

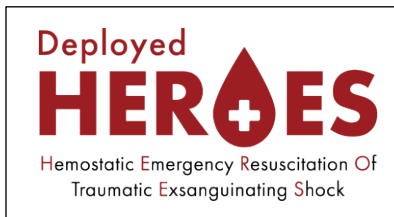


The Deployed Hemostatic Emergency Resuscitation Of Traumatic Exsanguinating Shock (Deployed HEROES) Study

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FINAL REPORT

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THE DEPLOYED HEMOSTATIC EMERGENCY RESUSCITATION OF TRAUMATIC EXSANGUINATING SHOCK (DEPLOYED HEROES) STUDY

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14. ABSTRACT- It is estimated that 90% of potentially survivable combat deaths were due to hemorrhage, thereby making hemorrhage control strategies of paramount importance to improving patient outcomes. There were over 350,000 units of blood products transfused during the conflicts in the Middle East, greater than 10,700 of which were fresh whole blood (FWB). Throughout the course of the conflicts, the recommendations for hemorrhage resuscitation have evolved and interim studies have associated the changes with improved outcomes. Use of aggressive hemorrhage control and blood transfusion to reduce morbidity and mortality is prioritized in the Joint Trauma System's Tactical Combat Casualty Care Guidelines as well as in the Damage Control Resuscitation Clinical Practice Guideline. The full study dataset was created in HIPAA compliant database (n=19,060). A total of 2,983 records were abstracted for phase I of the Deployed HEROES project. Of those, we included patients that were, 1. Battle injured, 2. had an injury time available, and 3. received whole blood (at least 1 unit). Each record was imported into REDCap. An interim analysis was complete and offered reportable insight to blood delivery practices. However, the significant undertaking of a full-spectrum analysis of transfusion strategies and associated outcomes has not yet been completed. Follow-on funding will be required to complete the full spectrum analysis. There remains a need for this analysis because despite the changes to the clinical practice guidelines and the evolution in transfusion practice to include the introduction of low titer type-O whole blood (LTOWB) into U.S. Central Command, there has been no comprehensive comparative effectiveness study of the advances in resuscitation strategies initiated during the conflicts in the Middle East. Additionally, many far forward surgical teams are unable to perform a balanced resuscitation due to multiple logistical, clinical, operational, and doctrinal challenges.					
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1.0 EXECUTIVE SUMMARY

The purpose of Deployed HEROES was to assess patient outcomes resulting from different fluid and blood transfusion practices in the deployed environment. Past work has looked at “when to transfuse” which was an important milestone, and this work aims to determine “what to transfuse” which is equally or more important and relevant to developing treatment improvements in hemorrhage control.

The full study dataset was created in HIPAA compliant database (n=19,060). A total of 2,983 records were abstracted for phase I of the Deployed HEROES project. Of those, we included patients that were, 1. Battle injured, 2. had an injury time available, and 3. received whole blood (at least 1 unit). Each record was imported into REDCap. An interim analysis was complete and offered reportable insight to blood delivery practices. However, the significant undertaking of a full-spectrum analysis of transfusion strategies and associated outcomes has not yet been completed. Follow-on funding will be required to complete the full spectrum analysis. There remains a need for this analysis because despite the changes to the clinical practice guidelines and the evolution in transfusion practice to include the introduction of low titer type-O whole blood (LTOWB) into U.S. Central Command, there has been no comprehensive comparative effectiveness study of the advances in resuscitation strategies initiated during the conflicts in the Middle East. Additionally, many far forward surgical teams are unable to perform a balanced resuscitation due to multiple logistical, clinical, operational, and doctrinal challenges.

If funded in the future, this study will execute a full-spectrum retrospective evaluation of transfusion strategies employed in the combat environment over the last 18 years to assess the clinical outcomes in traumatically injured casualties requiring transfusion and will evaluate each resuscitation strategy from the point of injury through the first 24 hours (when applicable) after traumatic injury; the primary outcome is mortality at 6 hours, 24 hours, and 30 days. Secondary outcomes include complications. The results of this study could include the strongest evidence-based data to date supporting the next step in the evolution of damage control resuscitation.

2.0 INTRODUCTION

It is estimated that 90% of potentially survivable combat deaths were due to hemorrhage, thereby making hemorrhage control strategies of paramount importance to improving patient outcomes. There were over 350,000 units of blood products transfused during the conflicts in the Middle East, greater than 10,700 of which were fresh whole blood (FWB). Throughout the course of the conflicts, the recommendations for hemorrhage resuscitation have evolved and interim studies have associated the changes with improved outcomes. Use of aggressive hemorrhage control and blood transfusion to reduce morbidity and mortality is prioritized in the Joint Trauma System’s (JTS) Tactical Combat Casualty Care Guidelines as well as in the Damage Control Resuscitation (DCR) Clinical Practice Guideline (CPG). However, the significant undertaking of a full-spectrum analysis of transfusion strategies and associated outcomes has not been done. Despite the changes to the clinical practice guidelines and the evolution in transfusion practice to include the introduction of low titer type-O whole blood (LTOWB) into U.S. Central Command (CENTCOM), there has been no comprehensive comparative effectiveness study of the advances in resuscitation strategies initiated during the conflicts in the Middle East. Additionally, many far forward surgical teams are unable to perform a balanced resuscitation due to multiple logistical, clinical, operational, and doctrinal challenges.

3.0 METHODS, ASSUMPTIONS AND PROCEDURES

This protocol used retrospective data from the DoDTR, the TMDS, the ASBP Database and AFMES, which document the data of patients treated at various in-theater medical treatment facilities to answer the following aims:

Aim 1. To determine the association of survival at 6 hours, 24 hours, and 30 days in combat casualties who received either fresh whole blood (FWB), LTOWB, or only component therapy.

Aim 2. To determine if the dose of crystalloid modifies the effect of transfusion on survival at 6 hours, 24 hours, and 30 days in combat casualties.

Aim 3. To determine if the amount of incompatible plasma in LTOWB is associated with survival at 6 hours, 24 hours, and 30 days in combat casualties.

4.0 MAJOR EVENTS/MILESTONES/SUCCESS

In preparation for the execution of this project,

- Kick Off Meeting – Nurse Abstractor for this contract was hired and onboarded (01 Aug 2022).
- IRB/Regulatory Approvals
 - US Army Institute of Surgical Research protocol H-19-035 “The Deployed Hemostatic Emergency Resuscitation of Traumatic Exsanguinating Shock (Deployed HEROES) Study” v9 version dated 25 Jul 2023, table 1 dated 25 Jul 2023, and approval memo dated 15 Nov 2023 (attached).
 - Defense Health Agency Data Sharing agreement renewal was approved (expires 30 Sep 2024 – attached).
- All experimental procedures completed - Phase I of abstraction is 100% complete (Sep 2023).
- Data Analysis – Interim data was collected, and interim analysis were completed (Sep 2023)
- Poster presentations of “The Importance of Clinical Nursing Expertise in Data Abstraction: Deployed HEROES Study” were presented at the following conferences:
 - 2023 Tri Service Nursing Research Program, San Antonio, TX April 4-6, 2023 (attached)
 - 2023 San Antonio Military Health and Universities Research Forum, San Antonio, TX June 15, 2023 (attached)
- Manuscript submitted to –
 - Journal of Trauma and Acute Care Surgery (JTACS) MHSRS supplement 2023 Supplement: “Data abstraction tool and guidelines development for the Deployed Hemostatic Emergency Resuscitation of Traumatic Exsanguinating Shock (HEROES) Study”, received extremely favorable reviews, however, it was rejected from the JTACS MHSRS 2023 supplement due to space (see attached proof).
 - We're trying to restructure the message of the article to focus on the importance of collecting timing data in transfusion research and how we did it, and then we would resubmit to Transfusion.
- Dissemination of Results – In addition to posters and paper referenced above, results from the ‘Deployed HEROES’ study/abstraction process contributed to the results referenced in the JTACS Western Trauma Association Podium manuscript, “Finding The bleeding edge: 24-hour mortality by unity of blood product transfused in combat casualties from 2002-2020” published online 03 July 2023 (attached)

5.0 RISK ASSESSMENT

5.1 Risk Analysis:

Data abstraction commenced 01 June 2022. The original plan was to complete all data abstraction for phase 1, which was accomplished. However, the original protocol did not include the entire CENTCOM experience – i.e., all years or patients that received at least one unit of blood during the CENTCOM war. Additional data abstraction will continue beyond this award and PoP.

5.2 Technical Challenges

A protocol amendment was submitted to include additional years and additional patient records. A trained nurse/data abstractor will need to be re-hired to assist with the remaining data abstraction from

TMDS/WISPR (etc.) – this will allow the research team to finalize the study dataset, database, and complete data analysis. The additional project deliverables will extend this project by 2-years. This study dataset will allow us to answer the current and future research questions outlined within the protocol.

6.0 TRANSITION PLAN

6.1 Military Relevance

Upon completion, the Deployed HEROES study will develop a knowledge product to evaluate current CPGs and interventions in the field to mitigate the consequences of trauma to reduce the overall mortality from preventable deaths. This in turn will help to develop interventional strategies and countermeasures to provide a safer solution.

6.2 Transition Strategy

No transitional plan due to the study needing to be completed.

7.0 RESULTS

The full study dataset was created in HIPAA compliant database (n=19,060). A total of 2,983 records were abstracted for phase I of the Deployed HEROES project. Of those, we included patients that were, 1. Battle injured, 2. had an injury time available, and 3. received whole blood (at least 1 unit). Each record was imported into REDCap. Abstractors used Theater Medical Data Store (TMDS) and Web Interface Scanned Patient Records (WISPR) to abstract specific and missing blood transfusion data. Using programming tools and automation, 100% of the records were reviewed for accuracy/out-of-range values. The abstraction team meets weekly for ongoing training, collaborations, and continuity.

8.0 CONCLUSION/DISCUSSION

This contract contributed to data abstraction for phase I of the study. Future abstraction will include anyone that received at least 1 unit of blood, from 2001-2022, in CENTCOM. This includes a total of 19,060 patients. A data abstraction scheduled was created with 32 phases. This dataset will support additional evidence-based blood transfusion research. The Deployed HEROES team has committed to and will continue working towards completing data abstraction. The completed data abstraction, and future abstraction will continue to contribute to the overall project aims and objectives. Planning for future operations should consider the results from this study.

9.0 DELIVERABLES

9.1 Publications:

“Data abstraction tool and guidelines development for the Deployed Hemostatic Emergency Resuscitation of Traumatic Exsanguinating Shock (HEROES) Study” anticipate re-submission to Transfusion.

9.2 Presentations:

2023 Tri Service Nursing Research Program, San Antonio, TX April 4-6, 2023 (attached)
2023 San Antonio Military Health and Universities Research Forum, San Antonio, TX June 15, 2023 (attached)

10.0 COST - \$93,885.45

11.0 REFERENCES

Gurney, Jennifer M., et al. "Determining resuscitation outcomes in combat casualties: Design of the Deployed Hemostatic Emergency Resuscitation of Traumatic Exsanguinating Shock (Deployed HEROES) study." *Journal of Trauma and Acute Care Surgery* 93.2S (2022): S22-S29.

Gurney, Jennifer M., et al. "Finding the Bleeding Edge: 24-hour Mortality by Unit of Blood Product Transfused in Combat Casualties from 2002-2020." *Journal of Trauma and Acute Care Surgery* (2023): 10-1097.

FIGURES AND TABLES:

Table 1. Necessary sample sizes by various effect sizes

	Effect size	Deaths	Sample size
1	1.2	945	14,758
2	1.3	457	7,127
3	1.4	278	4,334
4	1.5	191	2,984
5	1.6	143	2,211
6	1.7	112	1,743
7	1.8	91	1,420
8	1.9	77	1,191
9	2	66	1,022

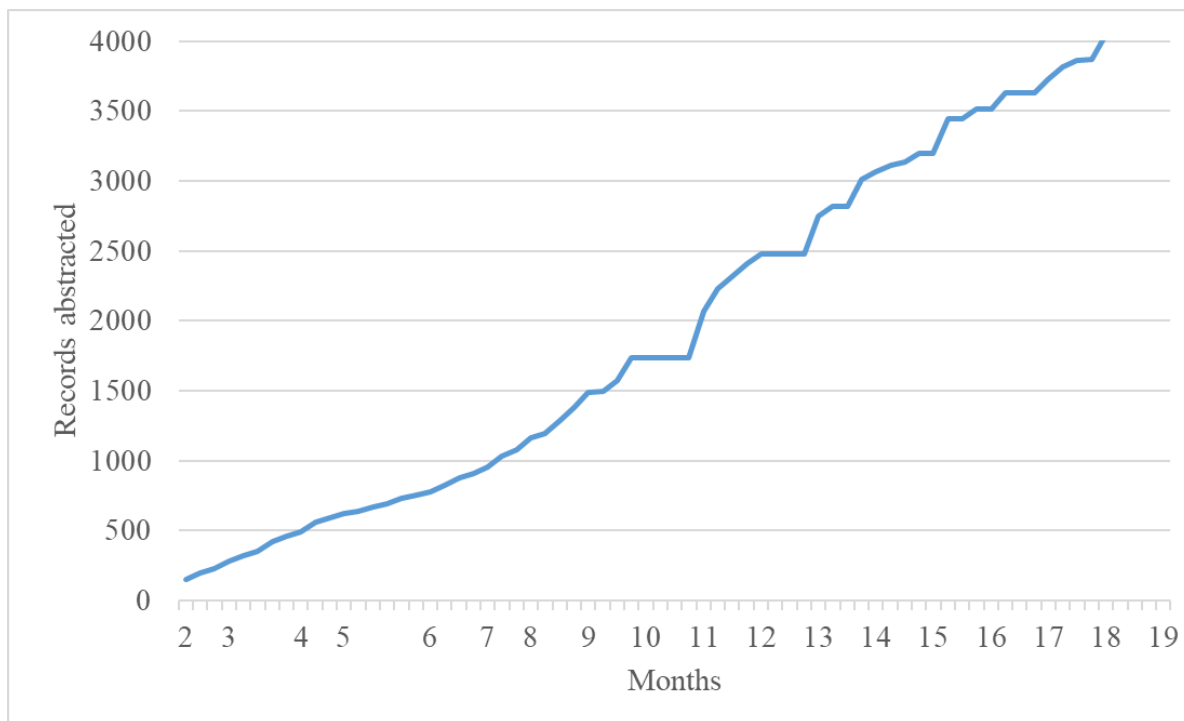


Figure 1. Cumulative records abstracted by month.

12.0 LIST OF SYMBOLS, ABBREVIATIONS AND ACRONYMS

AFMES – Armed Forces Medical Examiners

ASBP – Armed Service Blood Program

Deployed HEROES - Deployed Hemostatic Emergency Resuscitation Of Traumatic Exsanguinating Shock

DoDTR – Department of Defense Trauma Registry

FWB – Fresh Whole Blood

LTOWB – low titer type-O whole blood

TMDS – Theater Medical Data Store