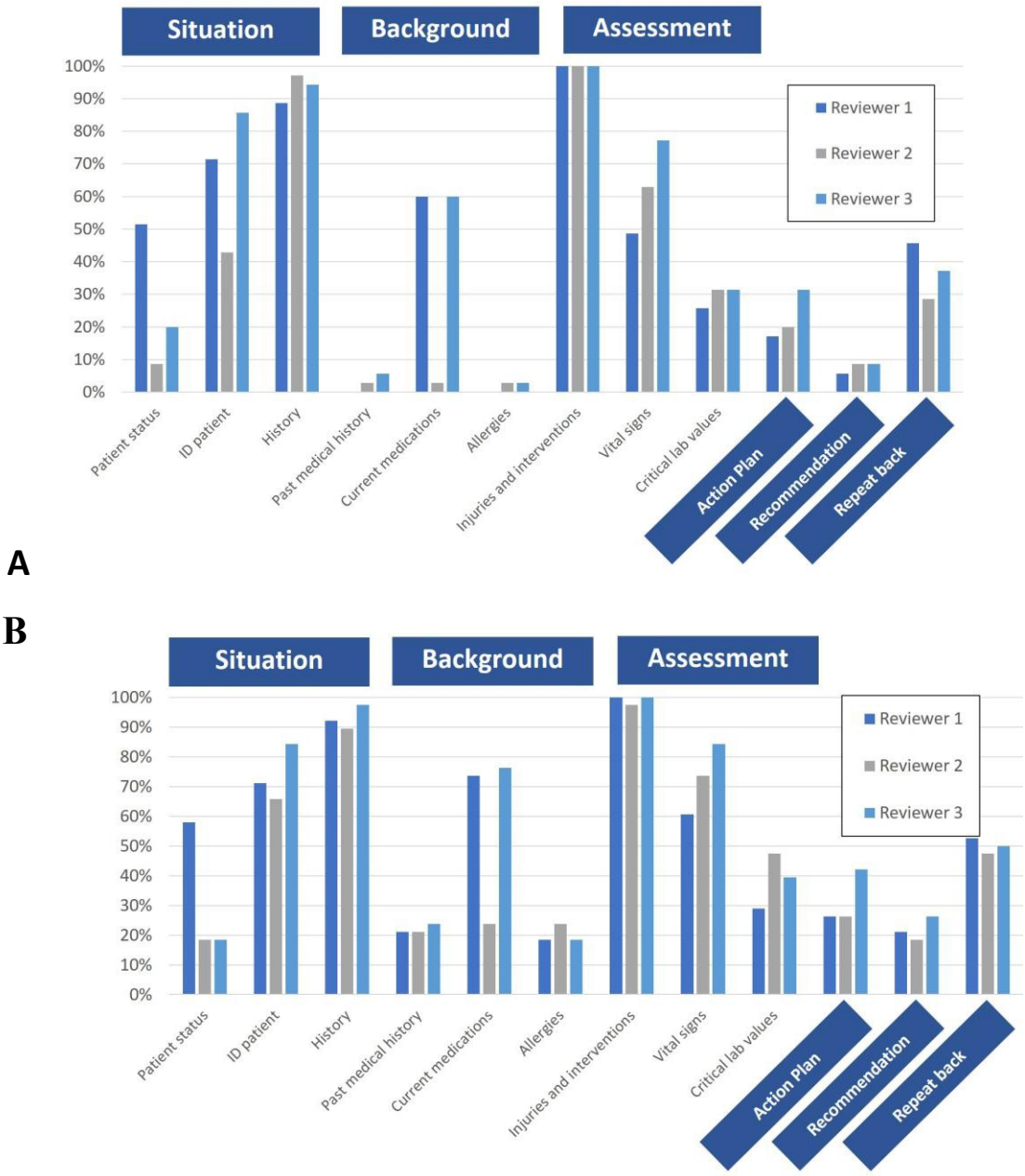

Figure 10. A) Pre-training scores by reviewer for SBAR evaluation; B) Post-training scores by reviewer for SBAR evaluation

6.0 DISCUSSION

This study evaluated the baseline handoff performance of US Air Force medical personnel attending one of the CSTARS training platforms during simulation-based training exercises using the MIST and SBAR techniques. Additionally, the incorporation of SBAR and MIST handoff curriculum into these platforms was evaluated to determine the impact on subsequent handoff performance. Baseline performance for the MIST technique with a prehospital to Role 2 handoff was better than that observed with SBAR during a Role 2 to CCATT or CCATT to Role 3. Medics on average incorporated 55% of the MIST elements into the handoff report compared to physicians who provided 41% of the SBAR elements. After incorporation of a educational intervention consisting of a separate videos covering the MIST and SBAR techniques, performance of the MIST handoff did not improve on subsequent testing while SBAR showed slight improvement.

As noted, when examining the specific elements of MIST tool, the failure to show improvement may have more to do with the use of a pneumonic rather than a specific problem with the training. Most trainees were observed to do at least one of the elements for each "letter" of the MIST pneumonic, but frequently did not address some of the minor components such as vital sign trends rather than just providing a single value. Similarly, mechanism was provided in almost all handoffs, but the time of injury and patient identifying information was excluded. In addition, MIST is also taught in the Tactical Combat Casualty Care (TCCC) programs with a simplified MIST (Fig 11) that was more in line with the approach taken by the majority of medics. This may account for the better baseline performance and failure to improve after training.

The improvement seen in the SBAR handoffs is not surprising. In this project, the medical personnel completing these handoffs are physicians from a variety of practices. Many of these individuals reported not having had specific training or no recent refresher on handoff best practices in their current clinical positions. Like the performance during MIST handoffs, certain elements were frequently excluded with the most common being past medical history, allergies, and explicit classification of patient status. The trainees also frequently failed to outline a suggested action plan and provide recommendations for subsequent treatment. This is notable since an action plan and recommendations is one of the specific "letters" for the SBAR pneumonic. These specific areas did show improvement after training but still only achieved 20% for an action plan and 50% for recommendation (up from 8% and 35% pre-training, respectively).

As a secondary endpoint, the interrater correlations were evaluated to determine whether independent video reviews by multiple reviewers would provide a consistent score. For this study, all reviewers were not actively involved in the simulation-based training and three of the four reviewers had extensive experience in simulation-based training and debriefing while one reviewer had over 20 years of experience as a trauma surgeon including several years as a CSTARS program director. Overall, the ICC for both the MIST and SBAR were rated as good although there was only fair agreement on some of the sub-elements of each scoring system.

There are several limitations that apply to this study. The population evaluated in this study was a convenience sample of individuals completing training at one of the CSTARS platforms. As a result, there was a large variation in the number and types of individuals in each class which sometimes resulted in team composition and numbers that may not correlate to real-world conditions. Nonetheless, performance of a structured handoff is a common task for all members of a medical team and this likely did not affect the results.

TACTICAL COMBAT CASUALTY CARE
(TCCC / TC3)

MIST REPORT FORMAT

MIST REPORT	
M – MECHANISM OF INJURY AND TIME OF INJURY (IF KNOWN)	Mechanism of Injury and time of injury (if known)
I – INJURY OR ILLNESS	Injury or Illness
S – SYMPTOMS AND VITAL SIGNS	A – Airway status B – Breathing rate C – Pulse rate D – Conscious/Unconscious E – Other signs
T – TREATMENT GIVEN	Such as Tourniquet/Time Applied Drugs administered

Figure 11. MIST report format used in the TCCC program

Additionally, the CSTARS platform is constantly evolving to meet operational needs. The original project design was completed when the majority of CSTARS Baltimore students were attending a 3-week course that included a field training exercise where the data was to be collected during the course. This course included pre-hospital management incorporating a direct MIST handoff from a field medic to the receiving team at a Role 2 facility where care continued with the same patient. At the Role 2 facility, resuscitation continued, and students provided handoff to the next echelon of care. One of the original aims of the study was to also evaluate the impact of the handoff on subsequent care. Unfortunately, the primary role of the CSTARS Baltimore program changed from the 3-week course to the a 2-week GFST course which did not incorporate an exercise requiring a student handoff from the pre-hospital setting to a Role 2 facility. The MIST handoff evaluation continued to use encounters during the combat medic training which was a part of a revised 2-week refresher course for medical personnel at the CSTARS Baltimore site. The change in course structure altered the project design but still allowed for incorporation of the original simulated patients since the GFST course used these patients in two separate simulation exercises at the Role 2 level. Ultimately, only 2 SBAR

handoffs came from the pre-GFST course and were unlikely to have affected the results of the study.

Finally, the use of a mixed training population (CCATT and GFST/FTX) may have affected the results. Although the educational intervention was added to both sites, aeromedical evacuation incorporates more training with a focus on communication and handoffs than routine practice. This may be a built-in bias towards the CCATT handoffs. Also, CCATT missions typically involved less personnel and fewer interventions than the GFST/FTX exercises which may contribute to improved communication and better transmission of data using the SBAR format. As noted above, the CCATT handoffs were significantly better both pre- and post-training suggesting that the course and/or nature of the handoffs better supported the use of the SBAR technique. Nonetheless, both sites showed some improvement with the incorporation of specific training focusing on the MIST and SBAR techniques.

7.0 CONCLUSIONS

Efficient and correctly performed handoffs can improve the outcomes of patients in numerous medical settings. During the management of the injured Warfighter, this is a key element that is frequently disrupted in a high demand, high output setting. With the added elements of a hostile environment, operational requirements, fatigue, and distractions, structured handoffs have the potential to save lives. Baseline performance by USAF medical personnel was moderate at baseline and improved for physicians with the addition of both didactic and video-based refresher training as part of refresher training incorporating simulation-based assessments.

The handoff training intervention was designed to be easily implemented into the training courses and delivered on a widespread scale and, therefore, relatively brief. Overall, the trainees failed to incorporate many of the specific handoff items on the checklist and defaulted to their standard, engrained behaviors, even in a training environment where they knew they were being evaluated. This occurred even when the handoff checklist was immediately available in hand. In order to change real works handoff behavior, a significant cultural change will be required, and additional training time would be necessary with constant re-enforcement throughout the course. Further work directed at the use of deliberate practice and integration of MIST and SBAR handoff training into all medical platforms is likely to improve overall performance.

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LIST OF ABBREVIATIONS AND ACRONYMS

AE	Aeromedical evacuation
AHRQ	Agency for Healthcare Research and Quality
CCATT	Critical Care Air Transport Team
CSTARS	Center for the Sustainment of Training and Readiness Skills
DoD	Department of Defense
Fig	Figure
FTX	Field exercise
GFST	Ground Field Surgical Team
I-PASS	**I**llness severity, **P**atient summary, **A**ction list, **S**ituation awareness and contingency plans, and **S**ynthesis
ICC	Intraclass correlation coefficient
MEDEVAC	Medical evacuation
MIST	Mechanism-Injuries-Signs-Treatments
MTFs	Medical Treatment Facilities
NPSG	National Patient Safety Goal
SBAR	Situation-Background-Assessment-Recommendation
SD	Standard deviation
TCCC	Tactical Combat Casualty Care
TeamSTEPPS™	Team Strategies and Tools to Enhance Performance and Patient Safety
US	United States
USAF	United States Air Force

Appendix 1: Patient Scenarios

PATIENT MOVEMENT REQUEST-Garrett

PATIENT DEMOGRAPHICS Cite# 1018329379

Patient Name: Garrett, David R. Status: A11 Cite# 1018329379 Precedence: U
ID: 555894321 Grade: E04 Gender: Male Classification:2A
Nationality: UNITED STATES Age: 20 Year CCATT: Y Special:
Y

UNIT INFORMATION Cite# 1018329379

Unit Name: 507 IN RGT 02 HHC INF BN ABN Duty Station: Com
Fax:
City: FORT BRAGG Com Phone: DSN Fax:
State/Province: NORTH CAROLINA DSN Phone:
Country: US PCS Code:

POR INFORMATION Cite# 1018329379

Address: RN237 City: FORT BRAGG State:
NORTH CAROLINA

Country: UNITED STATES Postal Code: 45219-0330 Phone:
513-555-0987

MOVEMENT INFORMATION Cite# 1018329379

Injury Type: Battle Injury Exception to Policy Comm
Transport?
Space Type: LITTER Will Return: U

Transport ID: Transport Origin:
Transport Destination:
Movement Remarks: JPMRC JD 188/0910z per TVFS Col Tan – Pt validated URGENT to BAF (Needs to move <6 h) -O2 and HOB per CCATT, STOPS, no, RON, no, CAR 5000, NV cks per CCATT//kg

ADMINISTRATIVE DATA Cite# 1018329379

Originating MTF: J5215 Kandahar-Role 3 MMU Ready Date: 6 July 2010
Destination MTF: Bagram Reason Regulated: CC
Appt: Casualty Event: OEF-Battle Injury Source System: T-WEB
Attending Physician: DSN Phone: Corn Phone:
Ward Name: DSN Phone: Corn Phone:
Last PMR State Changed by: DSN Phone: Corn Phone:
Accepting Physician: DSN Phone: Corn Phone:
Max Stops: No stops Max RON's: No RONs Altitude Restriction: 5000

CLINICAL DATA Cite# 1018329379

Primary Med Specialty: SOO- Orthopedic Surgery Primary Diagnosis: 897.6-AMPUTATION LEG, BILAT
Secondary Med Specialty: SOO- Orthopedic Surgery Secondary Diagnosis: 808.8 – PELVIC FRACTURE NOS-CLOS
Other Med Spec: Other Diagnosis:
Patient History:
20 y/o male s/p dismounted IED blast. Pt sustained traumatic B BKA, open pelvis fx, and scrotal blast injury. Vitals were BP 88/58, P 118, RR 22, SpO2 98% RA. POI performed Tourniquets placed BLE, pelvic binder, packing to scrotum, 18g PIV left AC, and ketamine 20mg given x2, c-collar and fully immobilized.
Role II → CCATT (CINCINNATI): On arrival to Role 2 pt w/ GCS 14. Pt immediately taken to OR for damage control and underwent ex-lap, resuscitative pelvic ex-fix, I & D of bilateral BKA. retroperitoneal hematoma and active extravasation of contrast. Pt taken back to OR (1610z-1650z) for pre-peritoneal packing of the pelvis.. Post-op taken to ICU for further resuscitation w/plan to return to OR in am. Pt transfused w/20 units PRBCs, 18 units FFP, TXA, 10 mg x2 FVIIa and 6 units Fresh Whole Blood. Post transfusion H/H 13/38. PT/PTT 14/57. Request urgent CCATT to Role III for further care.

Presentation to Role III (SLU): As above, tourniquets placed to bilateral lower extremities due to re-bleed in flight. Transfused x units of pRBC and y units of FFP. Additionally, low urine output and elevated peak airway pressures experienced due to abdominal compartment syndrome.

MEDICATIONS Cite # 1018329379 (5 rows) IVs (2 rows)

Medication Name:	Dose:	Frequency:	Route:	IV Location:	IV Type:	Solution: Rate cc/hr:
Ancef	1 gram	Q8	IV	Right Subclavian	TLC	NS 110
Versed	10mg/hr		cont IV	Right wrist	A Line	
Fentanyl	50 mcg/hr	Cont	IV			
Ketamine	10 mg/hr		Cont IV			
Protonix	40 mg	QD	PO			

Allergies NKDA

VITAL SIGNS, LABS AND ARTERIAL BLOOD GASES Cite # 1018329379

T: 39.6 C	P: 121	R: 18	BP: 113/88	Wt: 170 lbs	Oxygen Rate: Per CCATT
Oxygen Mode:	HGB: 13	HCT:38	WBC:42000	Date Taken:	
SPO2 Rate: 95	SPO2 Comments:				
Ventilator Mode: AC	FiO2: 40	TV: 800	Ventilator Rate: 12	Peep: 5	PS: 0
pH: 7.33	PO2: 81	PCO2: 44.4	HCO3:23.6	BE: -2	

DRAINAGE (2 rows) Cite # 1018329379 Orthopedic (2 rows)

Drainage Location:	Type:	Suction Type:	Suction Amount:	Type: Location:
Oral	OG	intermittent		Extended
Fixator Other				
Bladder	Foley Cath	Gravity		
Abdomen	Other	Cont		

PMI DATA Cite # 1018329379

Cardiac Monitor: Y	Suction: Y	Pulse Ox: Y	Incubator: N
Ventilator: Y	Pump: Y	Stryker: N	Traction: N

TRANSPORTATION INFORMATION Cite # 1018329379

Orig Transport Name:	POC:	Com Phone:	DSN Phone:
Dest Transport Name:	POC:	Com Phone:	DSN Phone:

ADMIN REMARKS: Cite # 1018329379

PATIENT MOVEMENT REQUEST-Brumley

PATIENT DEMOGRAPHICS Cite# 0455678922

Patient Name: Brumley, Chuck Status: A11 Cite# 0455678922
Precedence: U
ID: 215-12-3434 Grade: E5 Gender: Male Classification: 2A
Nationality: UNITED STATES Age: 24 Special: N

ADMINISTRATIVE DATA Cite# 0455678922

Originating J5215 Kandahar-Role 3 MMU Ready Date: 20080109
Destination MTF: Bagram Reason Regulated: CC
Appt: Casualty Event: DNBI Source System: T-WEB
Attending Physician: Dr Barnes, Maj DSN Phone: Corn Phone:
Ward Name: DSN Phone: Corn Phone:
Last PMR State Changed by: DSN Phone: 779-4201 Corn Phone: 618-229-4201
Accepting Physician: Role III DSN Phone: Corn Phone:
Max Stops: Unrestricted Max RON's: Unrestricted Altitude Restriction: None Comm Travel? N

CLINICAL DATA Cite# 0455678922

Primary Med Specialty: SURGERY
Primary Diagnosis: THIRD DEG BURN MULT SITES
Secondary Med Specialty:
Secondary Diagnosis:
Other Med Spec:
Other Diagnosis:
Patient History:

28 y/o M, GATE GUARD IN VICINITY OF VBIED. BROUGHT TO CSH WITH CIRCUMFERENTIAL BURNS TO BUE AND LOWER RLE, ANTERIOR TRUNK AND ABDOMEN, NO FACIAL BURNS OR DYSPNEA. BP 136/88, P 103, RR 28, SpO2 97% RA. GCS 15, 16g PIV right AC, c-collar, morphine 10mg IV given. GCS 15.
Role II → CCATT (CINCINNATI): On arrival to Role 2, GCS 15 and vitals stable. C-spine CLEARED, NO SKELETAL TRAUMA. Pt w/ complaints of SOB. Loss of pulse to RLE. Pt intubated and taken to OR for debridement and escharotomies to RLE, BUE, and anterior trunk. Pt kept intubated postoperatively. FLUID RESUSCITATION ONGOING.
Presentation to Role III (SLU): As above, endotracheal tube replaced in flight due to perforated cuff. Burn resuscitation flow sheet maintained in flight to include starting albumin 5% due to high projected IVF resuscitation.

MEDICATIONS Cite # 0455678922

Medication Name:	Dose:	Frequency:	IV Location:	Solution: Rate cc/hr:
Morphine	2-4mg IV	q2 prn	R IJ	LR 225
Lovenox	30 mg SQ	BID		
Protonix	20 mg IV	q day		

VITAL SIGNS AND LABS Cite # 0455678922

T: 98 P: 115 R: 16 BP: 95/44 Wt: 110 kg Oxygen Rate: 3L Oxygen Mode: NC
HGB: 18 HCT: 50 WBC: 8.4 Date Taken: 20080109

DRAINAGE (2 rows) Cite # 0455678922

Orthopedic (0 rows)

Drainage Location:	Type:	Suction Type:	Suction Amount:	Type:	Location:
Foley					

PMI DATA Cite # 0455678922

Cardiac Monitor: Y Suction: Y Pulse Ox: Y Incubator: N
Ventilator: N Pump: Y Stryker: N Traction:N

TRANSPORTATION INFORMATION Cite # 0455678922

Orig Transport Name: POC: Com Phone: DSN Phone:
Dest Transport Name: POC: Com Phone: DSN Phone:

ADMIN REMARKS: Cite # 0455678922

Appendix 2: MIST and SBAR Scoring

MIST

	Was each MIST component included in the handoff?	Yes	No
1. **M**echanism	• Identify patient (name, age, sex)		
	• Mechanism of injury or chief medical complaint		
2. **I**njury	• Time of injury or onset of symptoms		
	• List all injuries or symptoms		
____	• Physical exam findings		
3. **S**igns	• Vital signs		
_____	• Trend or change in vital signs		
4. **T**reatment	• All interventions listed		

4. Verbalizes a concise, accurate summary of each patient	**YES**	**NO**

Evaluate the provider who gave the handover:	**Always**	**Sometimes**	**Never**
1. Actively engages receiver to ensure shared understanding of patients (The Giver encouraged questions during the handover, asked questions to Receiver).			
2. Giver appropriately prioritizes key information, concerns, or actions			
3. Distractions: Tangential or unrelated conversation			

5. Appears focused, engaged, and demonstrates active listening skills.	**YES**	**NO**

6. **What was especially effective about the handover?**	**13. What aspect(s) of the handover could be improved?**	**14. Additional comments:**

SBAR

	Was each SBAR component included in the handoff?	Yes	No
5. **S**ituation	• Patient status: Stable, Unstable, Critical		
	• Identify patient (name, identifiers, age, sex, location)		
	• Current history		
6. **B**ackground	• Past medical history		
	• Current medications		
	• Allergies		
7. **A**ssessment	• Diagnosis/injuries, interventions, medications received, response to treatment		
	• Vital signs and monitors		
	• Critical lab values and reports		
Action plan	• What needs to be done?		
8. **R**ecommendation	• Precautions and contingency plan		
Repeat back	• Receiver repeats back key information	**NA**	**NA**
	• Questions and clarification sought by reporter		

Evaluate the provider who gave the handover:	**Always**	**Sometimes**	**Never**
7. Actively engages receiver to ensure shared understanding of patients (The Giver encouraged questions during the handover, asked questions to Receiver).			
8. Giver appropriately prioritizes key information, concerns, or actions			
9. Distractions: Tangential or unrelated conversation			
10. Verbalizes a concise, accurate summary of each patient	**YES**	**NO**	
11. Appears focused, engaged, and demonstrates active listening skills.	**YES**	**NO**	

12. **What was especially effective about the handover?**	**13. What aspect(s) of the handover could be improved?**	**14. Additional comments:**