Mobile Trauma Resuscitation Documentation Using T6 Health Systems and BATDOK Closure

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MOBILE TRAUMA RESUSCITATION DOCUMENTATION USING T6 HEALTH SYSTEMS AND BATDOK CLOSURE

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14. ABSTRACT-

Purpose: The purpose of this project is to facilitate medical treatment by ensuring medical documentation at the point of injury (POI) is appropriately documented, accurate, complete, and present in hostile conditions on the battlefield. **Methods:** The pilot study involved ten medics and ten nurses recruited from BAMC and the U.S. Army Burn Center and were randomly assigned to use the proposed integrated mobile applications (BATDOK/T6) or standard documentation (TCCC card/patient movement record/resuscitation record). The project was conducted in two phases, splitting the participants into two groups (five medics and five nurses each), which were evaluated for documentation accuracy, completeness, speed, and appropriate care given as evidenced by CPG compliance rates during simulated casualty scenarios. Using each platform, we also assessed the efficiency and accuracy of resource utilization determination. **Results:** *Phase 1 testing* in the simulation lab demonstrated that the proposed mobile applications had a significant increase in both total percent complete (84.2 ± 8.1% versus 77.2 ± 6.9%; p=0.02) and total percent accuracy (77.6 ± 8.1% versus 68.9 ± 7.5%; p<0.01) when compared to standard paper documentation. There was an observed significant increase in time to completion between the mobile applications and paper groups (31.4 ± 3.0 minutes versus 24.8 ± 3.1 minutes, respectively, p<0.01) in the second scenario without any difference in overall time to completion of all three scenarios between mobile applications and paper groups (89.6 ± 17.5 minutes versus 76.0 ± 12.2 minutes, respectively; p=0.19). *Phase 2 field testing* demonstrated that the proposed mobile applications had a significant increase in both total percent complete (91.6 ± 5.8% versus 70.0 ± 14.1%; p<0.01) and total percent accuracy (87.7 ± 7.6% versus 64.1 ± 14.4%; p<0.01) when compared to standard paper documentation. **Conclusions:** This study demonstrates that the use of mobile applications improves both accuracy and completion of trauma documentation throughout the continuum of combat casualty care from POI, through ERC, and at Role 2 facilities compared to paper documentation.

15. SUBJECT TERMS- trauma, BATDOK, T6, medical documentation, electronic documentation, EMR

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1.0 EXECUTIVE SUMMARY

To facilitate medical treatment, medical documentation must begin early, at the point-of-injury (POI) and continue throughout the continuum of care for a comprehensive health record. In hostile conditions on the battlefield, patient care documentation is often delayed, incomplete, inaccurate, or non-existent. The absence of information from POI inhibits communication between the patient care teams and can be detrimental during patient care as well as to future performance improvement initiatives. In a prolonged field care (PFC) situation, medical documentation will be even more challenging for providers because they will be treating patients and coordinating evacuation to a higher level of care, all while under resource-limited conditions.

2.0 INTRODUCTION

Over the past two decades, combat casualty care has been poorly documented due to the impracticality of paper cards and forms in the tactical environment both in terms of being able to write on them as well as being able to secure them to ensure they make it to the next echelon of care. Currently, missing and/or inconsistent prehospital documentation may be contributing to inaccurate clinical practice guidelines. Action item #11 of the Department of Defense (DoD) Joint Requirements Oversight Council Memorandum (JROCM) dated 11 Dec 2017 directs the DHA and the Office of the Joint Staff Surgeon to "Enhance existing DoD trauma registry by leveraging existing IT structure in order to operate an adaptive, agile, and passive collection system to automate trauma information collection and sharing in the pre-hospital environment as well as the subsequent mapping of trauma injuries to clinicians, and providing clinical support tools in an operating environment" with a suspense 11 Dec 2019. In addition, Joint Force Health Protection (JFHP) initial capabilities document dated Feb 2010, Gap Joint Casualty Management (JCM) 1-10 identified "Inadequate integrated medical information systems across the taxonomy of casualty care." While the Joint Trauma System's (JTS) Performance Improvement (PI) initiative is to improve trauma system performance including recommendations for patient evaluation and treatment across the DoD care continuum, the next iteration of Electronic Health Record (EHR) management, Military Health System (MHS) Genesis, does not offer trauma resuscitation recording templates that meet the needs of trauma care providers, and there are no plans currently to transition to using MHS Genesis to electronically document trauma resuscitations in real-time. It is also important to note that MHS Genesis does not currently support the data collection (data fields contained in DD3019) and reporting requirements of the DoD trauma patient registry program. The existing process and current MHS Genesis expectations do not reflect the Agency's quadruple aim for joint trauma care; a better solution is needed to support the care of trauma patients and enhance the operational efficiency and effectiveness of the MHS. There is an urgent unmet operational need for an information technology (IT) solution that will enable medics to better capture patient treatment information to improve long term healthcare without impacting short term care responsibilities. Currently, medics and providers have limited capabilities to document combat casualty care in austere environments including initial resuscitation of trauma patients from point-of-injury (POI) prehospital environments to surgical teams at role of care 2 and 3.

3.0 METHODS, ASSUMPTIONS AND PROCEDURES

The pilot study will involve 10 medics and 10 nurses recruited from BAMC and the U.S. Army Burn Center and randomly assigned to use the proposed integrated mobile applications (BATDOK/T6) or standard documentation (TCCC card/patient movement record/resuscitation record). The two groups (5 medics and 5 nurses each) will be evaluated for documentation accuracy, completeness, and speed as well as appropriate care given as evidence by CPG compliance rates during simulated casualty scenarios. We will also evaluate the efficiency and accuracy of resource utilization determination using each platform. The Enhanced Usability Model posits that usability is influenced by system effectiveness, efficiency, satisfaction, learnability, and security. The technical requirements and expertise for assessing security of each platform is beyond the capabilities of the research team. Additionally, the investment of time and effort into testing system security is best spent on the most usable platforms. As such, this project will not consider system security. Usability can be assessed in laboratory (classroom), high fidelity simulation environments and in real-life environments. To achieve the specific aims of this project, the research team will conduct a scenario-based evaluation of platform usability in a laboratory (classroom setting) to achieve Specific Aim 1 and in a high-fidelity simulated POI environment under PFC conditions for Specific Aim 2. A scenario-based evaluation is part of an iterative evaluation process that guides the refinement of platform design and focuses on use in a given situation,

4.0 MAJOR EVENTS/MILESTONES/SUCCESS

In preparation for the execution of this project,

- Kick Off Meeting – April 2022
- IRB/IACUC Approval – June 2022
- All experimental procedures completed – Sep 2022
- Data Analysis – 10/22
- Poster presentation – provide location and date: see below
- Manuscript submitted to – name of journal and date: see below
- Dissemination of Results – November 2023

5.0 RISK ASSESSMENT

5.1 Risk Analysis:

There was a delay in regulatory approval as the IRB transitioned to DHA. This resulted in slight delay in data collection. We were able to secure BAMC simulation center space to perform training and for the initial classroom type performance with devices. We worked with VAPOR site on Camp Bramble for the field portion of the project. A few supply items were delayed due to back orders but nearly all arrived in time. The BAMC Simulation Center fronted some supplies until our items arrived.

VAPOR site on Camp Bramble had conflicting training events so we were unable to secure dates for the field portion of the study until mid-September. We also had the research coordinator replaced on the project by HJF due to capability concerns and the assistant has left the project due to relocating out of state.

5.2 Technical Challenges

There were no identified technical challenges.

6.0 TRANSITION PLAN

6.1 Military Relevance

The electronic modernization and digitization of the Military Health System (MHS) has significantly improved with the introductions of AHLTA, Essentris, Genesis and further subcomponents of the Defense Health Agency's Electronic Health Record (EHR) system. However, the care of trauma patients in theater combat operations (Role 2s and Role 3s) and in-garrison emergency departments, continues to be handwritten on DD Form 3019 Resuscitation Record 5-page flow sheet. Bridging the gap between EHRs and this antiquated process for documenting trauma care has been a significant challenge for the MHS; there is currently no way to document a trauma patient's resuscitation, and for that data to be immediately available within the patient's electronic medical record for healthcare teams to see, due to the manual step required to bridge the gap between electronic and paper record management. Identifying a solution will benefit military personnel, impact patient care, and lead to better data capture abilities that could translate to improved CPG and research capabilities. This platform could enhance the efficiency of healthcare operations, ensure the delivery of high-quality healthcare services by improving information accessibility, and provide better decision support for clinicians. This solution will improve information accessibility and decision support for clinicians using patient-generated data, interoperable medical device information, and mobile and telehealth technologies. The implementation of these mobile applications may also result in tremendous savings both in dollars and lives to the DoD:

- 75% reduction in registry manpower/personnel to manually mine the data-- only requiring validation
- real-time availability of data that integrates with decision support tools for medical personnel in the combat care environment to improve performance and decrease morbidity and mortality
- 10-fold increase in efficiency of data analysis that is relevant to CPG changes more efficient capture of care and thus resource utilization of personnel, supplies, and equipment
- reduction in manpower required to manually scan and upload records into the CDR as w ell as reduction in time spent investigating and attempting to locate lost records
- ability to conduct combat-related research through easily accessible patient records, including patient-centered outcomes and assessment of CPGs.

6.2 Transition Strategy

This capability requirement will be first evaluated by the CENTCOM Clinical Functional Champion and Operational Medicine Functional Champion, as this solution will address issues with both in-garrison care and healthcare missions in the operational theater environment. The Joint Operational Medicine Information Systems (JOMIS) office will continue involvement as the Defense Healthcare Management Systems (DHMS) consultant. Once a system is proven successful, the project will be transitioned to an information management/information technology (IM/IT) program management office (JOMIS or possibly Solutions Delivery Division [SDD] under DHA J6) to manage the deployment with the Joint Trauma System as the primary customer/consultant community.

The purpose of this feasibility study was to explore the feasibility of using BATDOK and T6 Health System mobile device applications in theater as digital documentation systems that can integrate, to allow for opportunities in the increase of efficiency and effectiveness of patient care through digital documentation, as well as to capture high resolution data for outcomes and clinical process surveillance and evaluation.

KRL 7 (conducts early studies adapting KRL 4-6 research supported applications for use in an identified context) to KRL 8 (expands on or replicates KRL 7 studies to directly assess whether the tool works in the context of interest).

7.0 RESULTS

Participants

Participant demographics averaged 10.8 ± 5.2 years of military service and 3.9 ± 0.6 hours of documentation platform initial training. Following the training 85% of the participants felt moderate comfort level with both platforms.

Phase 1 Data

Phase 1 testing in the simulation lab demonstrated the proposed mobile applications had a significant increase in both total percent complete (84.2 ± 8.1% versus 77.2 ± 6.9%; $p=0.02$) and total percent accuracy (77.6 ± 8.1% versus 68.9 ± 7.5%; $p<0.01$) when compared to standard paper documentation, **Table 1**. There was no observed difference between groups when comparing each individual scenario.

There was an observed significant increase in time to completion between the mobile applications and paper groups (31.4 ± 3.0 minutes versus 24.8 ± 3.1 minutes, respectively, $p<0.01$) in the second scenario without any difference in overall time to completion of all three scenarios between mobile applications and paper groups (89.6 ± 17.5 minutes versus 76.0 ± 12.2 minutes, respectively; $p=0.19$), **Table 2.**

There was no statistically significant difference between average SUS scores following Phase 1 for the mobile applications and paper groups (70 [65.0, 81.9] versus 67.5 [45.0, 80.6], respectively; $p=0.14$).

Phase 2 Data

Phase 2 field testing again demonstrated the proposed mobile applications had a significant increase in both total percent complete (91.6 ± 5.8% versus 70.0 ± 14.1%; $p<0.01$) and total percent accuracy (87.7 ± 7.6% versus 64.1 ± 14.4%; $p<0.01$) when compared to standard paper documentation, **Table 3**.

There was no observed difference in overall time to completion between the mobile applications and paper groups (62.8 ± 14.2 minutes versus 54.8 ± 12.8 minutes, respectively; $p=0.44$), **Table 4.** In addition, there was no observed difference in time to completion between groups within each scenario.

8.0 CONCLUSION/DISCUSSION

This study demonstrates that the use of mobile applications improves both accuracy and completion of trauma documentation throughout the continuum of combat casualty care from POI, through ERC, and at Role 2 facilities when compared to paper documentation. This enhanced documentation was demonstrated without a significant change in the time to complete, an important factor given the arduous tactical environments associated with combat casualty care and the limited time at each echelon to provide care for the combat wounded. Overall, the use of mobile applications in lieu of paper documentation greatly improves the movement of complete and accurate patient information throughout the continuum of care allowing for improved understanding of patient's clinical situation and history.

9.0 DELIVERABLES

9.1 Publications:

Connor Kenney, Tesserae A. Komarek, Lindsey N. July, Steven G. Schauer, Gregory M. Burnett, Christopher A. VanFosson, Julie A. Rizzo, Valerie G. Sams, Effectiveness of Mobile Applications for Trauma Care of Combat Casualties Throughout the Continuum. Journal of Surgical Research, accepted September 2023, pending publication.

9.2 Presentations:

Presentation Title: Effectiveness of Mobile Applications for Trauma Care of Combat Casualties Throughout the Continuum.
Conference:18th Annual Academic Surgical Congress, 9 February 2023. (Accepted for Podium presentation; Tesserae A. Komarek, Lindsey N. July, Steven G. Schauer, Gregory M. Burnett, Christopher A. VanFosson, Julie A. Rizzo, Valerie G. Sams.)
Presentation Title: Effectiveness of Mobile Applications for Trauma Care of Combat Casualties Throughout the Continuum.
Conference: MHSRS Aug 2023(Accepted for Podium Presentation Tesserae A. Komarek, Lindsey N. July, Steven G. Schauer, Gregory M. Burnett, Christopher A. VanFosson, Julie A. Rizzo, Valerie G. Sams.)
Presentation Title: Effectiveness of Using Mobile Applications for Trauma Care of Combat Casualties throughout the Continuum.
Conference: MHSRS, Sep 2023 (Accepted for Poster Presentation; Valerie Sams, Chris VanFossen, Gregory Burnett.)

10.0 COST

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FIGURES AND TABLES:

Table 1: Comparison of average percent complete and average accuracy for Phase 1 testing for standard paper document and proposed mobile application system

	Paper (TCCC Card)		Electronic (BATDOK/T6)		P-Value	
	% Complete	% Accuracy	% Complete	% Accuracy	% Complete	% Accuracy
Scenario #1	78.7 ± 7.5	69.8 ± 7.6	85.8 ± 3.7	78.1 ± 5.6	0.15	0.13
Scenario #2	78.1 ± 6.1	69.3 ± 7.1	81.4 ± 13.2	74.0 ± 11.1	0.66	0.43
Scenario #3	74.8 ± 8.1	67.5 ± 9.2	85.4 ± 5.3	79.7 ± 7.1	0.08	0.08
Total	77.2 ± 6.9	68.9 ± 7.5	84.2 ± 8.1	77.6 ± 8.1	**0.02***	**<0.01***

Mean Values ± SD; * represents a significant p-value <0.05

Table 2: Comparison of time to completion for Phase 1 testing for standard paper document and proposed mobile application system

	Paper (TCCC Card) Time (mins)	Electronic (BATDOK/T6) Time (mins)	P-Value
Scenario #1	24.2 ± 6.3	29.6 ± 9.0	0.30
Scenario #2	24.8 ± 3.1	31.4 ± 3.0	**<0.01***
Scenario #3	27.0 ± 3.4	28.6 ± 7.2	0.67
Total	76.0 ± 12.2	89.6 ± 17.5	0.19

Mean Values ± SD; * represents a significant p-value <0.05

Table 3: Comparison of average percent complete and average accuracy for Phase 2 testing for standard paper document and proposed mobile application system

	Paper (TCCC Card)		Electronic (BATDOK/T6)		P-Value	
	% Complete	% Accuracy	% Complete	% Accuracy	% Complete	% Accuracy
Scenario #1	71.4 ± 20.8	64.3 ± 19.5	91.7 ± 5.7	85.1 ± 10.2	0.11	0.12
Scenario #2	63.2 ± 6.2	56.4 ± 5.1	91.8 ± 8.0	89.4 ± 8.0	**<0.01***	**<0.01***
Scenario #3	75.2 ± 14.6	71.4 ± 15.9	91.4 ± 5.2	88.7 ± 5.3	0.09	0.09
Total	70.0 ± 14.1	64.1 ± 14.4	91.6 ± 5.8	87.7 ± 7.6	**<0.01***	**<0.01***

Mean Values ± SD; * represents a significant p-value <0.05

Table 4: Comparison of time to completion for Phase 2 testing for standard paper document and proposed mobile application system

	Paper (TCCC Card) Time (mins)	Electronic (BATDOK/T6) Time (mins)	P-Value
Scenario #1	17.8 ± 5.7	22.8 ± 2.5	0.16
Scenario #2	17.3 ± 1.7	24.0 ± 6.3	0.08
Scenario #3	19.8 ± 5.7	21.0 ± 6.2	0.78
Total	54.8 ± 12.8	62.8 ± 14.2	0.44

Mean Values ± SD; * represents a significant p-value <0.05

12.0 LIST OF SYMBOLS, ABBREVIATIONS AND ACRONYMS

DHA Defense Health Agency

DOD Department of Defense

HER Electronic Health Record

IT Information Technology

JCM Joint Casualty Managment

JFHP Joint Force Health Protection

JROCM Joint Requirements Oversight Council Memorandum

JTS Joint Trauma System

MHS Military Health System

PFC Prolonged Field Care

PI Performance Improvement

POI Point of Injury

TCCC Tactical Combat Casualty Care