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CONTRACTING ORGANIZATION: National Trauma Institute
San Antonio, TX 78230

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13. SUPPLEMENTARY NOTES

14. ABSTRACT
The purpose of this project is to focus DoD high priority research in: vascular injury, pain, and airway management. These studies are extending evidenced-based pre-hospital interventions as well as populate the National Trauma Research Repository (NTRR). During the third year, the PROOVIT study data collection was completed. The ketamine pain study was closed due to excessive delays and logistical issues. The airway management simulator development was completed and volunteer testing was performed. The National Trauma Research Repository (NTRR) was launched (www.nti-ntrr.org). The program officer and contracting officer granted a fifteen month no cost extension for project completion and additional development of the NTRR. NTI submitted a journal article on data sharing and the NTRR that was published in June 2018.

15. SUBJECT TERMS Vascular injury, airway management, pain management, Ketamine, National Trauma Research Repository

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INTRODUCTION:

Advances in trauma care in both pre-hospital and hospital settings have reduced trauma-related deaths and morbidities markedly; however, there is a substantial opportunity to further reduce deaths in the pre-hospital setting. Gaps in civilian and military pre-hospital care must be closed in order to reduce the number of potentially preventable deaths among wounded Warriors and civilian trauma patients. The purpose of this project is to focus on three specific areas of research identified high priority by the DoD: better solutions for vascular injuries, improved pain management, and better approaches for airway management. These studies will extend evidenced-based hospital interventions as well as populate the National Trauma Research Repository (NTRR) that will allow for data sharing, secondary analysis and greater power to detect statistical significance. As available research funding shrinks and federal budget pressure increases, it is essential that the return from dollars invested in research be maximized by replacing the expensive and repetitive assembly and disassembly of short-lived clinical investigator networks with a stable and enduring operational infrastructure for clinical trauma research.

KEYWORDS:

Vascular injury, airway management, pain management, Ketamine, National Trauma Research Repository, research dissemination

ACCOMPLISHMENTS:

Major Objectives of the Project:

Objective: To conduct research projects addressing military research gaps in airway management, pain management and vascular injury; and to develop tools to allow for the collection and dissemination of results and data from studies

Technical Objective 1: To conduct research projects addressing military research gaps in airway management, pain management and vascular injury**;** the contractor will perform Award management and compliance to include subcontracts, contract compliance, and all appropriate USAMRMC HRPO requirements.

Technical Objective 2: To develop tools to allow for the collection and dissemination of results and data from studies, including:

1) Develop a scalable repository of translational research data.
   a) Determination of common data element based on previously NTI funded project and other database sources.
   b) Creation of the data dictionary
   c) Development of policies for utilization guidance which includes repository requirement documents and website development.
   d) Conduct vendor solicitation and vendor selection process based upon requirements and capabilities identified.
   e) Build a scalable repository
   f) Alpha and beta testing with previous NTI funded studies and studies funded through this grant.

2) Provide a forum for dissemination of research outcomes to the trauma community.

Accomplishments under these Goals:

Major activities of this grant are organized under two study protocols and two projects.

STUDY 1:
Protocol Title: Determining the Efficacy and Safety of Ketamine as a Battlefield Analgesic
Principal Investigator: John Fauerbach, PhD
Participating Site: Johns Hopkins University School of Medicine
HRPO Assigned A-number: A-19299.2
Abstract: Background: Early, effective pain control for acute traumatic injury is important for successful outcomes. Despite the known importance of pre-hospital pain management, few studies have reported the use of analgesics and the type of analgesics used in combat. Ketamine has emerged recently as a potentially effective analgesic alternative to narcotics for use in combat-associated casualties. While early case reports attest to its effectiveness, these reports are anecdotal. Ketamine is the only single-agent anesthetic capable of producing a "dissociative" anesthesia, which has been useful for a variety of outpatient and inpatient surgical procedures. More than 50,000 service members have been injured in OIF, OEF, and OND and experience varying degrees of pain throughout their care. Of these injured service members, 31.8% are also diagnosed with PTSD.
Hypothesis: The addition of ketamine to narcotic analgesics will reduce significantly self-rated pain during dressing change/debridement on the Visual Analogue Scale for Pain (VAS-Pain):
Methods: Persons enrolled in the study through the informed consent process will be patients admitted to the Johns Hopkins Burn Center after sustaining burns less than 25% total burn surface area and not requiring initial endotracheal intubation. This would enable them to participate in structured interviews conducted by a psychologist assigned to the Burn Unit. These interviews would evaluate:

- The effectiveness of sub-anesthetic doses of ketamine as a sole analgesic vs. as a narcotic sparing drug for the treatment of acute post-traumatic pain
- The side effect profile of ketamine when administered in sub-anesthetic doses
- Whether the early administration of ketamine during the first three days following injury has a sustained effect on reducing the incidence or severity of Post-Traumatic Stress
- Disorder (PTSD)
- Whether the early administration of ketamine during the first three days following injury has a sustained effect on reducing the incidence or severity of clinical depression

Once IRB and HRPO approval is secured, patients will be randomized to a trial comparing a usual pain regimen, typically narcotics and benzodiazepines (UR-N) against a low dose ketamine regimen supplemented with usual pain medications (K+UR) on the effect of self-reported pain severity at the start of the procedure, every 5 minutes during the procedure and 5 minutes after the procedure ending, as well as the incidence and severity of PTSD and Depression at 24 hours, one week, and one month.

Military Significance: The DOD has identified capability gaps in combat casualty care. Several of the high priority gaps are well-suited for research in the civilian setting including en route care. A specific gap in these capabilities that the DoD has identified as high risk to the military and amenable to study in the civilian setting is: Ability to provide 100% acute and chronic pain management for wounded and injured soldiers, starting at the point of injury and continuing across the spectrum of care.

Progress Reported:

Year 1

Refinement of eligibility criteria and exclusion criteria as well as drafting of the screening protocol, enrollment protocol and final consent form was accomplished as stated in the Scope of Work. The human subjects documentation (study protocol, consent form, etc.) was submitted to the local IRB and was pending approval by the High Risk Review Committee. That committee requested minor

clarification regarding the role of nurses on the protocol. This study is seeking authorization to screen 300 for 100 completers.

The PI, Dr. Fauerbach, worked with the John Hopkins Bayview Medical Center pharmacy to finalize drug handling procedures such as clarify procedures for sub-anesthetic, low-dose, slow infusion of ketamine for pain management during wound care sessions. The participant recruitment folder was completed and the protocol Manual of Operations was in final stages of preparation. Study clinical report forms are in the final stage of completion. The Study 1 team presented a poster depicting the protocol for the "Ketamine for Acute Burn Pain" project at a local Behavioral Pharmacology Research Unit conference.

Study 1: Participant Accrual in Year 1

Site	Recruited	Screened	Enrolled	Completed
Johns Hopkins University	0	0	0	0

Number of subjects recruited/original planned target: **0/300**
Number of subjects screened/original planned target: **0/300**
Number of patients enrolled/original planned target: **0/100**
Number of patients completed/original planned target: **0/100**

Year 2

The original period of performance for this project was from January 1, 2016 through December 31, 2016. The period of performance was extended to June 30, 2018. Due to a policy change that was need within the hospital, the study team worked to update the hospital pharmacy policy for Ketamine administration. HRPO approval was received in June 2017. An amendment for this study was approved by the IRB on 9/28/17 and was submitted for HRPO approval on 10/18/2017. Dr. Fauerbach presented study progress to the NTI board of directors on September 30, 2017 (see appendices). The board discussed the need for close monitoring to ensure that the study can be completed in the remaining time on the no cost extension. Once approved the study should begin to enroll patients and is approved to screen 300 patients for 100 completers.

Study 1: Participant Accrual in Year 2

Site	Recruited	Screened	Enrolled	Completed
Johns Hopkins University	0	0	0	0

Number of subjects recruited/original planned target: **0/300**
Number of subjects screened/original planned target: **0/300**
Number of patients enrolled/original planned target: **0/100**
Number of patients completed/original planned target: **0/100**

Year 3

On September 13, 2018, we received the HRPO protocol memorandum for the Ketamine study closure at Johns Hopkins University.

STUDY 2

Protocol Title: The PROspective Observational Vascular Injury Trial (PROOVIT)
Principal Investigator: Joseph DuBose, MD (Travis Air Force Base)
Lead Site: University of California at Davis
Participating Sites: Baylor College of Medicine/Ben Taub Hospital, Emory University, Loma Linda Medical Center, University of Southern California, Scripps Health, University of Maryland/R. Adams Cowley Shock Trauma, University of Tennessee – Memphis, University of Texas Health Science Center at Houston, University of Wisconsin School of Medicine and Public Health, Wright State University, East Carolina University
HRPO Assigned A-number: A-19299.1a-1m
Abstract: Background: Few if any decisions throughout the phases of vascular trauma management are guided by strong evidence. This fact is unfortunate, as many new diagnostic, therapeutic and surveillance strategies have the potential to improve morbidity and mortality following this vexing injury pattern. The lack of evidence-based practice is even more concerning given the devastating consequences associated with mismanaged vascular trauma. To date, no studies exist that would allow the prospective aggregation of larger amounts of data pertaining to all phases of vascular trauma management.
Hypothesis: This prospective, multicenter, observational study will provide the necessary data to develop best practices and optimize the care of this unique population of patients.
Specific Aims: 1. To determine the impact of tourniquet utilization after extremity vascular injury on limb-specific complications and limb salvage; 2. To determine the optimal utilization of endovascular versus open repair modalities after vascular injury; 3. To determine the role of early anticoagulation in mitigating complications after vascular injury repair.
Study Design: This study is a prospective multi-center observational trial on the management of vascular trauma. Data and endpoints will be observational and involve no proscribed therapeutic interventions or alterations in patient care. Waiver of informed consent has been received. Institutions and providers are conducting normal diagnosis, management and surveillance procedures without interference by this study. The location and type of endovascular therapy for vascular trauma is tracked including comparison of outcomes to those following open operative repair of similar injury patterns. Finally, data elements are gathered in a wide range of age groups with vascular trauma including the challenging scenarios of pediatric and geriatric vascular injury.
Military Benefit: Hemorrhage from vascular injury, at both Non-Compressible Vascular Injury (NCVI) and Compressible Vascular Injury (CVI) sites, remains a primary cause of mortality and morbidity on modern battlefields. This study will provide linkage to crucial elements of subsequent limb salvage and long-term outcomes – data that are presently not available on any significant scale in the military realm.

Progress Reported:

Year 1

In the first year of this project, the PROOVIT study was adapted to meet DoD funding requirements. All subawards were executed. All sites had existing IRB approval or received timely continuing review. All clinical sites received HRPO approval and were screening and enrolling. (UTHSCSA is providing statistical analysis only.)

Year 2

In Year 2, East Carolina University was added as a clinical site. Subjects were enrolled at 12 sites. Preliminary data analyses were conducted and abstracts were submitted to the American Association for the Surgery of Trauma (AAST) for the 2017 annual meeting.

Year 3

In Year 3, PROOVIT sites continued patient enrollment. Patient enrollment was finalized at all study sites and study site closures were completed. Currently, HRPO closure is pending for Wright State University. Below are the final patient enrollment tables for the study.

Study 2: Participant Accrual in Year 1, 2, and 3

Recruited	Year 1 Qtr 1	Year 1 Qtr 2	Year 1 Qtr 3	Year 1 Qtr 4	Year 2 Qtr 1	Year 2 Qtr 2	Year 2 Qtr 3	Year 2 Qtr 4	Year 3 Qtr 1	Year 3 Qtr 2	Total
Tennesse	0	24	16	99	24	40	31	67	0	0	301
Wisconsin	0	0	0	25	7	15	17	0	0	0	64
Baylor	0	10	73	17	15	15	0	2	0	0	132
Emory	0	4	11	0	10	21	0	12	0	0	58
USC	0	0	0	0	0	0	0	0	0	0	0
ECU				80			18		0	0	98
Scripps	0	0	0	0	0	0	0	0	0	0	0
Maryland	0	0	0	0	0	0	0	0	0	0	0
Loma Linda	78	39	40	43	32	50	39	49	40	33	443
UC Davis	3	9	10	5	3	10	0	0	10	0	50
UT Houston	0	0	0	0	0	0	0	0	0	0	0
Wright State	0	0	0	0	9	6	6	26	18	10	75
								Total Recruited			**1193**

Screened	Year 1 Qtr 1	Year 1 Qtr 2	Year 1 Qtr 3	Year 1 Qtr 4	Year 2 Qtr 1	Year 2 Qtr 2	Year 2 Qtr 3	Year 2 Qtr 4	Year 3 Qtr 1	Year 3 Qtr 2	Total
Tennesse	0	24	97	42	24	40	31	67	0	0	325
Wisconsin	0	0	0	25	100	275	300	0	0	0	700
Baylor	0	10	73	7	15	15	0	2	0	0	122
Emory	0	4	11	0	10	21	9	14	0	0	69
USC	0	0	42	45	48	66	77	72	0	0	350
ECU							18		0	0	18
Scripps	50	4	1	0	0	20	20	20	20	20	155
Maryland	0	0	0	112	0	0	0	189	0	0	301
Loma Linda	**78**	**39**	**40**	**43**	32	50	39	49	40	33	443
UC Davis	5	17	21	13	7	10	0	0	10	0	83
UT Houston	0	0	0	0	0	0	0	0	0	0	0
Wright State	15	71	43	19	14	18	18	26	22	10	256
								Total Screened			**2770**

Enrolled	Year 1 Qtr 1	Year 1 Qtr 2	Year 1 Qtr 3	Year 1 Qtr 4	Year 2 Qtr 1	Year 2 Qtr 2	Year 2 Qtr 3	Year 2 Qtr 4	Year 3 Qtr 1	Year 3 Qtr 2	Total
Tennesse	0	24	16	99	24	40	31	67	0	0	301
Wisconsin	0	0	0	6	7	7	10	0	0	0	30
Baylor	0	10	73	4	15	15	0	2	0	0	119
Emory	0	4	11	0	10	21	0	12	0	0	58
USC	0	0	21	26	16	53	29	30	0	0	175
ECU							18		0	0	18
Scripps	2	4	0	0	0	6	2	4	4	4	26
Maryland		36	48	4	33	27	58	41	0	0	247
Loma Linda	42	15	33	14	18	17	13	20	15	5	192
UC Davis	0	8	9	3	0	14	14	9	10	0	67
UT Houston	34	40	23	36	35	38	35	0	0	0	241
Wright State	11	66	31	13	16	6	6	14	18	10	191
								Total Enrolled			**1633**

Completed	Year 1 Qtr 1	Year 1 Qtr 2	Year 1 Qtr 3	Year 1 Qtr 4	Year 2 Qtr 1	Year 2 Qtr 2	Year 2 Qtr 3	Year 2 Qtr 4	Year 3 Qtr 1	Year 3 Qtr 2	Total
Tennesse	0	24	16	99	24	40	31	67	0	0	301
Wisconsin	0	0	0	6	7	7	10	0	0	0	30
Baylor	0	10	14	41	12	12	0	2	0	0	91
Emory	0	0	0	0	0	0	17	41	0	0	58
USC	0	0	0	0	0	0	37	136	0	0	173
ECU							16		0	0	16
Scripps	0	0	0	0	0	0	0	0	0	0	0
Maryland	0	9	16	45	0	0	0	112	0	0	182
Loma Linda	42	15	33	14	0	0	0	0	0	260	364
UC Davis	0	1	7	3	0	0	17	2	8	0	38
UT Houston	10	23	54	53	19	51	26	5	128	0	369
Wright State	11	66	31	13	20	9	9	14	22	10	205
								Total Completed			**1795**

Number of subjects recruited/original planned target: **11,903/1,000**
Number of subjects screened/original planned target: **2,770/1,000**
Number of patients enrolled/original planned target: **1,633/1,000**
Number of patients completed/original planned target: **1,795/1,000**

PROJECT_1

Project Title: High Anatomic Fidelity Surgical Airway Training System

Principal Investigator: Robert Buckman, MD

Lead Site: Operative Experience, Inc.

HRPO Assigned A-number: Not applicable

Abstract: Background: Airway obstruction is the third most common cause of potentially-preventable combat death. Because of this, surgical management of the threatened or obstructed airway is an essential skill for special operations medics and combat surgeons. Cricothyroidostomy and tracheostomy are infrequently performed, life-saving surgical procedures required when a casualty's airway cannot be maintained by other means. Surgical airway procedures may be required at any level along the continuum of care/evacuation. Published data from recent theaters of war indicate that these emergency procedures are often performed incorrectly. Due to the limitations of existing methods of training, surgical airway management procedures are not currently taught to all combat medics. Improved, simulation-based methods of training will not only improve the training and enhance the capability of SOF medics and surgeons, but also will allow additional military healthcare providers and even combat lifesavers to be trained in this critical skill.

The Defense Health Board recommended optimized airway devices and training as a research priority for the Combat Casualty Care Research Program, contributing to the identification of a Combat Casualty Care Capability Gap.

Methods: Develop a prototype surgical airway simulator that provides high anatomical and surgical fidelity and challenges trainees with increasing degrees of clinical difficulty.

This project will develop an airway simulator that is capable of accurate anatomic representation of the airway from the mouth to the lungs, simulates a variety of traumatic tissue disruption with the face and neck, bleeds realistically, and supports training in tracheostomy and cricothyroidotomy. Development includes anatomic design, engineering design, medical modeling, physical modeling, engineering and system integration.

Progress Reported:

Year 1

The subaward was fully executed on 05/12/2016. The PI and Operative Experiences, Inc. (OEI) completely developed the model base and integrated electro-mechanical systems. Programmable logic controllers (PLC) have been developed but have not yet been fully integrated. OEI substituted a microcontroller to support more hardware at lower cost.

Year 2

In Year 2, Operative Experiences, Inc (OEI) continued development of a table-top task trainer that can be integrated into a full-sized manikin. This has involved adaptation of the head and neck model to the thorax of an existing OEI prototype Tactical Combat Casualty Care (TC3) manikin. Development activities included:

1) integrated the major vascular structures of the neck, including the carotid arteries and internal jugular veins
2) designed methods to enhance the elasticity of the facial skin and mucosa
3) finalized the design for the principal module of the simulator, which will extend from the in for orbital region of the face to the thoracic inlet. This module will be exchangeable and is being engineered to incorporate submodules simulating a variety of combat-relevant wounding patterns, including those that directly injure the airway and others that cause deformation or deviation of the airway by tissue injury or hematomas.
4) developed a method for creating multi-laminar models of the soft tissue structures of the face and neck which will incorporate potential spaces for fluid. This capability will permit the reversible deformation of head and neck soft tissue structures to simulate the effects of

hematomas and/or edema. It will also allow the deviation of the airway by surrounding soft tissue injuries to be simulated.
5) designed asymmetric submodules that can be exchanged within the modular face and neck structures to simulate varying combat-relevant wound patterns that are exchangeable
6) re-sculpted the fascial features of the simulator and deconstructed the revised sculpture of the superficial and deep anatomy to incorporate the maxilla and mandible
7) invented a mechanism to create separate mucosal planes over a simulated cartilage laryngo-tracheal skeleton. This mechanism permits the incorporation of potential submucosal spaces, which can be reversibly and controllably infused with fluids to simulate intrinsic airway edema. The mechanism is similar to the recently-engineered method for creating simulated potential spaces in the soft tissues of the muscular and fascial layers of the face and neck

Dr. Buckman, principal investigator at Operative Experiences, Inc (OEI) presented project progress via videoconference to Dr. Jenkins and NTI staff on May 19, 2017. There were no concerns regarding project progress.

In response to the Year 2 Quarter 3 technical report, Florence D'Orazi, PhD, the study's Science Officer, requested information on the future plans for intellectual property and commercialization with regard to the Surgical Airway Simulator.

Year 3

In Year 3, Operative Experiences, Inc (OEI) completed development of a table-top task trainer that can be integrated into a full-sized manikin. This involved adaptation of the head and neck model to the thorax of an existing OEI prototype Tactical Combat Casualty Care (TC3) manikin. Development activities included:

1) created molds of the anatomical components of the face and neck, including the bones, selected individual muscles, fascia, larynx, trachea, thyroid gland, major arteries and veins.
2) created serial iterations of these models to complete engineering.
3) developed materials for a high anatomical and surgical fidelity laryngo--tracheal complex.
4) developed new viscoelastic tissue construction for the upper airway and selected soft tissues of the neck. A US patent will be filed incorporating this work.
5) developed integration of a lubrication system into the structures of the airway.
6) contracted with a supplier of computerized three-dimensional anatomy images that can be used for computer-assisted modeling of various regional anatomy constructs.
7) contracted for the leasing of 3-D printing capability equipment to develop a regional model of the internal anatomy of the upper airway from which a 3-D hard model can be printed.
8) Conducted volunteer testing of the high anatomic fidelity surgical airway simulator at University of Maryland/Shock Trauma.

The subcontract with Operative Experiences, Inc (OEI) was completed on 8/31/2018. They are in the process of preparing a final report that is due to NTI on October 31, 2018.

PROJECT 2

Project Title: National Trauma Research Repository
Principal Investigator: Donald Jenkins, MD
Lead Site: The National Trauma Institute
HRPO Assigned A-number: Not applicable

Abstract: There is a critical need for a national trauma research repository to synthesize study data for maximum use. Advances due to clinical trauma research have been accomplished largely through separate, organizationally distinct and disconnected efforts. Even when funding has derived from federal entities, individual projects have been somewhat dispersed and uncoordinated. This situation leads to research delays, duplications, inefficiencies and increased costs. To date there relatively little attention has focused on data exchange in the clinical research domain. While clinical researchers in different locations may have similar lines of investigation, the computer systems in use to store and retrieve data locally do not, and for the most part cannot, transmit, receive, combine, analyze and use shared data as information. Clinical research data are fragmented, sometimes within one facility, and can rarely be repurposed to answer additional research questions. Sharing data maximizes its value, promotes follow-up studies and minimizes duplicative data collection. Universal developments in information technology, like the creation of distributed data networks and virtual data access, provide ways to address clinical research needs that did not exist before. It is time to exploit and enhance these technologies to support clinical trauma research.

The consolidation and linkage of data sets in a shared data repository would greatly expand their use and provide a robust scientific platform; pooled data sets can create the additional statistical power necessary to improve statistical significance. This clinical research repository employing common data elements will be particularly beneficial in maximizing trauma study data because it is often difficult to obtain informed consent since the injury and the need for early interventions often coincide; the patient is often unable to give consent due to the level of consciousness; and family are often unavailable in the early stages of treatment after trauma. The ability to make aggregated research data widely available to clinical investigators is critical to reform trauma research and care because, while the practice of medicine should be evidence-based, within the field of trauma there is surprisingly little evidence to support clinical practice. The formation of a national trauma research repository will ensure maximum utilization of trauma data for translation into evidence-based practice.

The NTRR will be built as a scalable, customizable repository that is capable of receiving data feeds from other data systems through a conversion method. NTRDB will be structured such that any study can contribute any portion of its data, besides the core common data elements, and those elements remain linked to the original source as well as available for secondary analysis in concert with any other data set. The initial module will be a set of generic data elements that is as globally representative across all trauma patients as possible yet is robust enough to support a data analysis plan.

Progress Reported:

Year 1

National Trauma Research Repository (NTRR)

The National Trauma Research Repository (NTRR) Steering Committee, consisting of stakeholder organizations and the DoD, provided oversight and governance of the project. Individuals were chosen because of national leadership positions, experience with database development, and/or other subject matter expertise. An Executive Committee of the larger body established four subcommittees of injury researchers and technical experts: Architecture, Regulatory/Human Subjects Protection, Data Definitions and Policies and Procedures.

National Trauma Research Repository Steering Committee

Organization Represented	Name	Home Institution
Coalition for National Trauma Research (CNTR), Clinician Scientists and Other Stakeholders	Don Jenkins, MD—Chair	Mayo Clinic
	Eileen Bulger, MD—Vice-chair	University of Washington
	Peggy Knudson, MD	UC-San Francisco
	Jerry Jurkovich, MD	Denver
	Greg Beilman, MD	University of Minnesota
	Joe DuBose, MD	Travis AFB
	Alex Valadka, MD	Virginia Commonwealth University
	Jason Sperry, MD	University of Pittsburgh
	Ellen MacKenzie, PhD	Johns Hopkins University
	Avery Nathens, MD	Sunnybrook HSC, Toronto
	Jim Ficke, MD	Johns Hopkins University
American College of Surgeons/Committee on Trauma	Ronny Stewart, MD	UTHSC—San Antonio
	Len Weireter, MD	Eastern Virginia Med. School
Department of Defense	LTC Kyle Remick, MD	CCRP, Military Deputy
	Jose Salinas, PhD	USAISR, San Antonio
	Mary Ann Spott, PhD	Dep. Dir. Joint Trauma System
	Tammy Crowder, PhD	CCCRP, Trauma Portfolio
	Frank Lebeda, PhD	MRMC, Dir. System Biology
National Institutes of Health	Matt McAuliffe, PhD	NIH, CIT, Bethesda MD

Note: Grayed background denotes members of Executive Group of the Steering Committee

NTRR Subcommittees

Architecture	Human Research Protections/Regul.	Data Definitions	Policies & Procedures
Jose Salinas	Len Weireter	Greg Beilman	TBN
Matt McAuliff	Peggy Knudson	Alex Valadka	Joe DuBose
Avery Nathens	Eileen Bulger	Jim Ficke	Ellen MacKenzie
Ronny Stewart	Mary Ann Spott	Jerry Jurkovich	
	Laura Brosch	Mary Ann Spott	

Note: Grayed background denotes subcommittee chair.

The subcommittees were established and charged as follow:

1. Architecture—Determine functional requirements of the physical product, reviewing how other clinical research databases are built and desired level of compatibility with related products such as the FITBIR informatics system; consider how to build the back end and front end of the database, including a plan for data quality and validation, report writing, and the user help desk.
2. Regulatory/Human Protections—Develop complete understanding of factors including protections/use of military data; established regulations in other research databases; how to meet or exceed requirements for human subject research protections; recommendations for future hosting of NTRR based on regulatory or human research protection requirements. Develop guiding policies and procedures on Data Sharing, Data Submission Requests.
3. Defining Data—Identify Common Data Elements and a well-defined data dictionary, following review of assembled elements from other trauma research databases (GLUE grant, ROC, etc.)
4. Policies & Procedures—Develop standards operating procedures and management policies for launching and maintain the NTRR.

The Architecture Subcommittee developed user requirements for NTRR which has since been transcribed into a formal Requirements Definition. NTI/NTRR project staff identified and reviewed the top 10 programming languages for front-end and back-end (database) websites and presented this information to the Architecture subcommittee. Several existing platforms were reviewed (such as Research Electronic Data Capture (REDCap), FITBIR, and Biologic Specimen and Data Repository Information Coordinating Center (BioLINCC)). This committee also developed Use Case Scenarios for the various users of the repository. NTI project staff developed a request for proposal (RFP) and statement of work (SOW).

Human Subject Protection/Regulatory Subcommittee drafted several policy documents based on FITBIR policies for data sharing, data contribution, data requesting, and the use of deidentified data. A Policy on Policies, which describes all regulatory references applicable to any policy, was written. The subcommittee also developed a Data Storage and Sharing Policy and a Data Access Request and Data Use Certification Policy.

The Data Definitions Subcommittee and NTI/NTRR staff reviewed more than 30 existing research databases, registries, and repositories and over 1,000 common data elements. Trauma specific registries/repositories included in this review were the Glue Grant, FITBIR, The Prospective, Observational, Multicenter, Major Trauma Transfusion (PROMMTT) Study, The Resuscitation Outcomes Consortium (ROC), National Trauma Data Standards (NTDB), National Burn Data Standards (NBDS), and the National Emergency Medicine Information System (NEMSIS). Common data elements were ranked in order of frequency across datasets and then evaluated by the Data Definitions Subcommittee. The subcommittee recommended an initial 18 clinical CDEs and 45 study attributes or meta-study data elements. Additional clinical CDEs and unique data elements will be drawn from the PROOVIT and Ketamine studies funded by this grant. Using the CDEs selected by the Data Definition Subcommittee, NTI project staff have created the NTRR data dictionary with 31 standardized data attributes for each element. The dictionary uses widely accepted data definitions/parameters from existing trauma and related research registries, and data from previous and ongoing studies.

Providing a forum for dissemination of research outcomes to the trauma community

Dissemination of trauma research was diverse and multipronged in Year 1. NTI supported the study PIs development of presentations and preparation of manuscripts and magnified those efforts through a comprehensive communications strategy. This strategy to communicate published work includes NTI website announcements and content, blog posts, electronic communications and newsletters, white papers for external audiences, social networking, and physical distribution of reprints. In Year 1, the NTI website had an average of 1,109 users per month. NTI communicated with the trauma stakeholder community regarding research findings via 10 communiques to 4,625 subscribers. NTI also tweeted 75 trauma research-related messages to 641 followers. Additionally, 26 blog posts regarding trauma research advances were posted on the NTI website (www.nationaltraumainstitute.org). The goal was to comprehensively disseminate published works to the wider trauma network through a Knowledge Translation Plan thereby accelerating the adoption of research findings to improve civilian trauma and combat casualty care and outcomes.

Year 2

National Trauma Research Repository (NTRR)

In Year 2, NTRR Committee continues to serve as the NTRR Steering Committee responsible for oversight and governance of the NTRR. The NTI project staff continued to compile and evaluate research registries and previous and ongoing studies (under this contract). Additionally, NTI staff met with Dr. Mary Ann Spott, Director of the DoD Trauma Registry (DoDTR), and Melanie Neal, with American College of Surgeons Trauma Quality Improvement Program (TQIP) to discuss compatibility of data definitions across military trauma registries, civilian trauma registries and the NTRR. Potential CDEs were presented to the NTRR Data Definition Subcommittee. The NTRR Data Definitions

Subcommittee finalized proposed clinical data and study meta-data elements for the initial repository. They reported their work to the NTRR Steering Committee Meeting on 10/28/2016.

NTI project staff continued to identify existing research and clinical repositories to review and compare and compiled a list of the top 10 programming languages for front-end and back-end (database) websites, which was presented to the NTRR Architecture subcommittee. With the committee's oversight, NTI staff developed NTRR requirements and use cases. This work and the documents were presented to and approved by the NTRR Steering Committee on 10/28/2016. NTI project staff developed a formal request for proposals document.

The NTRR request for proposals (RFP) was released February 1, 2017. The vendors were instructed to submit a plan with six months to construct the repository (roughly July – December 2017) followed by 12 months of hosting and technical support. The request was distributed to 3,411 recipients via Constant Contact. The announcement had 29% (989) open rate and 13% (443) click-through rate. It was posted on the National Trauma Institute website. The RF was also submitted to the Small Business Association call for proposals website. An extensive internet search was performed to identify vendors that have done similar work. Thirteen potential vendors were identified and solicited. Interested vendors were required to submit a letter of intent by February 24, 2017. NTI received letters of intent (7) from the following organizations: Healytics, ImageTrend, Med Star Health, National Institutes of Health Center for Information Technology (NIH CIT) with Sapient Government Services, QuesGen Systems, Quintiles, and Webhead. Vendors submitted questions about the proposal to NTI by March 1, 2017 and questions/answers document was provided by NTI on March 9, 2017. Proposals were due March 31, 2017. Four vendors submitted proposals.

NTRR Vendor Proposals Submitted

Vendor	Development Cost	Hosting Cost	Total Cost
ImageTrend	$545,610	$88,660	$634,270
NIH CIT/Sapient	$576,064	$215,204	$791,268
QuesGen	$610,856	$524,520	$1,135,376
WebHead	$165,642	$37,706	$203,348

The NTRR Architecture Sub-committee (four reviewers) scored proposals on the strength of each vendor's technical approach/responsiveness to the RFP, relevant experience and past performance evaluations (see NTRR Review Form). The aggregated scores are in the table below. Maximum possible score was 440.For detailed reviewer scores, please see NTRR Technical & Prior Performance Matrix.

NTRR Vendor Proposals Scores

Vendor	Technical Approach	Vendor Previous Experience	Total Scores*
ImageTrend	122	122	244
NIH CIT/Sapient	229	136	365
QuesGen	128	116	244
WebHead	119	76	195

NIH CIT/Sapient was the unanimous choice of the review committee. NIH CIT/Sapient proposed to customize the Biomedical Research Informatics Computation System (BRICS) to meet the functional needs of the NTRR. BRICS is a NIH-developed, disease agnostic, web-based research data repository system currently used by seven research communities including Federal Interagency Traumatic Brain Injury Research (FITBIR), Clinical Informatics for Trials and Research (CiSTAR), and the Center for Neuroscience and Regenerative Medicine (CNRM). This system already meets 80% of the NTRR requirements and can be customized to meet the remaining 20% (see NIH CIT proposal for details). The proposal included maintenance and hosting on the BRICS servers, which sit in "NIH's demilitarized zone" at the Center for Technology in Bethesda, MD. The BRICS team will ensure that all software/data

developed for the NTRR are in accordance with the rules of the Federal Information Security Management Act (FISMA) and all Health and Human Services information security policies.

NTI requested additional information on the NIH CIT/Sapient proposal regarding the scope of work and costs (via a written request and a teleconference with a product demonstration). NIH CIT/Sapient submitted a written response and a revised budget that was reviewed with Dr. Jose Salinas (chair of the NTRR Architecture Subcommittee). The vendor recommendation, vendor proposal and budget were sent to the NTRR Executive Committee for review on 06/23/2017. The NTRR Executive Committee and the NTI Executive Committee approved the selection of NIH CIT/Sapient on 7/19/2017.

In the fourth quarter of Year 2, we learned that NIH would not be able to host the NTRR. Therefore, we have been working with NIH and Sapient to identify commercial hosting options. The selected commercial option will meet or exceed all of the security standards described in the request for proposal. We discussed this with COL Mike Davis in September 2017 and he did not express any concerns about hosting via a commercial solution as opposed to NIH. We also discussed this with Jose Salinas, PhD, chair of the Architecture subcommittee. He was not concerned about using a commercial hosting vendor. Sapient is pricing commercial options and working with NIH to execute a technology transfer agreement.

Dr. Jenkins presented the NTRR project to the NTI board of directors on September 30, 2017. There were no concerns regarding project progress.

Providing a forum for dissemination of research outcomes to the trauma community

In year 2, NTI's knowledge translation and awareness-raising activities included robust social media outreach through Facebook, Twitter, and website blog posts. Our 36 posts to Facebook had a total reach of 5,595 people; while our 96 tweets and retweets on Twitter garnered more than 117,000 impressions. Over the period, NTI's Twitter follower base saw a 30% increase. In addition, we posted 26 times to NTI's website blog in the course of the year. We sent seven communications directly to our stakeholder community of roughly 4,500 people, including general news about NTI and CNTR, announcements about grants and meetings, and an opportunity to participate in a research project. NTI's messages average an open rate of 29%, well above the industry standard of 25% for nonprofit email campaigns.

With the launch of a new, more agile NTI website (www.NatTrauma.org) in July 2017 after nearly four months under construction, we began increasing output of original content: creating new infographics and posting a different trauma survivor story each month. We also published an exclusive interview with incoming Director of the Combat Casualty Care Research Program, Col. Michael Davis in August, 2017. The site improvements aim to engage more stakeholders with compelling and accessible content and raise awareness both about NTI and the toll of trauma in the United States. In addition, the new site provides improved insight into the diffusion of NTI-sponsored research by linking to Altmetric scores for each resulting research publication. The new site has information about the coming National Trauma Research Repository and will have a portal to that site.

Through a planned Knowledge Translation Tools page, the site will serve researchers as a portal to a full-spectrum KT pathway including access to research data, dissemination of research results, measurement of impact, synthesis of findings, and mobilization of knowledge into new guidelines and treatments. Since the launch of the new site, the number of unique visitors has held steady around 1,300 per month.

Also during the period of performance, the NTI Board of Directors launched two new committees in an effort to increase its profile and outreach: the Communications Committee and the Advocacy and Patient Engagement Committee. The mission of the Communications Committee is to support the priorities of NTI by assisting with communications plan by engaging stakeholder groups in developing compelling messages regarding DoD funded trauma research. Chaired by NTI Board member Dr. Steven Venticinque, the Communications Committee is currently in the formation stage as staff and board members prioritize audiences. Once established, the committee will serve as generator of and sounding board for molding the messages and visuals that connect dots between research and outcomes, tie the trauma treatment angle to relevant news stories (unfolding natural disasters, mass casualty events, public health and safety, national security, the national healthcare conversation, aging,

etc.) and resonate with policy makers and funders. Committee members will facilitate connections with the health and healthcare policy press that result in published articles, op-eds, and quotes from our experts in related stories.

The mission of the Advocacy and Patient Engagement Committee is to widen the perspective of NTI to include those personally affected by trauma (military and civilian) and professionals along the continuum of trauma care. Through this committee, NTI seeks to craft more compelling messages and to make broader and more connections between DoD funded research and patient outcomes. It will also be a vehicle to involve patients and family members in the development of new research programs (e.g., including patient-centered outcomes in research designs and including patients on study steering committees). This committee has launched with NTI Board member Dr. Martin Croce as chair, and five members: Dr. Anna Newcomb, a new NTI Board member and Trauma Research Manager at Inova Trauma Center in Fairfax, Virginia; Peter Thomas, principal with the law firm Powers Pyles Sutter & Verville with a practice in healthcare and disability policy and a trauma survivor, himself; Patrick Downes, a survivor of the 2013 Boston Marathon Bombing and an amputee who advocates for tighter collaboration between civilian and military resources in the treatment of trauma patients; Ian Weston, executive director of the American Trauma Society; and Terrie Stewart, a trauma nurse and Trauma Program Director at Blake Medical Center in Bradenton, Florida. The committee will engage with NTI's government relations team and participate in strategy discussions; attend congressional and agency meetings and planned advocacy days on Capitol Hill; make phone calls to members of Congress and fellow stakeholders; and contribute ideas and content for policy-related materials and advocacy communications. Additionally, committee members will be tapped to weigh in on NTI's research agenda, helping to advance NTI's patient-centered approach.

Year 3

National Trauma Research Repository (NTRR)

In Year 3, NTI negotiated agreements with the National Institutes of Health – Center for Information Technology (NIH – CIT) and Sapient Governmental Service, Incorporated for repository building and hosting. The collaboration agreement between NTI and NIH – CIT is a collaboration agreement to test, adapt and utilize NIH owned software (Biomedical Research Informatics Computing Systems (BRICS)) to create improved software that will was the foundational code for the NTRR. Under this agreement, NIH - CIT provided its BRICS source code to NTI solely for use under this agreement. NTI enhanced the NIH-developed BRICS capability and usability to meet the specific research objectives of NTI. NTI provided its contracted employee (Sapient Governmental Services, Inc.) to work on the project with the NIH-CIT investigators. The parties mutually planned the project details and will determine any necessary hardware and software components, configurations and technical roles of the team members from each of the parties. A mutually organized core set of system managers from NTI, NIH-CIT and Sapient provided operational support to enable NTI research staff to make use of the BRICS modules. The research subcontract between NTI and Sapient Governmental Services, Inc. consisted of a 6-month period to build and test the NTRR followed by a 12-month option period to host the repository. The NTI Executive Committee approved executing both agreements on December 15, 2017.

Sapient and NTI worked collaboratively to build the public website (10 pages) and the repository functions. In March 2018, Sapient released a demo site to NTI staff. Work continued to configure the website and optimize functioning. The repository management policies were refined based on the website components, functions, labels, etc. Additionally, NTI executed the NTRR Communications Plan to maximize utilization of the repository. In January 2018, NTI exhibited the NTRR at the Eastern Association for the Surgery of Trauma (EAST). Early career trauma researchers were very interested in the opportunity to conduct secondary data analyses of existing trauma data sets. As part of that plan, NTI submitted a scientific abstract to the American Association for the Surgery of Trauma (AAST) 2018 annual scientific meeting (not accepted).

In June 2018, Sapient and NTI conducted a two-day training on NTRR utilization for the NTI staff. Work was completed to configure the website and optimize functioning. NTI staff created basic common data elements and published the initial data dictionary that will be used to populate the NTRR.

NTI staff approached several large research groups regarding contributing legacy (completed studies) data into the repository. The repository management policies and data sharing templates were finalized. The NTRR was launched on June 25, 2018 at www.ntrr-nti.org.

NTI staff managed the NTRR daily activities (requests to submit or receive data from the repository). NTI staff organized the NTRR Data Use Committee that reviews requests to submit or receive repository data. NTI staff work with NTI/DoD funded trauma research studies to load those datasets into the NTRR. NTI staff worked with major federally funded trauma legacy studies (completed datasets) to add data into the repository. Data transfer agreements were initiated for study datasets (pending).

Study/Projects Major Tasks and Accomplishments to Date (Years 1, 2, and 3)

Protocol 1: KETAMINE STUDY	**Timeline in Months**	**Actual completion date**	**% of completion**
Major Task 1: Prepare and adapt Research Protocol for DoD Funded Status for Study 1			
Subtask 1: Refine research protocol	1-3	06/28/2016	100%
Refine eligibility criteria, exclusion criteria, screening protocol, enrollment protocol	1-3	06/28/2016	100%
Finalize consent form and human subjects protocol	1-3	06/28/2016	100%
Coordinate IRB protocol submission	1-3	06/28/2016	100%
Submit for Military 2nd level IRB review (ORP/HRPO)	3-6	05/30/2017	100%
Submit amendments, adverse events and protocol deviations as needed	6-18	Ongoing	N/A
Milestone Achieved: Protocol for Study 1 developed	3	06/28/2016	100%
Milestone Achieved: Local IRB approval	4-5	03/20/2017	100%
Milestone Achieved: HRPO approval	8	06/21/2017	100%
Major Task 2: Data Analysis for Study 1			
Subtask 1: Monitor data collection and data quality	8-20	Closed	0%
Protocol 2: PROOVIT STUDY			
Major Task 3: Adapt PROOVIT Protocol for DoD Funded Status for Study 2			
If applicable, coordinate with sites for IRB protocol submission	1-6	01/05/2016	100%
Coordinate with sites for Military 2nd level IRB review (ORP/HRPO)	1-6	03/31/2016	100%
Submit amendments, adverse events and protocol deviations as needed	As needed	Closed	N/A
Coordinate with sites for annual IRB report for continuing review	Annual	06/28/2017	100%
Prepare and submit quarterly progress report to DoD	Qrtly	06/28/2017	100%

Milestone Achieved: Local IRB approval at all sites	3	03/29/2016	100%
Milestone Achieved: HRPO approval for all protocols	6	04/22/2016	100%
Major Task 4: Subcontract with all Study Sites for Study 2			
Verify sub-award documents: budget, budget justification, salary verification	1-3	03/22/2016	100%
Issue and execute sub-award document	1-3	04/13/2017	100%
Receive quarterly progress reports	Qtrly	03/15/2017	100%
Review quarterly progress reports	Qtrly	04/11/2017	100%
Milestone Achieved: Subawards issued for all sites	3	04/13/2017	100%
Major Task 5: Data Analysis for Study 2			
Subtask 1: Coordinate with sites and NTI for monitoring data collection rates and data quality	4-6		95%
Perform all analyses according to specifications, share output and findings with all investigators	Ongoing		95%
Project 1: SURGICAL AIRWAY SIMULATOR			
Major Task 6: Develop High Fidelity Airway Simulator			
Execute Subaward	1	05/12/2016	100%
Develop a model base	1-4	07/01/2016	100%
Engineer hydraulic, mechanical and pneumatic systems for head movement, airway lubrication, respiration and circulation	1-4	07/01/2016	100%
Develop and integrate a programmable logic controller	1-4	07/06/2016	100%
Integrate subsystems into the infrastructure built upon the base	5-9	03/31/2017	100%
Develop a layered, high-fidelity anatomical model for face, neck and upper thorax	5-9	02/24/2017	100%
Separate the components of high-fidelity anatomical model for molding	5-9	8/31/2018	100%
Create molds of the anatomical components including bones, selected individual muscles, fascia, larynx, trachea, thyroid gland, major arteries and veins	10-12	8/31/2018	100%
Create serial iterations of the models and molds to complete engineering	10-12	8/31/2018	100%
Research materials for high anatomical and surgical fidelity laryngo-tracheal complex	10-12	08/31/2018	100%
Major Task 7: Requirements Function Testing			
Confirm requirements function through volunteer use	19-24	8/31/2018	100%
Coordinate with volunteer pool to test	19-24	8/31/2018	100%

Report evaluations of volunteer testing	19-24	Report Pending	
Project 2: NATIONAL TRAUMA RESEARCH REPOSITORY			
Major Task 8: Determine Data Dictionary and Vendor Requirements			
Coordinate with Steering Committee to determine Common Data Element Workgroup	1-6	03/29/2016	100%
Common Data Element Determinations	6-9	03/30/2018	100%
Develop Data Dictionary	6-9	03/30/2018	100%
Milestone Achieved: Data dictionary			
Major Task 9: Vendor solicitation and selection	1-6	08/11/2016	100%
Determine repository requirements	6-9	08/11/2016	100%
Vendor solicitation and selection process	6-9	08/11/2016	100%
Milestone Achieved: Repository requirements document	6-9	07/19/2017	100%
Milestone Achieved: Vendor Selected			
Major Task 10: Repository build and testing	9-12	06/25/2018	100%
Repository build (back and front end)	9-12	06/25/2018	100%
Go Live	9-12	06/25/2018	100%
Milestone Achieved: Repository Live	9-12	06/25/2018	100%
Major Task 11: Website development and policy	3-9	6/25/2018	100%
Develop management policies	6-15	6/25/2018	100%
Develop website and interfaces	6-15	6/25/2018	100%
Milestone Achieved: Policies available on functional website		6/25/2018	100%
Major Task 12: Repository Hosting			
Repository hosting	37-52	Ongoing	
Importing legacy studies	37-48	Ongoing	
Supporting investigators with new studies	37-52	Ongoing	

Training and Professional Development

Training of research staff at all sites including research ethics and privacy and confidentiality has been completed. On Study 1 (ketamine), an educational PowerPoint was developed for burn wound care (see appendices).

Dissemination of Results to Communities of Interest

Year 1

Although we did not have study findings or completed projects, there were three opportunities for disseminating information to communities of interest in Year 1.

Study 1: Determining the Efficacy and Safety of Ketamine as a Battlefield Analgesic

The Study 1 team presented a poster depicting the protocol for the "Ketamine for Acute Burn Pain" project at a local Behavioral Pharmacology Research Unit conference.

Study 2: PROOVIT Study

The PROOVIT Study team gave two research presentations with data from this study at the 2016 the American Association of Surgery for Trauma (see products).

Project 1: Airway Management Simulator

No dissemination of results to report.

Project 2: National Trauma Research Repository

The project PI (Dr. Donald Jenkins) and the NTI study team were invited to submit a manuscript detailing the work underway for this contract for the 2016 Shock Military Supplement. The team prepared a manuscript detailing the development of the National Trauma Research Repository and submitted it in May 2016. It was accepted and published in the Military in August 2016. Additionally, the project PI (Dr. Donald Jenkins) and the NTI study team were invited to present at the 2016 Military Health System Research Symposium during the Surgical Critical Care and Burn Session moderated by Dr. Jose Salinas. The presentation detailed work completed previous DoD funded projects with the National Trauma Institute and introduced the National Trauma Research Repository under for this grant.

Year 2

Study 1: Determining the Efficacy and Safety of Ketamine as a Battlefield Analgesic

No dissemination of results to report.

Study 2: PROOVIT Study

The PROOVIT Study team published two articles on this study in trauma journals. They gave two podium presentations and two poster presentations from this study at the 2017 American Association of Surgery for Trauma annual conference (see products).

Project 1: Airway Management Simulator

No dissemination of results to report.

Project 2: National Trauma Research Repository

Information regarding the National Trauma Research Repository was disseminated via the call for proposals, the NTI website and other social media (see products)

Year 3

Study 1: Determining the Efficacy and Safety of Ketamine as a Battlefield Analgesic

Study was closed; therefore, no dissemination of results will be reported.

Study 2: PROOVIT Study

The PROOVIT Study team published one article on this study in a trauma journal and submitted several abstracts.

Project 1: Airway Management Simulator

No dissemination of results to report. OEI is in the process of preparing a final report that will detail the results of the volunteer testing/training.

Project 2: National Trauma Research Repository

In June 2018, NTI published an article in Trauma and Acute Care Open describing the NTRR and how it is available to help researchers meet new data sharing requirements from the International Committee of Medical Journal Editors (included in the appendices). The NTRR was registered as a research repository with Fairsharing, DataMed and r3data. In July 2018, Dr. Jenkins and Dr. Price recorded an educational podcast for the Eastern Association for the Surgery of Trauma (posted on the EAST website). In July and August 2018, NTI conducted an NTRR awareness campaign called "Prepare to Share" with Wolters Kluwer. This campaign encouraged researchers visiting Wolters Kluwer journal websites to contribute to or request data from the NTRR. Additionally, NTI hosted an exhibition booth at the 2018 American Association for the Surgery of Trauma annual scientific meeting featuring the NTRR. There was a high level of interest in using the NTRR among the attendees.

Plans for the Next Quarterly Reporting Period

Study 1: Determining the Efficacy and Safety of Ketamine as a Battlefield Analgesic

Study closed, no further reporting.

Study 2: PROOVIT Study

PROOVIT sites are closed, no further reporting.

Project 1: Airway Management Simulator

Operative Experiences, Inc. will submit its final project report with the detailed results of the volunteer testing activities. They will provide an in-person demonstration of the airway management simulator in San Antonio, Texas. OEI will develop a training curriculum and pursue funding to test the simulator against other teaching methods.

Project 2: National Trauma Research Repository

NTI will begin importing legacy data from closed studies such as the trauma studies from the Resuscitation Outcomes Consortium (ROC), PROMMT, and PROPPR and this data mapping and data element creation within the system will take several months for each study. It is critical to import this legacy data to provide the beginning of a robust data source for secondary analysis, possibly across studies. Each data set will need to be mapped to the existing CDE's and all data elements beyond the

CDE set will need to be created in the NTRR. These data sets have 100's of data elements. This process for the legacy data will easily take until March of 2019 at least.

NTI will also begin identifying Common Data Elements for the pre-hospital, inpatient, and outcomes/rehabilitation modules. The process for this includes a review of all existing repositories and large study data sets to illicit any variables that are routinely collected, convening a module specific data element workgroup to review the analysis and ultimate decision as to CDE's to be identified in the NTRR. It is critical that the CDE's are socialized and accepted by the stakeholders to increase acceptance and use in future studies. This process for the module specific CDE's will take a year. We have funds available to extend the hosting period of the Repository through the December 2019 timeframe. This will allow us to solidify maintenance funding options/plans for the repository ideally without a break in Repository service/availability to the research community.

The NTRR Communication Plan will continue to be executed to ensure that trauma researchers are aware of the repository and the research opportunities and data sharing it provides. NTI staff will prepare to exhibit the NTRR at the January 2019 Eastern Association for the Surgery of Trauma annual meeting in Austin, Texas.

IMPACT:

As we have just completed Year 3 and received a no-cost extension for an additional fifteen months, there are no developments in the principal discipline, other disciplines, technology transfer or to society beyond science and technology to report at this time.

CHANGES/PROBLEMS:

There are no changes in the approach for this work.

PRODUCTS:

Year 1

Year 1 products were included in the appendices of the Year 1 Annual Report.

1. Song, A., Gerold, K., McCann, U.D., Caffrey, J., Latif, A., Milner, S.M., Fauerbach, J.A. Safety and Efficacy of Ketamine as a Battlefield Analgesic for Acute Burn Pain. Poster presentation at the Asthma and Allergy Center of Johns Hopkins Bayview Medical Center in Baltimore, MD, July 27, 2016.
2. Smith SL, Price MA, Fabian TC, Jurkovich GJ, Pruitt BA, Jr., Stewart RM, et al. The National Trauma Research Repository: Ushering in a new era of trauma research (Commentary). Shock. 2016;46(3 Suppl 1):37-41.
3. Jenkins, DH. Impact of Department of Defense Research to the National Trauma Institute. Presented at the Military Health System Research Symposium, Orlando FL, August 17, 2016.
4. Loja MN, Wishy A, Humphries M, Savage S, Fabian T, Scalea TM, Holcomb JB, Poulin N, Galante JM, Rasmussen TE, AAST PROOVIT Study Group. Systemic anticoagulation in the setting of vascular extremity trauma. Podium Presentation, American Association for the Surgery of Trauma Annual Meeting, Maui, Hawaii, 2016.
5. Loja MN, DuBose J, Saummann A, Li CS, Savage S, Scalea T, Holcomb JB, Rasmussen TE, Knudson MM, AAST PROOVIT Study Group. The Mangled Extremity Score and Amputation: Time for a Revision. Quickshot Podium Presentation, American Association for the Surgery of Trauma Annual Meeting, Maui, Hawaii, 2016.

6. Human Subjects Policies/procedures from NTRR
7. NTRR Requirements Document
8. NTRR Use Case Document
9. Knowledge Translation Plan

Year 2

Products completed in Year 2 are included in the appendices of this report.

1. Coimbra R, Kozar RA, Smith JW, Zarzaur BL, Hauser CJ, Moore FA, Bailey JA, Valadka A., Jurkovich GJ, Jenkins DH, Davis KA, Price MA, Maier RV. The Coalition for National Trauma Research supports the call for a national trauma research action plan. J Trauma Acute Care Surg. 2017 Mar;82(3):637-645.
2. Clinical report forms, staff training and other materials for the ketamine study
3. Loja MN, DuBose J, Sammam A, Li CS, Liu Y, Savage S, Scalea TM, Holcomb JB, Rasmussen TE, Knudson MM, AAST PROOVIT Study Group. The Mangled extremity score and amputation: Time for a revision. J Trauma Acute Care Surg. 2017 Mar;82(3):518-523.
4. Faulconer ER, Branco B, Loja M, Grayson K, Sampson J, Fabian T, Bee T, Holcomb JB, Brenner M, Scalea TM, Skarupa D, Inaba K, Poulin N, Rasmussen TE, DuBose JJ, AAST PROOVIT Study Group. Use of open and endovascular surgical techniques to manage vascular injuries in the trauma setting: A review of the AAST PROOVIT Registry. Podium presentation - American Association for the Surgery of Trauma Annual Meeting, Baltimore, MD, 2017.
5. Ferencz SA, DuBose JJ, Hennigan J, Nolan K, Sampson JB, Rasmussen TE, Galante JM, Bee T, Fabian TC, Menaker JA, Scalea TM, Holcomb JB, Skarupa DJ, Inaba K, Bini JK, AAST PROOVIT Study Group. Contemporary tourniquet use in extremity vascular trauma: The AAST prospective observational injury treatment (PROOVIT) registry. Quick shot presentation - American Association for the Surgery of Trauma Annual Meeting, Baltimore, MD, 2017.
6. Loja MN, DuBose JJ, Stephenson J, Kessel B, Bee T, Fabian T, Menaker J, Scalea TM, Holcomb JB, Skarupa D, Inaba K, Catalano R, Poulin N, Bini JK, Rasmussen TE, AAST PROOVIT Study Group. Pediatric vascular trauma: Current management and early outcomes. Poster presentation - American Association for the Surgery of Trauma Annual Meeting, Baltimore, MD, 2017.
7. Russo R, Galante J, DuBose JJ, Bee T, Fabian T, Holcomb JB, Brenner M, Scalea TM, Skarupa D, Inaba K, Poulin N, Turay D, Bini J. Rasmussen TE, AAST PROOVIT Study Group. Contemporary outcomes and management of blunt cerebrovascular injuries: Results from the AAST PROOVIT multicenter registry. Poster presentation - American Association for the Surgery of Trauma Annual Meeting, Baltimore, MD, 2017.
8. Loja MN, Galante JM, Humphries M, Savage S, Fabian T, Scalea T, Holcomb JB, Poulin N, DuBose J, Rasmussen TE; AAST PROOVIT Study Group. Systemic anticoagulation in the setting of vascular extremity trauma. Injury. 2017 Sep;48(9):1911-1916.
9. 3 PowerPoint Protocol/project presentations to the National Trauma Institute Board of Directors
10. New NTI website www.NatTrauma.org, social media materials, communications

Year 3

Products completed in Year 3 are included in the appendices of this report.

1. Ketamine project had three presentations:
    a. Research Poster presented at the Bayview Science Symposium entitled " Breaking New Ground: RCT testing the Safety, Efficacy & Opiate Sparing Effect of Ketamine Augmentation of Fentanyl for Daily Burn Wound Care Pain"
    b. Research Poster presented at the Bayview Science Symposium entitled " Pain and PTSD Severity are Reciprocally Related in Burn Survivors at 6 Months Post-Discharge"

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2. Faulconer, E. R., et al. (2018). "Use of open and endovascular surgical techniques to manage vascular injuries in the trauma setting: A review of the American Association for the Surgery of Trauma PROspective Observational Vascular Injury Trial registry." Journal of Trauma and Acute Care Surgery 84(3): 411-417.
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7. Donald Jenkins & Michelle A Price. The National Trauma Research Repository #105. Eastern Association for the Surgery of Trauma – Traumacast. Continuing education podcast posted 7/17/2018 https://www.east.org/education/online/traumacasts/detail/1163/the-national-trauma-research-repository

PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

Name	Project Role	Nearest person month worked	% Effort	Contribution to the project
Donald Jenkins	Principal Investigator	.60	5%	Oversight of entire project
Amy Flores	Controller	2.7	30% Oct-Dec 2017 20% Jan-Sept 2018	Subaward financial and contract management, tracking grant expenditures
Elisia Stevens	Executive Assistant	1.8	30% Oct 2017-Mar 2018	Coordinating Steering Committee meetings, drafting minutes, planning face to face steering committee meetings.
Ana Guerrero	Executive Assistant	.15	15% Sept 2018	Coordinating Steering Committee meetings, drafting minutes, planning face to face steering committee meetings.
Monica Phillips	Research Operations Director	3.75	20% Oct-Dec 2017 30% Jan-June 2018 45% Jul-Sept 2018	Assist in data element review. Attends all committee meetings

Pam Bixby	Communications	3.375	32.5% Oct-Dec 2017 10% Jan-Mar 2018 35% Apr-Sept 2018	Responsible for the communication and dissemination tasks of the projects.
Sharon Smith	Project Administrator	3.15	45% Oct-Dec 2017 20% Jan-Sept 2018	Managing Steering Committee meetings, agenda, process. Establishment of working groups.
Michelle Price	Co-Investigator/ Program Manager	5.7	47.5% Oct 2017 52.5% Nov 2017 60% Dec 2017 50% Jan 2018 40% Feb-Jun 2018 55% Jul-Aug 2018 50% Sept 2018	Conducting research on existing registries, platforms, and common data elements. Coordinating subcommittee work and meetings. Communicating with stakeholders and potential collaborators at DoD, NIH, academic trauma centers and trauma professional organizations.
Lizette Villarreal	Program Manager	2.73	55% Oct-Nov 2017 47% Dec 2017 17% Jan 2018 23% Feb 2018 13% Mar-Jun 2018 8% Jul-Sept 2018	Responsible for regulatory oversight and coordination of regulatory reviews and reporting for the 13 research subawards.

Other Collaborating Organizations

Organization	Location	Contribution to Project
Baylor College of Medicine/Ben Taub General Hospital	1504 Taub Loop, Houston, TX 77030	PROOVIT Clinical Site (PI: Dr. Ramyar Gilani)
Emory University	201 Dowman Drive, Atlanta, GA 30322	PROOVIT Clinical Site (PI: Dr. Ravi Rajani)
Loma Linda Medical Center	11234 Anderson Street, Loma Linda, CA 92354	PROOVIT Clinical Site (PI: Dr. Richard Catalano)
University of Southern California	1983 Marengo Street, Los Angeles, CA 90033	PROOVIT Clinical Site (PI: Dr. Kenji Inaba)
Scripps Health	4077 Fifth Avenue, San Diego, CA 92103	PROOVIT Clinical Site (PI: Dr. Michael Sise)
University of California, Davis	2315 Stockton Boulevard, Sacramento, CA 95817	PROOVIT Clinical Site (PI: Dr. Joseph Galante)
University of Maryland/R. Adams Cowley Shock Trauma	22 S. Greene Street, Baltimore, MD 21201	PROOVIT Clinical Site (PI: Dr. Thomas Scalea)
University of Tennessee – Memphis	920 Court Street, Memphis, TN 38163	PROOVIT Clinical Site (PI: Dr. Timothy Fabian)
University of Texas Health Science Center at Houston	6410 Fannin Street, Houston, TX 77030	PROOVIT Clinical Site (PI: Dr. Laura Moore)

University of Wisconsin School of Medicine and Public Health	750 Highland Avenue, Madison, WI 53276	PROOVIT Clinical Site (PI: Dr. Suresh Agarwal)
Wright State University	1 Wyoming Street, Dayton, OH 45409	PROOVIT Clinical Site (PI: Dr. John Bini)
University of Texas Health Science Center at San Antonio	7703 Floyd Curl Drive, San Antonio, TX 79230	PROOVIT Statistical Analysis (PI: Dr. Joel Michalek)
Johns Hopkins University	600 North Wolfe Street, Blalock 1415, Baltimore, MD 21287	Ketamine Clinical Site (PI: Dr. John Fauerbach)
Operative Experience, Inc.	500 Principio Parkway West, Suite 300, North East, MD 21901	Airway Management Simulator Development (PI: Dr. Robert Buckman)

SPECIAL REPORTING REQUIREMENTS

The Quad chart for this project follows.

APPENDICES:

1. Research Poster presented at the Bayview Science Symposium entitled " Breaking New Ground: RCT testing the Safety, Efficacy & Opiate Sparing Effect of Ketamine Augmentation of Fentanyl for Daily Burn Wound Care Pain"
2. Research Poster presented at the Bayview Science Symposium entitled " Pain and PTSD Severity are Reciprocally Related in Burn Survivors at 6 Months Post-Discharge"
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9. Donald Jenkins & Michelle A Price. The National Trauma Research Repository #105. Eastern Association for the Surgery of Trauma – Traumacast. Continuing education podcast posted 7/17/2018
10. National Trauma Institute Communications Report for July- September 2018
11. National Trauma Research Repoository Online Ads

A National Coordinating Center for Trauma Research

PI: Donald Jenkins, MD **Org:** National Trauma Institute

Study/Product Aim(s)

Hypothesis: The civilian trauma research community can be used as a surrogate for military combat casualty care research, maximizing the return from dollars invested by replacing the expensive and repetitive assembly and disassembly of short-lived clinical investigator networks with a stable and enduring operational infrastructure for clinical trauma research.

- Technical Objective 1: To manage specific research projects addressing military research gaps in airway management, pain management and vascular injury.
- Project 1: Determining the Efficacy and Safety of Ketamine as a Battlefield Analgesic;
- Project 2: High Anatomic Fidelity Surgical Airway Training system;
- Project 3: The PROspective Observational Vascular Injury Trial (PROOVIT);
- Technical Objective 2: Develop tools to allow or the collection and dissemination of results and data from studies.

NTRR Launched in June 2018 at www.nti-ntrr.org

Timeline and Cost (direct + indirect)

Activities	FY16	FY17	FY18	FY19
Ketamine Study				
Airway Simulator Development				
PROOVIT				
NTRR Development				
Total Budget ($M)	$1.1M	$1.2M	$1.2M	$1.1M

Goals and Milestones

CY16 Goal –
☑ HRPO approval for studies; Subcontracting complete; Studies commence
☑Common Data Elements and NTRDB functional requirements
CY17 Goals
☑Airway simulator developed
☑ NTRR developer solicited and chosen
CY 18 Goals
☑Ketamine study concludes
☑PROOVIT study concludes
CY19 Goals
☐ NTRR development continues (ongoing)
Comments/Challenges/Issues/Concerns: Ketamine study closed due to non-performance, PROOVIT sites completed on May 31, 2018.
Budget: $4,642,861 Actual: $3,508,357 (as of 09/29/18)

Florence D'Orazi ((301) 619-7035/Florence.d.dorazi.ctr@mail.mil)

Breaking New Ground: RCT testing the Safety, Efficacy & Opiate Sparing Effect of Ketamine Augmentation of Fentanyl for Daily Burn Wound Care Pain

Jokhai, Rayyan; Leventhal, Shanna; Presseller, Emily; Vulaj, Amberley; Song, Alex; Shephard, Ellen; Gehrke, Amanda; Quiroga, Luis; Asif, Mohammed; Ladd, Seth; Gerold, Kevin; Caffrey, Julie; Fauerbach, JA

Johns Hopkins Burn Center, Psychiatry & Behavioral Sciences, Plastics & Reconstructive Surgery, Johns Hopkins University School of Medicine, Baltimore, MD, USA; Uniformed Services University of the Health Sciences, Bethesda, MD.

Introduction

Severe burns are intensely painful and increase risk of chronic pain, PTSD, and major depression (1). Wound care requires painful twice-daily wound care to prevent infection and promote healing. Repeated aversive stimulation of peripheral nociceptors may develop central sensitization and chronic pain (2). Notably, shared symptoms of chronic pain and PTSD are reciprocally related (3). Further, PTSD increases sensitivity to acute pain (4), central sensitization (5) and increased rates of chronic pain (6). Chronic pain, in turn, exacerbates PTSD severity (1). Opiates are ubiquitous in managing burn wound care pain, yet, opiates alone are insufficient (7) as they do not block all μ opioid receptors - thus tolerance and secondary hyperalgesia increase (2). Hyperactivity of the N-methyl-D-aspartate receptor (NMDAR) is the underlying mechanism of sensitization to noxious stimuli and opioid non-responsiveness (8). Ketamine is a selective, non-competitive NMDAR-blocker which enhances opioid efficacy by enhancing μ-opioid receptor-mediated signaling (ERK1/2 signaling) thus reducing desensitization and increasing resensitization and preventing opioid-induced hyperalgesia (9). Low-dose, slow infusion Ketamine has been shown safe and effective for acute burn (10) and chronic pain (11). Ketamine has also been shown to relieve treatment-resistant chronic depression (12), and chronic PTSD perhaps by increasing supply of brain derived neurotropic factor (BDNF) protein (13)

Aims, Design, Treatment Arms

Specific Aims: To evaluate the safety and efficacy of Ketamine in reducing wound care pain, and to evaluate the opiate sparing effects. Secondary aims include investigating the effect on diagnoses and symptom trajectory of depression, PTSD and sleep disturbance.

Trial Design: Double-blind, parallel-group, randomized, controlled trial with repeated-exposure analogous to contexts with repeated exposure to severe pain (e.g., combat wounds). All participants will receive standard clinical care for acute burn injury. Both groups will receive the assigned study drug during twice-daily wound care for the 7-day study period (up to 14 sessions).

Treatment Arms: Augmentation Arm (ketamine plus Fentanyl) and Usual Care Arm (placebo plus Fentanyl). The Augmentation Arm will receive low dose, slow-infusion ketamine (0.3 mg/kg loading dose and 2.5 mcg/kg/min infusion during wound care) in addition to fentanyl (1 mcg/kg loading dose and 1mcg/kg PRN during wound care). The Usual Care Arm will receive a saline-placebo infusion (identical volume to ketamine loading dose and ketamine infusion) in addition to fentanyl (as above).

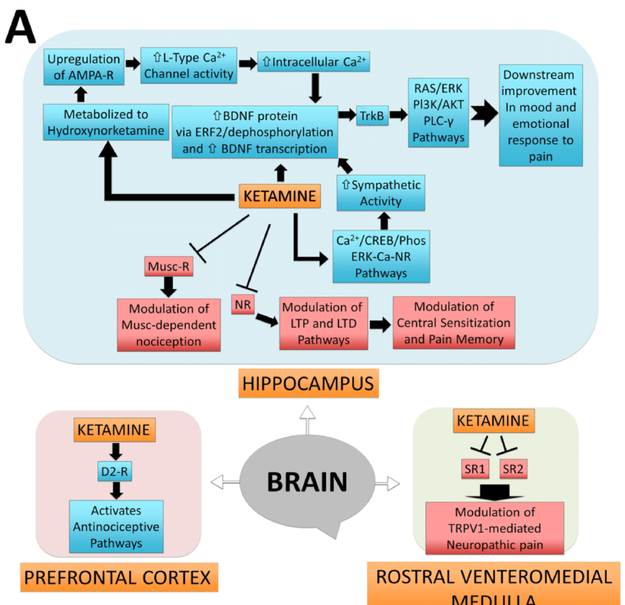
Inclusion

- **TBSA** ≥2% and ≤40% admitted to JHBMC
- **Age** ≥ 18 years and ≤ 70 years

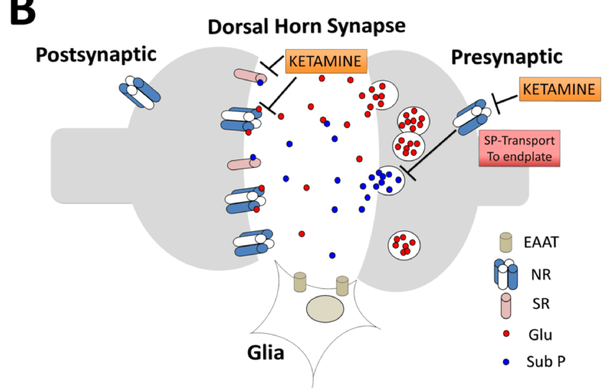
Exclusion

- **Pain** <5/10 in ER
- Insensate
- Lacks Capacity
- Intubated
- LOS <3 days

A. Ketamine's Central Mechanisms of Action on Mood (blue) and Pain (pink)



B. Ketamine's Mechanisms of Action at Dorsal Horn Synapses



Methods

Validated measures are given at 3 stages:

1. Baseline Measures (pre-injury moderators and event-related data): demographic information, injury descriptors, previous exposure to traumatic events (Life Events Checklist), and general health information prior to burn injury (SF-12 Health Survey).

2. Wound Care Measures (before, during, after each session): Pain, pain unpleasantness, and satisfaction with pain relief (numeric analogue scales), and positive and negative affect are collected from patients every 10 minutes during daily wound care sessions for the 7-day study protocol. Opiate sparing is assessed via total opiate equivalent dosages of analgesic (e.g., PRN fentanyl) and other medications administered during wound care.

3. Follow-Up Measures (1-day, 1-week, 1-month after last study session): pruritus, medication usage, pain recall, pain relief satisfaction, health and function (Burn-Specific Health Scale-Brief, SF-12 Health Survey),and appearance satisfaction (Satisfaction With Appearance Scale).

Conclusions

Ketamine has recently emerged as a potentially effective analgesic alternative to narcotics for use in combat associated casualties. Further, it has shown promise in managing PTSD and chronic pain in independent studies and thus may be the key to simultaneously addressing both conditions, especially since the two are intricately connected and concurrently fuel each other through the mutual maintenance model (e.g. the shared symptoms of one increase that of the other and vice versa). Thus, the study will evaluate the safety and opiate-sparing effects of standard of care opiate (fentanyl) augmented with low-dose, slowly infused ketamine for the treatment of pain, hyperalgesia, and allodynia during acute burn wound care. In addition, it will be observed if study-drug participants have reduced symptoms of acute stress disorder, posttraumatic stress disorder, major depressive disorder and sleep disturbance during the study and for up to one-month follow-up.

References & Acknowledgements

References and Measures available upon request.

External Funding: The contents of this poster were developed under a grant from the National Trauma Institute (NTI) and the Department of Defense (DOD). The opinions and assertions contained in this poster are the private ones of the authors and are not to be construed as official or reflecting the views of NTI, DOD, the Federal Government, or the Uniformed Services University of the Health Sciences.

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National Trauma Institute / Department of Defense
National Institute on Disability and Independent Living Rehabilitation and Research
Johns Hopkins Bayview Medical Center, Office of the Vice Dean for Research
Johns Hopkins University, Office of the Provost

Pain and PTSD Severity are Reciprocally Related in Burn Survivors at 6 Months Post-Discharge

A. Gehrke, MS, E. Presseller, L. Quiroga, MD, J. Caffrey, DO, J.A. Fauerbach, PhD

Johns Hopkins Burn Center, Psychiatry & Behavioral Sciences, Plastics & Reconstructive Surgery, Johns Hopkins University School of Medicine, Baltimore, MD, USA; Uniformed Services University of the Health Sciences, Bethesda, MD.

Introduction

Burn pain starts with injury and continues with daily wound care. The present study investigated the relationship of acute pain and chronic posttraumatic stress disorder (PTSD) to chronic pain in burn survivors. Chronic, moderate-severe graft site pain is reported by 28% of burn survivors at 6 weeks and 21% at 6 months[2] and PTSD is reported by 2-40% of burn survivors 3-6 months post-burn.[3] Veterans with PTSD had greater pain severity and disability.[4] Predictors of chronic pain[5] and PTSD[6] are known in burns and other populations,[7] yet theory-driven knowledge of their reciprocity remains limited.[8] The Mutual Maintenance Model posits that pain and PTSD symptoms are reciprocally exacerbating and reinforcing.[1]

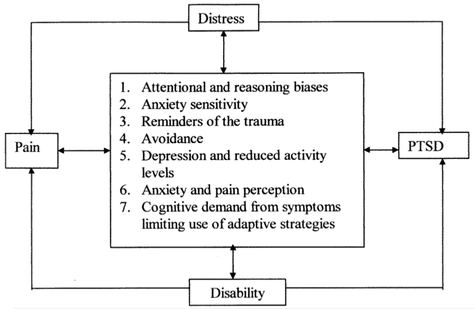


Figure 1. Chronic Pain and Posttraumatic Stress Disorder: mutual maintenance[1]

Objectives

- To investigate the specific relationship between chronic pain at 6 months and PTSD symptoms at 6 months post-discharge in burn injury survivors
- To assess the applicability of the Mutual Maintenance Model to the relationship between burn pain and burn-related PTSD.

Materials and Methods

Burn Model System data (1994 to 2014) were analyzed. The predictor variables were acute pain at discharge (Acute Pain-DC: Short Form-McGill Pain Questionnaire, SF-MPQ), and PTSD at 6 months (PTSD-6, Davidson Trauma Scale). The outcome of interest was chronic pain at 6 months post-discharge (Chronic Pain-6, SF-MPQ). Linear regression examined the association of Acute Pain-DC and Chronic PTSD-6 and their interactions (i.e., Acute Pain-DC X PTSD-6) with Chronic Pain-6. Post-hoc multivariate linear models also regressed Acute Pain-DC and PTSD-6 on the Chronic Pain-6 subscales, Affective Pain and Sensory Pain.

Note. References for measures available upon request.

Results

Sample characteristics (N= 166 with complete data) include: Caucasian (70%), male (69%), mean age 42 years (SD = 15). Injury severity descriptors include: mean TBSA burned 14.65% (SD = 15.6), and length of stay 21.5 days (SD = 23.4). The overall regression models for Chronic Pain-6, Chronic Pain-6 (Affective), and Chronic Pain-6 (Sensory) were significant (R^2 = 0.45, 0.42, 0.42, p = 0.001, 0.001, <0.001 respectively). See Figure 2 for detailed results.

Outcome	Predictor	*B*	SE *B*	B	*T*	*p*
Chronic Pain-6	Chronic Pain-DC	0.14	0.10	0.13	1.42	.159
	PTSD-6	0.09	0.04	0.29	2.36	.019
	Chronic Pain-DC X PTSD-6	0.00	0.00	0.31	1.92	.057
	Constant	1.74	1.45		1.20	.232
Chronic Pain-6 (Sensory)	Chronic Pain-DC (Sensory)	0.14	0.10	0.13	1.40	.164
	PTSD-6	0.04	0.03	0.18	1.24	.216
	Chronic Pain-DC (Sensory) X PTSD-6	0.01	0.00	0.40	2.30	.023
	Constant	1.80	1.21		1.49	.138
Chronic Pain-6 (Affective)	Chronic Pain-DC (Affective)	0.06	0.08	0.07	0.71	.476
	PTSD-6	0.04	0.01	0.48	5.28	.000
	Chronic Pain-DC (Affective) X PTSD-6	0.00	0.00	0.16	1.31	.193
	Constant	0.09	0.28		0.32	.752

Figure 2. Results

Note. DC = At discharge, 6 = 6 months post-discharge, Chronic Pain = Short Form McGill Pain Questionnaire; PTSD = Davidson Trauma Scale

Conclusion

As hypothesized, the Mutual Maintenance Model was supported. Accounting for the influence of acute pain, chronic PTSD at 6 months post-discharge was significantly associated with chronic pain at 6 months post-discharge. Results also indicate that the interaction of acute sensory pain at discharge and chronic PTSD at 6 months post-discharge was significantly related to chronic sensory pain 6 months post-discharge. As such, efforts to prevent or treat chronic pain and PTSD in acute care and rehabilitation will likely reduce their chronicity. See Figures 3 and 4 for potential interventions and their mechanisms.

External Funding: The contents of this poster were developed under a grant from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR grant number 90DP0035). NIDILRR is a Center within the Administration for Community Living (ACL), Department of Health and Human Services (HHS). The opinions and assertions contained in this poster are the private ones of the authors and are not to be construed as official or reflecting the views of NIDILRR, ACL, HHS, the Federal Government, the Department of Defense, or the Uniformed Services University of the Health Sciences.

Acknowledgements:

National Trauma Institute

Department of Defense

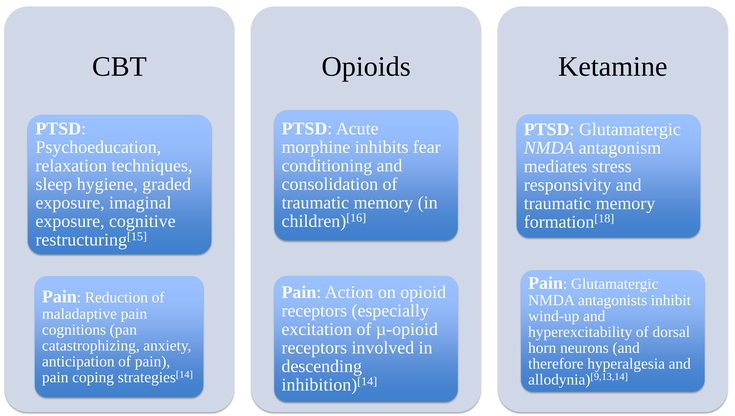
National Institute on Disability and Independent Living Rehabilitation and Research

Johns Hopkins Bayview Medical Center, Office of the Vice Dean for Research

Figure 3. Potential treatment interventions

	Burn Survivors	General Population
Chronic Pain	• Acute non-opioid analgesics (including NMDA antagonists)[9] • Centrally-acting pharmacological agents (antidepressants, anticonvulsants, NMDA antagonists)[10] • Surgical intervention[11] • Fat grafting[12]	• Pharmacotherapies (ketamine, lidocaine, acetaminophen, opioids, SSRIs, SNRIs)[13,14] • Cognitive Behavioral Therapy[14]
PTSD	• CBT with modules addressing consequences of physical injury[15] • Acute morphine (in children)[16]	• Cognitive Therapy • Exposure Therapy • EMDR[17] • Pharmacotherapies (SSRIs, risperidone, topiramate, venlafaxine, ketamine)[17,18]

Figure 4. Potential mechanisms of treatments effective for both pain and PTSD



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CRMS
How to Enroll A Patient

4 Steps:

1) Add Participant
2) Consent
3) Check Eligibility
4) Enroll

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CRMS-63686 Evaluating the Safety, Efficacy and Opiate Sparing Effects of Ketamine in a Setting Analogous to Austere Battlefield Conditions

CRMS Status: Active
PI: Fauerbach, James
IRB Number: IRB00089761
Lead Study Coordinator:
Department/Division: Psychiatry - Behavioral Medicine
Lead Research Nurse:

General | Study Team | Regulatory | Sponsors | Sites | Drug/Device | Enrollment

Protocol Number
CRMS-63686

CRMS Number
CRMS-63686

NCT Category
Treatment

NCT Code
03305055

Short Title
Evaluating the Safety, Efficacy and Opiate Sparing Effects of Ketamine in a Setting Analogous to Aus

Epic Research: Active Flag and Study Team Notification of Inpatient Admission
Display Research Active Flag, Notify Team of Admission

Approved

CRMS Status
Active

PI
Fauerbach, James

PI's Site
Bayview Med Cntr

PI's Primary Affiliation
Psychiatry & Behavioral Sciences

PI's Primary Department
Psychiatry - Behavioral Medicine

Johns Hopkins Authored?
Yes

Is this a Clinical Trial?
Yes

IRB Number
IRB00089761

Phase
Phase IV

IRB
JHMIRB

JHMIRB Committee
3

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CRMS-63686 Evaluating the Safety, Efficacy and Opiate Sparing Effects of Ketamine in a Setting Analogous to Austere Battlefield Conditions

CRMS Status: Active
IRB Number: IRB00089761
Department/Division: Psychiatry - Behavioral Medicine

PI: Fauerbach, James
Lead Study Coordinator:
Lead Research Nurse:

General | Study Team | Regulatory | Sponsors | Sites | Drug/Device | Enrollment

Find Participant on Enrollment List: *(First Name, Last Name, Subject Number, Medical Record Number (MRN))*

Search **Reset List** Back to List

Display Enrollment Status: all; Current Site: all;
Ordered By Name (asc)

0 Participants

Add Participant | Not candidate | Consent | Eligibility | Enroll | Follow Up | Off study | Delete | Lock

No matching participant found. Please click "Add Participant" to add a person to the study.

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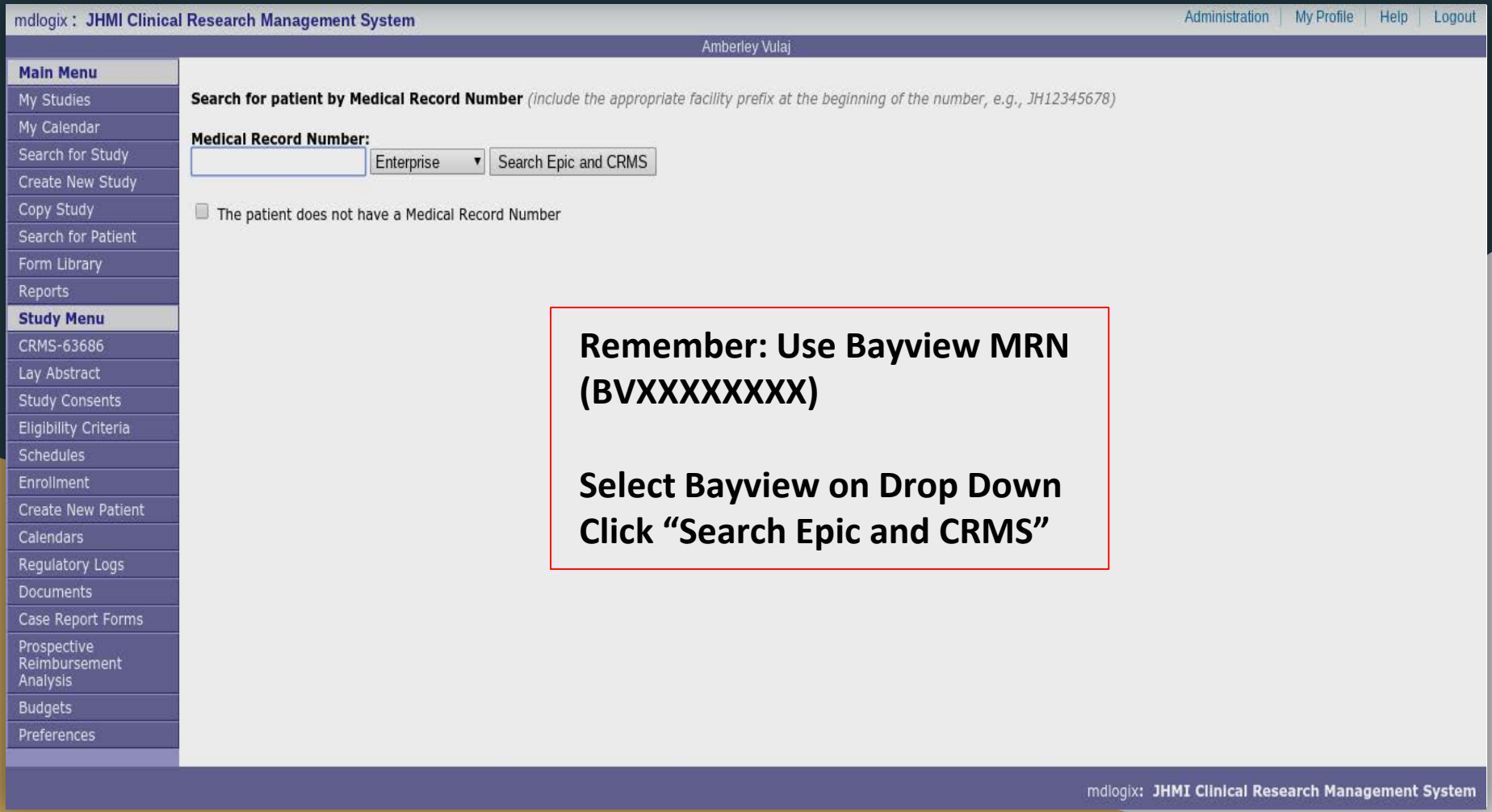
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CRMS Patient	Epic Patient
No matching record found in CRMS	*Name: Shawn Cassidy *Medical Record Numbers: Enterprise - E106647209 JHH - JH66997105 Bayview - BV02138941 *Date of Birth: 01/29/1965 *Social Security Number *Gender: Male Race: White or Caucasian Ethnicity: Not Hispanic or Latino *Address: 7121 Rock Creek *City: FREDERICK *State: MD *Zip: 21702

* Fields used in updating or creating CRMS patients from Epic

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January 29 1965

Social Security Number

***Gender**

Male

***Race**

- American Indian or Alaskan Native
- Asian
- Black/African American
- Native Hawaiian or Pacific Islander
- Other
- Unknown
- White
- Two or more Races
- Declined to Answer

***Ethnicity**

Primary Insurance Carrier

Street Address

7121 Rock Creek

City

FREDERICK

State

MARYLAND

Zipcode

21702

Country

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CRMS-63686 Evaluating the Safety, Efficacy and Opiate Sparing Effects of Ketamine in a Setting Analogous to Austere Battlefield Conditions

CRMS Status: Active
IRB Number: IRB00089761
Department/Division: Psychiatry - Behavioral Medicine
PI: Fauerbach, James
Lead Study Coordinator:
Lead Research Nurse:

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Needham, Cara - Not eligible Bayview Med Cntr — CRFs Docs — [Enter Subject Progress]

MRN:	BV02087391	**Consent:**	12/16/2017	**Scr. Failure:**	[Add]	**Start Int:**	**End Int:**
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Lead Research Nurse:

Needham, Cara

Medical Record Number Enterprise - E106523567
JHH - JH26823506
Bayview - BV02087391
Howard County - HC01138109

Social Security Number
Date of Birth 06/08/1987
Date of Death
Gender Female
Race White
Ethnicity Non-Hispanic

General | Study Team | Regulatory | Sponsors | Sites | Drug/Device | Enrollment

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Site:
Bayview Med Cntr

***Consent:**
RCT Ketamine Augmentation vs. Usual Care for Acute Pain During Burn Wound Care(Main)-11/28/2017

Is this a reconsent?

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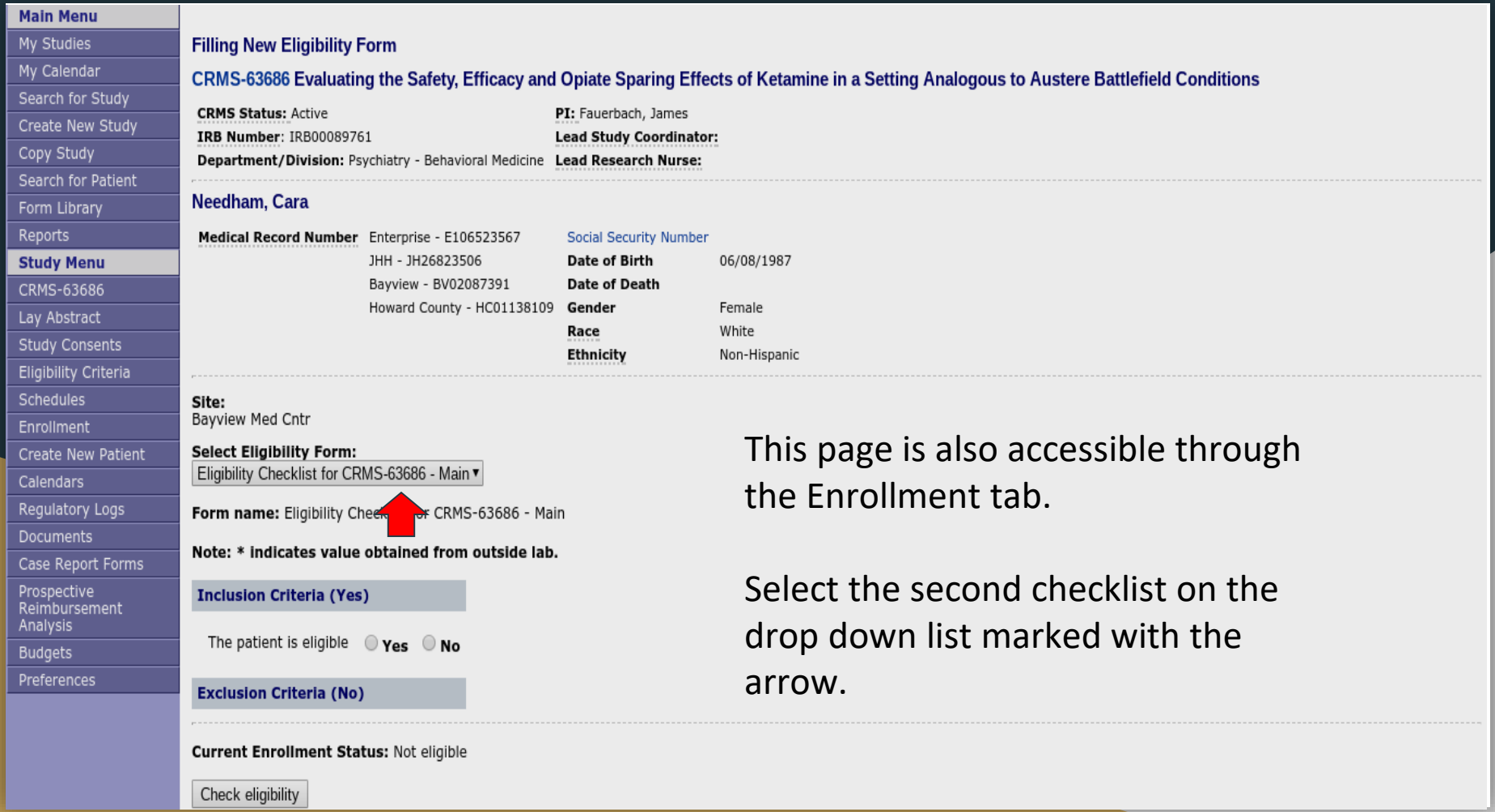

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Inclusion Criteria (Yes)

Does the patient have an acute burn injury with TBSA greater than 2% and less than 40%?	Yes No
Is the patient older than 18 and younger than 70 years of age?	Yes No
Is the estimated length of stay on the day of admission for this patient greater than around 5 days?	Yes No
Did the patient report a pain rated NAS of at least 5 in the Emergency Room during initial wound evaluation/debridement or on admission to the BICU while undergoing debridement?	Yes No

Exclusion Criteria (No)

Does the patient require endotracheal intubation or sedation?	Yes No
Does the patient show a Diminished Level of Consciousness/Cognitive Function (MMSE less than or equal to 20)?	Yes No
Does the patient show a Diminished Capacity (incapable of providing informed consent)? If so, please explain.	Yes No
Is there a concern for the patient's safety due to contra-indication? (e.g., potential drug interactions, medical comorbidities)	Yes No

Is the estimated length of stay on the day of admission for this patient greater than around 5 days? Yes No

Did the patient report a pain rated NAS of at least 5 in the Emergency Room during initial wound evaluation/debridement or on admission to the BICU while undergoing debridement? Yes No

Exclusion Criteria (No)

Does the patient require endotracheal intubation or sedation? Yes No

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Does the patient show a Diminished Capacity (incapable of providing informed consent)? If so, please explain. Yes No

Is there a concern for the patient's safety due to contra-indication? (e.g., potential drug interactions, medical comorbidities) Yes No

Is the patient insensate to pain in the burn wound location? (e.g., SCI; peripheral neuropathy) Yes No

Current Enrollment Status: Not eligible

Check eligibility

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Is the estimated length of stay on the day of admission for this patient greater than around 5 days?	○ Yes ◉ No
Did the patient report a pain rated NAS of at least 5 in the Emergency Room during initial wound evaluation/debridement or on admission to the BICU while undergoing debridement?	○ Yes ◉ No
Exclusion Criteria (No)	
Does the patient require endotracheal intubation or sedation?	◉ Yes ○ No
Does the patient show a Diminished Level of Consciousness/Cognitive Function (MMSE less than or equal to 20)?	◉ Yes ○ No
Does the patient show a Diminished Capacity (incapable of providing informed consent)? If so, please explain.	◉ Yes ○ No
Is there a concern for the patient's safety due to contra-indication? (e.g., potential drug interactions, medical comorbidities)	◉ Yes ○ No
Is the patient insensate to pain in the burn wound location? (e.g., SCI; peripheral neuropathy)	◉ Yes ○ No

Needham, Cara is Not eligible for study CRMS-63686

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Enroll the following patient(s): *(0 of 100 patients enrolled)*

Name	Enrollment Status	Subject number	Date on Study	Message
Needham, Cara	Not eligible	*		must be "Eligible" to enroll

*Patients must have a subject number to enroll

Enroll Cancel

Use of open and endovascular surgical techniques to manage vascular injuries in the trauma setting: A review of the American Association for the Surgery of Trauma PROspective Observational Vascular Injury Trial registry

Edwin R. Faulconer, MBBS, Bernardino C. Branco, MD, Melissa N. Loja, MD, Kevin Grayson, PhD, James Sampson, MD, Timothy C. Fabian, MD, John B. Holcomb, MD, Thomas Scalea, MD, David Skarupa, MD, Kenji Inaba, MD, Nathaniel Poulin, MD, Todd E. Rasmussen, MD, *and* **Joseph J. Dubose, MD***, Fairfield, California*

BACKGROUND: Vascular trauma data have been submitted to the American Association for the Surgery of Trauma PROspective Observational Vascular Injury Trial (PROOVIT) database since 2013. We present data to describe current use of endovascular surgery in vascular trauma.

METHODS: Registry data from March 2013 to December 2016 were reviewed. All trauma patients who had an injury to a named artery, except the forearm and lower leg, were included. Arteries were grouped into anatomic regions and by compressible and noncompressible region for analysis. This review focused on patients with noncompressible transection, partial transection, or flow-limiting defect injuries. Bivariate and multivariate analyses were used to assess the relationships between study variables.

RESULTS: One thousand one hundred forty-three patients from 22 institutions were included. Median age was 32 years (interquartile range, 23–48) and 76% (n = 871) were male. Mechanisms of injury were 49% (n = 561) blunt, 41% (n = 464) penetrating, and 1.8% (n = 21) of mixed aetiology. Gunshot wounds accounted for 73% (n = 341) of all penetrating injuries. Endovascular techniques were used least often in limb trauma and most commonly in patients with blunt injuries to more than one region. Penetrating wounds to any region were preferentially treated with open surgery (74%, n = 341/459). The most common indication for endovascular treatment was blunt noncompressible torso injuries. These patients had higher Injury Severity Scores and longer associated hospital stays, but required less packed red blood cells, and had lower in hospital mortality than those treated with open surgery. On multivariate analysis, admission low hemoglobin concentration and abdominal injury were independent predictors of mortality.

CONCLUSION: Our review of PROOVIT registry data demonstrates a high utilization of endovascular therapy among severely injured blunt trauma patients primarily with noncompressible torso hemorrhage. This is associated with a decreased need for blood transfusion and improved survival despite longer length of stay. (*J Trauma Acute Care Surg.* 2018;84: 411–417. Copyright © 2017 Wolters Kluwer Health, Inc. All rights reserved.)

LEVEL OF EVIDENCE: Therapeutic/care management, level III.

KEY WORDS: Vascular trauma; noncompressible torso hemorrhage; endovascular trauma management.

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Presentation: Presented at the American Association for the Surgery of Trauma 76th Annual Meeting in Baltimore, 13-16th September 2017 in session XIIIB — Outcomes/Guidelines.

DOI: 10.1097/TA.0000000000001776

With the advancement of endovascular techniques and technology, the traditional methods of open vascular exposure and vessel repair or bypass are no longer the only option available when faced with a case of vascular trauma.[1] Increased availability of hybrid operating rooms and advancements in industry technology, such as refinements in wires, catheters, and stents, has enhanced management options for those with a vascular injury.[2,3] Examples of current endovascular use in trauma include angioembolization of pelvic injuries in hemodynamically unstable pelvic injuries, stent use in blunt aortic injury and emerging techniques, such as aortic balloon occlusion as part of resuscitation.[4–6] Despite these advances, hemorrhage remains the second highest cause of death in trauma, and noncompressible torso hemorrhage (NCTH) accounts for the highest number of preventable deaths in this group.[7–9] Endovascular techniques for hemorrhage control with subsequent definitive open or endovascular management are gaining popularity for vascular injuries in noncompressible regions due to the minimally invasive nature of the technology.[10,11] Based on observational data, in certain blunt

injury patterns, such as pelvic arterial trauma associated with a fracture and thoracic aortic injuries, endovascular intervention is becoming the primary treatment modality.[5,12,13] For other noncompressible vascular injuries, endovascular management is not yet as mainstream. Temporary proximal balloon occlusion for hemorrhage control is one technique that is evolving in trauma centers and the prehospital setting as an alternative to open resuscitative thoracotomy.[14–16] By using this minimally invasive technique for proximal control, it may be possible to rapidly control vascular injuries, reestablish a proximal perfusion pressure, and extend life for further assessment, open surgical repair, or a definitive endovascular solution.

The PROspective Observational Vascular Injury (PROOVIT) registry was established in 2013 by the American Association for the Surgery of Trauma to collect data specific to vascular trauma and the management of these injuries. To date, over 2,500 different injuries are included in the database. The aim of this study was to report the incidence of arterial injuries in the registry to date and to analyse injuries in noncompressible regions of the body to assess mortality and hospital resource use associated with open surgical and endovascular management strategies.

METHODS

Enrolled trauma centers submit data directly to the PROOVIT Study through the online data collection portal developed by the American Association for the Surgery of Trauma. Ethical approval for participation in the study and for data submission was received by each center before joining the study through local institutional review boards. Approval for this review of the data was granted by the PROOVIT Study review panel. Following approval, anonymized records for admissions between March 1, 2013, and December 31, 2016, were studied.

Patients who sustained an arterial injury were identified and included in the study. We excluded injuries distal to the knee and elbow. Data extracted included age, gender, mechanism of injury, vessel injury location and grade, admission details, management details, hospital resource utilization, and mortality. Figure 1 summarizes the methodology in the form of a flow chart.

Arteries were first grouped into the anatomic regions of neck, thoracic outlet, thorax, upper limb, major abdominal, abdominal branches, and lower limb for descriptive purposes. Arteries in the major abdominal group included abdominal aorta, and common and external iliac. The abdominal branch arteries included all other named arteries in the abdomen and pelvis. Descriptive analyses of demographics, injury patterns, and presenting features were performed for all regions. Anatomic regions were further grouped into whether they were compressible or noncompressible zones and management strategies were compared in these two groups. For detailed analysis of the noncompressible group by treatment option, patients managed nonoperatively and those with injuries defined as pseudoaneurysms or occlusions were excluded from the cohort. Pseudoaneurysms were overwhelmingly managed with endovascular techniques, and it was felt that these were likely to be stable injuries. Occlusive injuries,

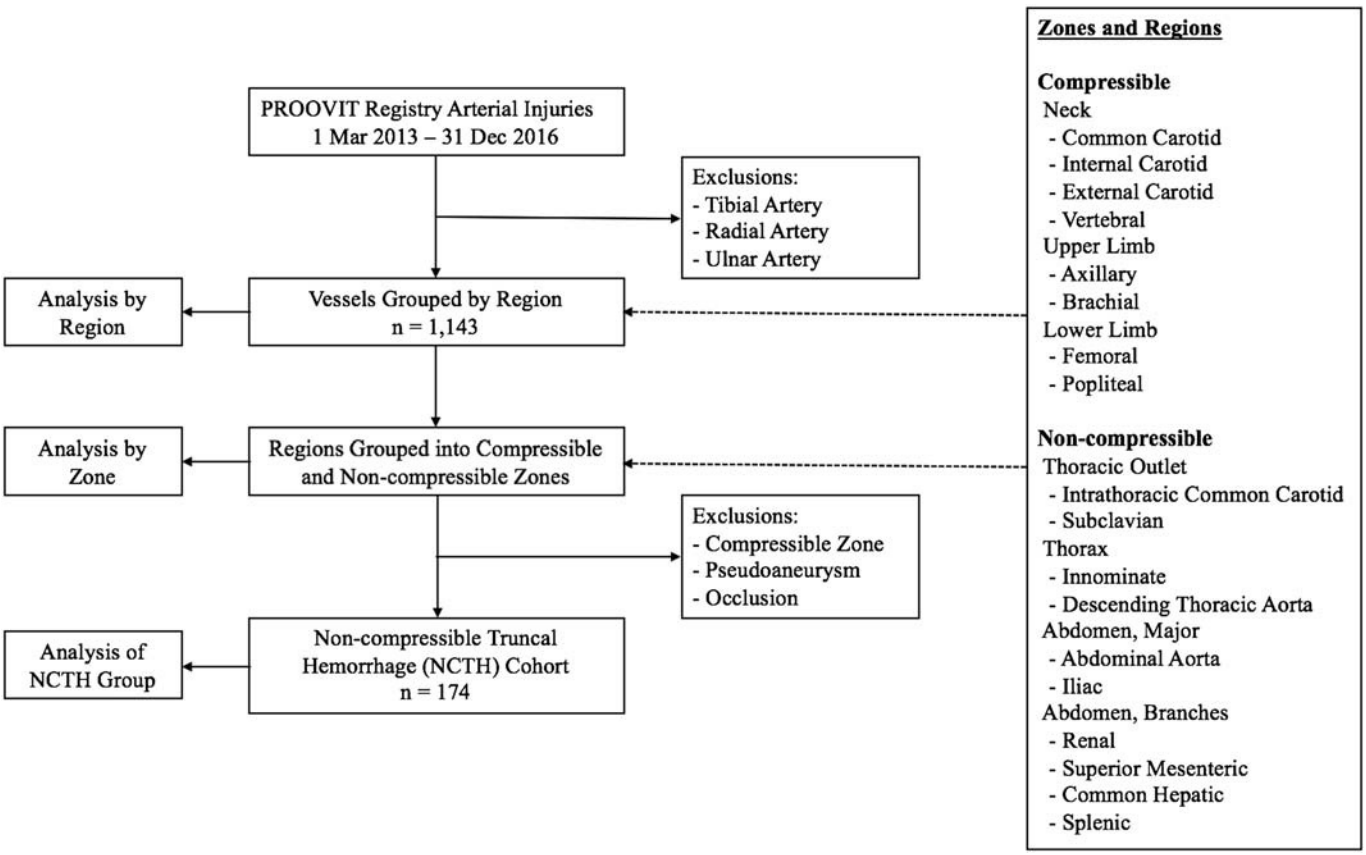

Figure 1. Schematic of study showing inclusions and exclusions for different stages of analysis.

by definition, are not bleeding. This left surgically managed injuries defined as "transection" and "partial transections or flow-altering injury" within noncompressible regions of the body to form the NCTH intervention group for analysis of outcomes by operative strategy. Where both open and endovascular approaches were reported, because of the heterogeneous nature of this small group and the fact that they had undergone definitive open repairs with simultaneous temporary or definitive endovascular procedures, they were considered as having undergone open surgery for purposes of comparison. Primary outcomes were hospital resource use and mortality.

Data were collected using a standard spreadsheet program (Excel for Mac v15.30, Microsoft Corporation, Redmond, WA) and statistical analysis was performed using a statistical software package (Stata for Mac v14.2, Stata Corp, Bryan, TX). Categorical data are reported as frequencies and percentages and compared using chi-square statistics. Continuous variables are reported as medians with interquartile ranges (IQR) and comparisons performed with Student's *t* tests. If data points were missing, they were excluded from that calculation and the denominator reduced. To identify independent predictors for hospital resource use and mortality, variables that on bivariate analysis were significant at *P* less than 0.2 were entered in a forward stepwise logistic regression model. Statistical significance was considered to be *P* less than 0.05 in all cases.

RESULTS

Between March 1, 2013, when the registry opened, and December 31, 2016, 1,143 trauma patients with one or more arterial injuries fitting the study inclusion criteria were submitted by 22 different Level I institutions (median, 31.5; IQR, 11.5–76.75 per institution). Most patients were young adults (median 32, IQR 23–48) males (76%, n = 871) with few comorbidities (Table 1). Nearly half of the injuries were listed as blunt (49.1%, n = 561) with penetrating wounds accounting for 40.5% (n = 464) of cases. A mixed blunt and penetrating injury was described in 1.8% (n = 21) and injury pattern was not specified in the remaining 8.4% (n = 97) of cases. Motor vehicle collisions were responsible for 61.3% (n = 344) of blunt injuries. Gunshots were the most common cause of penetrating injuries (73.5%, n = 341). Within the whole cohort of arterial injuries, transection (36.8%, n = 421) and partial transection or flow limiting defect (24.8%, n = 283) were more commonly described than occlusion (10.1%, n = 115).

When named arteries were grouped by anatomic region (Table 2 and Fig. 2), lower-limb arteries (33.3%, n = 381) accounted for the largest group of single region injuries and a combination of thoracic outlet and thorax arteries (18.1%, n = 207) accounted for the largest number of multi-region injuries. The Injury Severity Score (ISS) was highest in patients with vascular injuries to the thorax and documented hard signs of injury (active hemorrhage, developing hematoma, or distal ischemia) were more commonly seen in extremity trauma than torso injuries. When considering a single region injury pattern only, upper limb had the lowest median ISS value of 10, and thorax had the highest median value of 24 in this cohort.

Table 3 describes the management strategies used for arterial injuries to compressible and noncompressible regions by injury mechanism. Of the 456 injuries to noncompressible regions, blunt injuries accounted for 78.1% (n = 356) of the cases and open surgery or combined open and endovascular surgery was performed in only 13.8% (n = 33) of cases. In contrast to the blunt injuries, 68.0% (n = 68) of the penetrating noncompressible vascular injury patients underwent open or combined open and endovascular surgery.

TABLE 1. Epidemiology of PROOVIT Patients With Arterial Injury Entered March 2013 to December 2016 (n = 1,143) (Excludes Forearm, Hand, Lower Leg, and Foot Arteries)

Demographics	
Male, n (%)	871 (76%)
Age, median (q1, q3)	32 (23, 48)
Premorbid comorbidities and medications	
Chronic kidney disease, n (%)	15 (1.3%)
Insulin-dependent diabetes mellitus, n (%)	49 (4.3%)
Anticoagulation therapy, n (%)	25 (2.2%)
Antiplatelet therapy, n (%)	39 (3.4%)
Injury type	
Blunt, n (%)	561 (49.1%)
Penetrating, n (%)	464 (40.5%)
Mixed, n (%)	21 (1.8%)
Not specified	97 (8.4%)
Most common mechanism of injury by type	
Blunt, motor vehicle collision, n (% of blunt)	344 (61.3%)
Blunt, pedestrian versus automobile, n (% of blunt)	77 (13.7%)
Penetrating, gunshot, n (% of penetrating)	341 (73.5%)
Penetrating, stabbing, n (% of penetrating)	70 (15.0%)
Mixed, motor vehicle collision, n (% of mixed)	10 (47.6%)
Arterial injury pattern	
Transection, n (%)	421 (36.8%)
Occlusion, n (%)	115 (10.1%)
Partial transection or flow limiting defect, n (%)	283 (24.8%)
Pseudoaneurysm, n (%)	135 (11.8%)

TABLE 2. Presentation Details for Anatomic Regions Injured (n = 1,143)

Region	n	ISS, med (q1, q3)	Hard Signs of Arterial Injury, n (% of Region)	Soft Signs of Arterial Injury, n (% of Region)
Single region				
Neck	52	21 (13.75, 29)	52 (100%)	28 (53.8%)
Thoracic outlet	44	20 (13, 32.75)	14 (31.8%)	17 (38.6%)
Upper limb	203	10 (6, 16)	108 (53.2%)	130 (64.0%)
Thorax	4	26 (17.5, 42)	0	1
Abdomen, major	148	22 (17, 34)	42 (28.4%)	55 (37.2%)
Abdomen, branches	80	25 (17, 38)	24 (30.0%)	24 (30.0%)
Lower limb	381	11.5 (9, 19.75)	179 (47.0%)	253 (66.4%)
Multiregion				
Thorax and thoracic outlet	207	32 (22, 41)	25 (12.1%)	34 (16.4)
Other multiregion	24	—	—	—

Major abdominal arteries include abdominal aorta, and common and external iliac. The abdominal branch arteries include all other named arteries in the abdomen and pelvis.

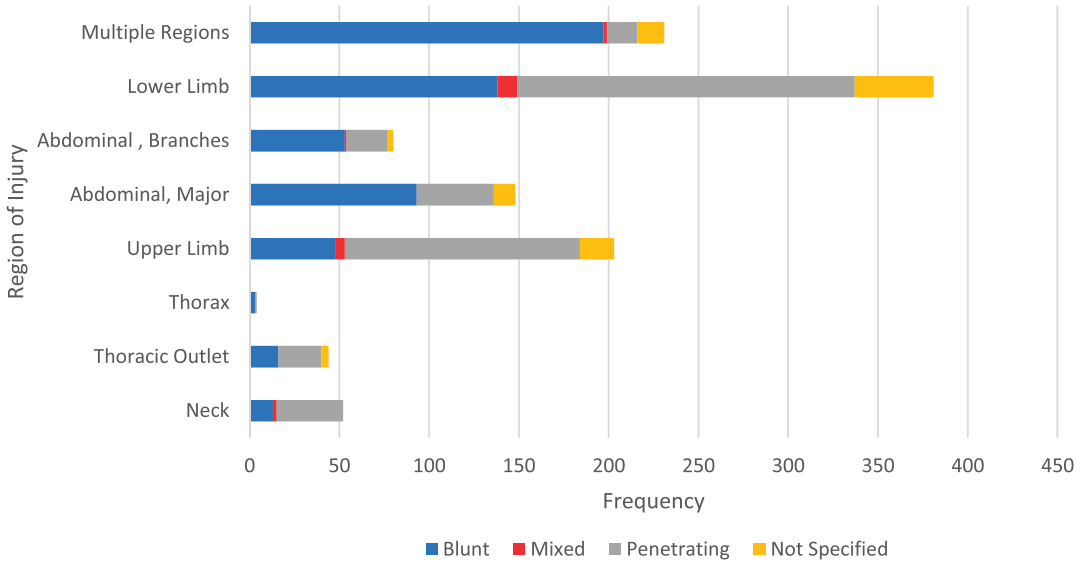

Figure 2. Mechanism of injury distribution by region of injury.

After exclusion of occlusive and pseudoaneurysm injuries and those not managed surgically from the noncompressible cohort, 174 patients made up the NCTH group who underwent surgical management. This group contained 138 males (78.1%) and 36 females with a median age of 36 (IQR, 24.25–54 years). Blunt mechanism of injury was more common than penetrating (109 vs. 65). Ninety-six injuries were to the abdomen/pelvis, 76 to the thoracic outlet or thorax and thoracic outlet and two patients had injuries to all three of these regions. Table 4 details the differences between those patients managed with open compared to endovascular surgery. The endovascular group had a significantly higher ISS on presentation (29 [21, 38] vs. 21 [16, 34]; $P = 0.020$), longer stays on intensive care unit (ICU) (7 [3, 18] vs. 3 [0, 13], $P = 0.009$) and in hospital (17 [7, 32] vs. 9 [2, 24]; $P = 0.003$) but required less packed red cell units (2 [0, 8] vs. 10 [4,24]; $P < 0.005$) than the open surgery group. Mortality rates were significantly lower in the endovascular group (10.8% vs. 39.5%, $P < 0.005$).

Multivariate Analysis

Multivariate regression analysis of mortality, packed red blood cell (PRBC) use in survivors, and hospital length of stay was performed using independent variables of PRBC use, hospital length of stay, treatment strategy, type of injury, admission lactate, hemoglobin (Hb), systolic blood pressure, use of vasopressors in first 24 hours, and NCTH subregion (abdomen vs. thorax/thoracic outlet).

Only Hb and PRBC use were independent predictors of mortality. When analyzing PRBC use as a dependent variable in survivors, admission lactate, penetrating injury, and the use of vasopressors in the first 24 hours were independently predictive. Hospital length of stay predictors in survivors included abdominal injuries and the use of vasopressors in the first 24 hours. In all three of these models, R^2 or pseudo-R^2 values were between 0.3 and 0.4.

TABLE 3. Management Strategies for Compressible and Noncompressible Regions by Injury Mechanism, n = 1,014

Description (n)	Conservative	Open Surgery	Endovascular Surgery	Combined Open and Endovascular
Compressible				
Blunt (199)	53 (26.6%)	130 (65.3%)	12 (6.0%)	4 (2.0%)
Penetrating (359)	69 (19.2%)	276 (76.9%)	5 (1.4%)	9 (2.5%)
Noncompressible				
Blunt (356)	164 (46.1%)	33 (9.3%)	143 (40.2%)	16 (4.5%)
Penetrating (100)	15 (15.0%)	65 (65.0%)	17 (17.0%)	3 (3.0%)

DISCUSSION

Our review of arterial injuries from the PROOVIT registry, focusing on NCTH patterns, shows evidence of use of both

TABLE 4. Resource Utilization and Outcomes for Transection and Partial Transection Injuries in Noncompressible Regions by Management Strategy (n = 174)

Noncompressible Transection, Partial Transection or Flow-Limiting Defect	Open Surgery	Endovascular Surgery	*P*
n	77	97	
Age, median (q1, q3)	31 (23, 48)	40 (25, 55)	0.032*
ISS, median (q1, q3)	21 (16, 34)	29 (21, 38)	0.020*
Admission systolic BP, median (q1, q3)	88 (73, 126)	116 (95, 137)	<0.005*
Admission Hb, median (q1, q3)	11.5 (10, 13)	12 (11, 14)	<0.005*
Admission pH, median (q1, q3)	7.16 (6.97, 7.28)	7.25 (7.19, 7.32)	<0.005*
Admission lactate, median (q1, q3)	6.65 (3.18, 11.6)	3.8 (2.3, 4.9)	<0.005*
Ventilator days, median (q1, q3)	2 (0.5, 5.5)	4 (0, 14)	0.280
ICU days, median (q1, q3)	3 (0, 13)	7 (3, 18)	0.009*
PRBC units in first 24 h, median (q1, q3)	10 (4, 24)	2 (0.8)	<0.005*
Hospital LOS, median (q1, q3)	9 (2, 24)	17 (7, 32)	<0.005*
In hospital mortality, n (% of group)	30/76 (39.5%)	10/93 (10.8%)	<0.005*

*denotes significance of <0.005.

open and endovascular surgical techniques to manage vascular injuries throughout the body. Vascular injuries across the spectrums of mechanism of injury, severity, type, and location are being managed with both techniques. Despite this, penetrating injuries are more commonly being managed with open surgery. These data show an increasing tendency to manage blunt NCTH injuries by endovascular means. In these cases, despite longer length of stay, transfusion requirements, and mortality rates were lower compared with the patients managed with open surgery. The ICU and hospital stays were longer likely due to the higher number of survivors in a group with a higher ISS value on admission. However, despite the obvious statistical difference in PRBC requirements and mortality when comparing the endovascular and open surgery NCTH groups, type of surgery was not an independent predictor of mortality, PRBC use, or hospital length of stay on multivariate regression analysis. This may indicate that there is more to the pattern of injury or presentation that is not available for comparison in the registry, and the low R^2 values seen on multivariate analysis support this assumption that a large proportion of the model is unaccounted for by the current variables. In Chang et al.'s[1] recent retrospective multicenter review of NCTH across four Level I trauma centers, a similar pattern was described in their data. They theorized that the endovascularly managed patients may be more stable and not actively exsanguinating, whereas those managed by open techniques were more urgent. In our data set, the subgroup of NCTH treated with open surgery had worse baseline vital signs than the endovascular group. This would suggest that the endovascular group were more stable, and therefore, the clinicians may have had more time to investigate and plan surgery rather than be forced into an immediate operation.

In this review, Level I trauma centers provided the majority of the data. The PROOVIT registry records location of procedure but not specialty or grade of the treating physician. There has been an increase in the rate of use of endovascular techniques to approach vascular trauma as seen in other reviews, and our data support these findings. There are many factors which influence the choice of surgical approach including patient factors, urgency of the procedure, facilities, available staff, and institutional protocols. It is not possible to tell from the data in the PROOVIT registry which factors are influencing the trauma team's decision making in each individual case.

The definitions and management strategies of NCTH were reviewed by Morrison and Rasmussen in 2012 and this review recently updated.[11,17] In their definition of NCTH injuries need to be from one of four anatomic categories (thoracic cavity, solid organ, named axial torso vessel or pelvic fracture with ring disruption) and include the presence of hemorrhagic shock or the need for immediate surgery to control bleeding. The results from our subset of 174 arterial injuries in noncompressible zones satisfy this NCTH criterion as only surgically managed patients were included. It might, however, be more accurate to describe our cohort as being arterial NCTH rather than the broader NCTH definition offered by Morrison and Rasmussen.

We sought to assess differences in outcomes of mortality and hospital resource use when adapting endovascular or open surgical strategies in arterial NCTH. A previous review of the PROOVIT registry presented the first year of data but numbers were too small to analyze different regions and treatments in detail.[18] This review has shown a significant difference in the NCTH outcomes between the two treatments but fails to prove that treatment is the sole reason for these differences. Branco et al.[19] published the largest US review of registry data on arterial injury outcomes for endovascular therapy to date using data from the National Trauma Data Bank (NTDB) between 2002 and 2010. They showed an increase in the use of endovascular techniques in blunt and penetrating causes over the nine years of the study and compared outcomes by matching the open and endovascular cohort groups. Although they conclude that endovascular is associated with lower mortality rates, this conclusion relates to the whole study and is not specific to noncompressible regions. Because the NTDB does not offer details on vessel injury descriptions such as occlusion, transection, and pseudoaneurysm, it is likely that their cohort is a mixture of these different injury patterns and therefore different from our cohort where occlusion and pseudoaneuryms have been excluded.

Two recent studies analyzing specific noncompressible vascular injuries include Branco and colleagues dual-center study on axillosubclavian injuries between 2002 and 2010 and Lauerman and colleagues[10,20] review of iliac injuries in the NTDB between 2002 and 2006. In the axillosubclavian study, the authors showed a trend of lower ventilator, ICU and hospital stays in matched endovascularly managed patients but not statistical significance. In the iliac NTDB review, both venous and arterial injuries were included, and the authors showed a higher rate of endovascular therapy use compared with open surgery in blunt patients with associated pelvic fractures. They did not attempt to compare mortality or resource use by treatment. It is difficult to compare our results and outcomes with either of these studies. Surgical practice continues to change over time, and our data are from a more recent period. This study also has different definitions for inclusion, and we have not attempted to match the different treatment groups.

This review has focussed on the type of surgery performed. While the PROOVT registry does account for damage control techniques, it does not address whether these techniques are open or endovascular in type. resuscitative endovascular balloon occlusion of the aorta is an endovascular technique gaining favour in trauma centers instead of open resuscitative thoracotomy in certain instances.[4] A separate registry monitoring its use in the US reported 1 year results showing no survival benefit between the two techniques.[21] It is not possible to tell in our review whether resuscitative endovascular balloon occlusion of the aorta was used in either the hybrid or endovascular groups. We have focused on the overall technique used to manage the injury.

As with any registry data, there are limitations to the accuracy of the data as a representation of practice on a wider scale. This review includes data on vascular injuries from 22 trauma centers across the United States, which represent a small percentage of the number of institutions who submit data to the NTDB. The PROOVIT institutions are categorized by level and by volume but the exact number of admissions for the period studied are not recorded, so the incidence of these injuries cannot be calculated. In this review, we did not address time delays to surgery, duration of procedure or whether the patient had a planned period of nonoperative observation before surgery. In the combined group, it is difficult to establish if patients had initial damage control using one technique, and then definitive management using another or whether the hybrid approach

was planned from the outset. Admission independent variables are the first recorded results in hospital. These data show significant differences between the admission vital signs of the NCTH groups undergoing different surgical approaches. By excluding missing data points in the analysis, it is possible that we have produced some bias in this analysis but it was felt that this was the appropriate way of presenting the data given its nature as a descriptive study of registry data. The PROOVIT registry does not account for prehospital vital signs, resuscitation efforts before presenting to the emergency department, or delays between injury and assessment which may greatly affect outcomes in vascular trauma and may influence the outcomes of this study if known. Despite these limitations, our results show an interesting pattern of lower mortality and transfusion amounts but longer hospital and ICU stay between patients with blunt NCTH vascular injuries managed with endovascular or open surgery.

CONCLUSION

Our review of the PROOVIT registry demonstrates utilization of endovascular therapy among severely injured blunt trauma patients primarily with noncompressible torso hemorrhage. In that population, endovascular therapy was associated with low requirements for blood transfusion and high survival rates but longer hospital length of stay than surviving patients treated with open surgery. Additional investigation is needed to define indications and optimal utilization of endovascular technologies in the setting of vascular trauma.

AUTHORSHIP

E.R.F., J.J.D., and B.C.B. were responsible for initial planning and data acquisition. E.R.F., M.N.L., and K.G. analyzed the data and performed the statistics. E. R. F. drafted the article. M.N.L., K.G., B.C.B., J.S., T.B.F., T.C.H., T.S., D.S., K.I., T.E.R., N.P., and J.J.D. provided advice and critical editing of the article. E. R. F. takes responsibility for the content of the article.

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DISCLOSURE

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DISCUSSION

Dr. J. David Richardson (Louisville, Kentucky): In the mid-1990s the AAST constituted the Multi-Institutional Trials Committee and I was actually privileged to be the chair of that group initially and for several years.

In 1997, exactly 20 years ago, the first paper from that group was published after presentation at this meeting on what was then the current management of blunt aortic rupture.

It's interesting, these things, even though there may not be trials, per se, that paper actually changed practice management a great deal by showing that the clamp-and-sew technique was inferior, really, to bypass in the treatment of blunt aortic rupture.

Now the original plan for the Committee was that we would do actual trials but logistics, review board issues, ethical concerns really make that unworkable.

Instead, that original paper outlined the current state of treatment with a huge data base of contemporaneously treated patients and in that spirit the PROOVIT trial, I think, now does the same thing.

Any time you can get treatment over a period of just three or four years on over 1,100 patients with vascular injuries, that makes it, in my view, a very valuable paper, regardless of any limitations it might have.

In the interest of time I'll ask only two questions.

The authors state the most common indication for endovascular treatment was – quote – blunt, non-compressible torso injuries, but didn't provide much granularity in that in terms of what type of vessels were treated and exactly how that treatment went.

I think your paper would be greatly enhanced by perhaps adding a table on that, to wit, how many if any of these endovascular treatments were embolizations of pelvic fractures, for example. You didn't mention that. I'm not sure if those were even included.

It's important to know that detail to distinguish between a technique in use for 40 years versus the more novel applications of stents or embolizations of non-pelvic vessels.

Then now many were endographs, if any – I would presume some were – for blunt aortic injuries? It all would be useful to know. And, again, I think actually adding a table to your manuscript would be very helpful.

My second question is perhaps a more philosophical one. You are probably unable to answer it. But do you have data or at least some general sense of who is doing the treatment, particularly on these penetrating extremity injuries? Are these done by vascular surgeons or acute care trauma surgeons?

One of the promises of acute care surgery was that surgeons would manage a broad spectrum of injuries, including vascular problems; but in my view of the landscape that is not often true or often not true, although in many places it is. So do you have data or opinions on my observations?

Regardless, I think this is an excellent paper and I certainly commend it to everyone for their review.

Dr. Edwin R. Faulconer (Davis, California): Dr. Richardson, thank you very much for your kind words and your comments.

The question about granularity on the non-compressible hemorrhage group and what is being managed within this data set. The pelvic embolizations, as was presented by the last presenter, tend to fall outside of this registry because the registry does not go down into very small, unnamed pelvic vessels. Very significant pelvic injuries might be in the data set but the majority of the pelvic fractures with angioembolization probably aren't making it into this registry. The blunt aortic injuries, however, are.

In the endovascular group of 97 patients that we presented, within the non-compressible trauma group 54 percent of these are thoracic injuries rather than abdominal or pelvic injures. And of these thoracic injuries all but one are blunt.

This is in contrast to the open surgical patients. They're more abdominal; they're more penetrating; and they're actually only got a 25 percent rate of thoracic injury. They are different groups. We accept that. And that's why we're not trying to say that one technique is better. It is clear in the multivariate analysis that the techniques don't make a significant difference as don't show up as independent variables in this data set.

I think with more numbers we could do that comparison much better but with the numbers we've got at the moment we kept the statistical analysis to non-compressible trauma.

Your second question I can't answer, as you suggested. I can tell you where in the Hospital these operations are being done: whether they are being done in a hybrid suite or whether they are being done in an interventional radiology suite, but I can't tell you who is doing them. I can't tell you whether it's a resident or a fellow or an attending and what their subspecialty or training is. And that may be something that can be brought in in the future or in trials or prospective studies.

IS YOUR CLINICAL TRIAL READY FOR NEW DATA SHARING REQUIREMENTS?

Jenkins, Donald H; Phillips, Monica J; Beilman, Gregory J; Bulger, Eileen M; Davis, Michael R; McAuliffe, Matthew J; Rasmussen, Todd E; Salinas, Jose; Smith, Sharon L; Spott, Mary A; Weireter, Leonard J; Price, Michelle A.

Introduction: Increasing data sharing and avoiding duplication of studies have been ongoing challenges in medical research. In order to address these issues and create a standard for data sharing among medical researchers, the International Committee of Medical Journal Editors (ICJME) will start requiring the use of data sharing plans as part of a clinical trial manuscript submission beginning in July 2018. ICJME journal members include *The Journal of the American Medical Association* and *The New England Journal of Medicine,* and many medical journals follow its recommendations (e.g., requiring trial registration at clinicaltrials.gov). To address this new requirement, the Department of Defense (DoD) funded the development of the new National Trauma Research Repository (NTRR).

Methods: The NTRR is designed to be a central, cloud-based repository for the clinical data resulting from both military funded and civilian research efforts. Access to the system is through web-based applications developed jointly with the National Institutes of Health – Center for Information Technology. Repository data will cover the entire patient care trajectory: from injury prevention, point of injury, en route care, hospital care, rehabilitation and long-term outcomes. The system allows researchers to share original data sets and request shared data sets for secondary analyses. The NTRR uses common data elements (CDEs) to improve data quality and opportunities for comparison and combination of data from multiple studies. To identify the initial CDEs, a review of data elements from more than 20 large trauma study data dictionaries (including PROOVIT, PROMMT, ROC and METRC) and the NIH Common Data Element Resource Portal was conducted.

Results: Over 500 data elements from 20 trauma-related research data dictionaries were reviewed to identify the most frequently used CDEs in trauma research. The most frequently used CDEs were organized into the following data storage modules: Core and study metadata (submitted by all studies), Prehospital, Inpatient, Rehabilitation, and Outcomes/Quality of Life. Studies contributing data to the NTRR are categorized to the appropriate phase of care module. Importantly, NTRR's data structure allows researchers to add unique data elements (UDEs) to the NTRR data dictionary for their study and use by other researchers. This will further promote data harmonization across trauma studies.

Conclusion: The NTRR was developed to facilitate data sharing in order to optimize the use of clinical trauma research data and collaboration across the trauma research community. The NTRR data dictionary contains the most frequently used CDEs among trauma research studies organized into phase of care modules. The NTRR will provide trauma researchers with a unique and novel tool to conduct exploratory analyses of shared data sets, to create and implement a data sharing plan, to adopt CDEs for study data dictionaries, and to meet new medical journal data sharing requirements.

Abstract Submitted for 2019 EAST Meeting

Introduction: Fasciotomy remains an important adjunct in the management of peripheral vascular injuries, yet the indications for and natural history of this intervention are not well elucidated.

Methods: The AAST PROOVIT registry was utilized to identify patients undergoing four compartment fasciotomy of the leg after femoropopliteal arterial injuries. Outcomes following fasciotomy for both therapeutic and prophylactic indications were compared, including whether primary skin closure or split-thickness skin grafting (STSG) was performed.

Results: From 2013 to 2018, 530 patients with femoropopliteal artery injuries were identified, of whom 272 (51.5%) underwent surgical management. Fasciotomy was performed at the initial operation in 55.5% (151/272) of patients, with 92.1% (139/151 surviving to discharge; of interest, delayed fasciotomy was performed at reoperation in only 5.8% (7/121) patients in this group. Among survivors, fasciotomies were classified as "therapeutic" in 58.3% (81/139) and "prophylactic" in 41.7% (58/139). There were no significant differences between these two groups, including amputation rate (14.8% vs. 8.6%, $p = 0.272$) and the rate of primary skin closure (54.0% vs. 53.4%, $p = 0.919$) of the fasciotomy site. Comparison of rates of primary skin closure versus STSG coverage revealed only that skin closure was more likely among patients who were more severely injured (ISS 16.0 vs. 10.0, $p = 0.039$; Extremity AIS 3.3 vs. 2.8, $p = 0.007$). Primary skin closure was achieved at a median of 5.0 days vs. 11.0 days for STSG ($p = 0.001$)

Conclusion: Over 55% of patients undergoing repair of a femoral or popliteal artery injury have a fasciotomy of the leg performed at the same operation, and delayed fasciotomies are very uncommon in the modern era. A "therapeutic" indication for fasciotomy continues to be more common than "prophylactic", while outcomes are identical in both groups.

Submitted to EAST 2019

Title: Contemporary Tourniquet Use in Extremity Vascular Trauma: The AAST PROspective Observational Vascular Injury Treatment (PROOVIT) Registry

Background: Correct tourniquet application can be a lifesaving intervention prior to definitive surgical treatment of extremity vascular trauma. Only a few small studies have evaluated tourniquet use in civilian trauma. We aimed to describe the contemporary use of tourniquets in the management of civilian extremity vascular trauma and evaluate the associated outcomes.
Methods: Data was analyzed from the multicenter AAST PROOVIT registry (Feb 2013-Dec 2016) using student t-tests and propensity-score matching using R-software. Controls were matched using Injury Severity Score(ISS), Abbreviated Injury Score of the extremity(AIS extremity), initial systolic blood pressure(SBP), initial Glasgow Coma Scale(GCS) score, lactate level, and age. Patients with multiple arterial injuries were excluded.
Results: 623 patients were included for analysis. Pre-hospital tourniquets were placed in 14.9% of patients with extremity arterial injury. The amputation rate following any extremity arterial injury, with or without placement of a tourniquet, was not statistically different when compared to propensity-matched controls (tourniquet 0.04 vs none 0.10;p=0.12). There was no statistical difference between in-hospital mortality with tourniquet placement (tourniquet 0.08 vs control 0.04;p=0.18). Tourniquet use did not significantly affect 24-hour packed red blood cell (pRBC) transfusion requirement (tourniquet 7.98 vs none 7.12;p=0.35), need for post-operative therapeutic anticoagulation (tourniquet 0.65 vs none 0.68;p=0.36), or the rate of infection in the affected limb (tourniquet 0.01 vs none 0.02;p=0.45).
Conclusion: The PROOVIT registry shows that in contemporary civilian practice, tourniquets are used for extremity arterial injury in just 14.9% of cases, much lower than previously reported. Tourniquet use was not associated with an increased rate of amputation, in-hospital mortality, 24-hour pRBC transfusion, or subsequent infection in the affected limb. As the national rollout of the Stop the Bleeding campaign gains momentum, we should continue to advocate for pre-hospital tourniquets, as the life-saving benefit does not appear to be offset by increased morbidity or mortality.

Level of Evidence: Level III, Prospective cohort study, prognostic
Keywords: vascular injury, tourniquet, exsanguination, trauma, amputation

Trauma Surgery & Acute Care Open

Launch of the National Trauma Research Repository coincides with new data sharing requirements

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NTRR IS LAUNCHING

Previous analyses of research data have shown that many trauma studies cannot be replicated or validated due to a variety of factors, including lack of access to study data, lack of access to protocol information, and inability to replicate procedures used in the study. New data sharing rules for federally funded studies have been put in place to address factors associated with this issue.

To address these new data sharing requirements, beginning this month, investigators conducting research on trauma and critical care will be able to maximize the utility of the data they produce with the launch of the National Trauma Research Repository (NTRR). The system was developed as a resource to support new and emerging data sharing needs within the trauma research community and is envisioned to be a key piece of the national trauma research infrastructure. It is funded by the Department of Defense (DoD) and developed by the National Trauma Institute (NTI) to promote collaboration, accelerate research, and advance knowledge on the treatment of trauma. When it becomes fully functional, the NTRR will be a comprehensive repository offering thousands of data points from hundreds of studies, enabling investigators to query across studies for their own research objectives.

The NTRR was developed by trauma researchers for trauma researchers. A national committee was convened of civilian and military trauma researchers and stakeholder organizations to define the functional requirements of the repository that would best serve investigators.[1] The NTRR allows users to peruse available data elements, study data sets, and supporting documentation (eg, protocols, consent forms, data dictionaries). Investigators contributing data to the NTRR can upload completed data sets and supporting documents at the completion of a study or as the study is being conducted. All studies will submit core data elements and study metadata (information about the study). Use of common data elements (CDEs) is encouraged to improve data harmonization and opportunities for comparison and combination of data from multiple studies. The system also allows researchers to use unique data elements, or UDEs, if a CDE for that variable is not available. When the data set is complete and validated, it will receive a digital object identifier (DOI) to allow contributing researchers to be acknowledged in publications resulting from secondary analyses.

The NTRR is organized in four modules representing the entire patient care trajectory: prehospital care, inpatient care, rehabilitation, and long-term outcomes/quality of life issues. Access to the system is through a web-based interface developed by the National Institutes of Health (NIH) – Center for Information Technology and enhanced by the NTI. Hosted in a secure Amazon Web Services cloud environment, the repository conforms to standards set forth in the Federal Information Security Management Act, which provides a standardized approach for assessing, monitoring, securing, and authorizing cloud computing products. Specific security controls in place for the NTRR include firewalls, application monitoring software and integrated cloud tools for operating system scanning, SSL (Secure Sockets Layer), antivirus and password encryption technology, and security audits and inspections.

Uploading trauma research data into the NTRR will fulfill both funder and publisher obligations to share and help to create a rich resource to support trauma investigations over time. Although it will take years to build out the repository and for it to be used at full capacity, the NTRR holds great promise for the responsible stewardship of data, respecting the contributions of study participants, the efforts of trialists, and the sources of public funding whose ultimate goal is to improve patient outcomes and minimize death and disability.

NTRR ENTERS AN EMERGING DATA SHARING LANDSCAPE

Over the past 15 years, the concept of data sharing has grown from a few disease-specific efforts such as traumatic brain injury and Parkinson's disease to almost universal expectations by research funding entities and journal editors. Those requiring various degrees of sharing include academic journal publishers and a wide variety of funding agencies, from government entities like the DoD and the NIH to private philanthropies like the Bill & Melinda Gates Foundation and Wellcome Trust, to corporate entities like Medtronic and GlaxoSmithKline.[2 3]

Perhaps the earliest funder to recognize the benefits of data sharing, the NIH initially published its Statement on Sharing Research Data in 2003.

Declaring that "data sharing is essential for expedited translation of research results into knowledge, products, and procedures to improve human health," the NIH requires applicants seeking $500 000 or more in grant funding to include a plan for data sharing in their proposals.[4] Likewise, since 2011, the National Science Foundation (NSF) has required funding proposals to include a data management plan describing how they will conform to the NSF policy on the dissemination and sharing of research results.[5] Such plans are expected to address the types of data and other materials to be produced during the study, the data and metadata standards to be used, policies for access and sharing, policies for reuse, and plans for archiving and preserving access to data and other research products.

In 2013, the White House Office of Science and Technology Policy (OSTP) asserted that federal agencies will work to develop policies to make the results of federally funded research freely available to the public and for requiring researchers to better account for and manage the digital data resulting from federally funded research.[6] After OSTP's mandate, the DoD issued its guidance in 2015, with a "Plan to Establish Public Access to the Results of Federally Funded Research." The plan provides a framework for increasing public access to both scholarly publications and the scientific data that underlie them—for the research and programs funded in part or wholly by the DoD. "Having DoD components work together within this proposed framework will yield synergies and innovations no single component can achieve alone," explained its authors (p2).[7] According to the plan, those submitting research proposals must include a data management plan that largely follows what is required by the NSF, and must upload research outputs—including peer-reviewed scholarly publications and data sets—to an online repository maintained by the Defense Technical Information Center.[7]

In 2014, *The Public Library of Science* (*PLOS*) was one of the first publishers to make data sharing a requirement for those investigators whose articles are accepted for publication in its journals.[8 9] *British Medical Journals*, *Springer Nature*, and many other publishers now have data policies requiring or recommending data statements and data sharing.[8 10] In 2017, the International Committee of Medical Journal Editors (ICMJE) revised its *Uniform Requirements for Manuscripts* (renamed *Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals*) to include a mandate that the results of clinical trials must contain a data sharing statement beginning in July 2018, and that clinical trials that begin enrolling participants on or after 1 January 2019 must include a data sharing plan in the trials' registration (table 1).[11–13] The ICMJE—a small working group of general medical editors including the *British Medical Journals*, *Journal of the American Medical Association*, *New England Journal of Medicine*, *PLOS Medicine*, and the *US National Library of Medicine*—has a great deal of clout. Most medical journal editors follow the ICMJE's recommendations. Trauma clinical trials researchers will recall that the ICMJE's recommendation requiring trial registration (eg, www.clinicaltrials.gov) was quickly adopted by nearly all medical journals. An informal survey of editors of the journals in which trauma investigators often publish revealed that they are aware of ICMJE's mandate and are developing their own data sharing policies.

Therefore, researchers who have had little incentive to share data now find that there is no choice but to do so, as more members of the research community recognize that data resulting from publicly funded clinical trials are a public good, to be made openly available with as few restrictions as possible.[14] The NTRR is the mechanism that trauma researchers can now use to meet such funder and publisher requirements.

Table 1 Examples of data sharing statements that fulfill the ICMJE requirements

	Example 1	Example 2	Example 3	Example 4
Will individual participant data be available (including data dictionaries)?	Yes.	Yes.	Yes.	No.
What data in particular will be shared?	All of the individual participant data collected during the trial, after deidentification.	Individual participant data that underlie the results reported in this article after deidentification (text, tables, figures, and appendices).	Individual participant data that underlie the results reported in this article after deidentification (text, tables, figures, and appendices).	Not available.
What other documents will be available?	Study protocol, statistical analysis plan, informed consent form, clinical study report, analytic code.	Study protocol, statistical analysis plan, analytic code.	Study protocol.	Not available.
When will data be available (start and end dates)?	Immediately after publication—no end date.	Beginning 3 months and ending 5 years after article publication.	Beginning 9 months and ending 36 months after article publication.	Not applicable.
With whom will the data be shared?	Anyone who wishes to access the data.	Researchers who provide a methodologically sound proposal.	Investigators whose proposed use of the data has been approved by an independent review committee (learned intermediary) identified for this purpose.	Not applicable.
What types of analyses are authorized to be conducted?	Any purpose.	To achieve aims in the approved proposal.	For individual participant data meta-analysis.	Not applicable.
By what mechanism will data be made available?	Data are available indefinitely at (include link).	Proposals should be directed to xxx@yyy. To gain access, data requesters will need to sign a data access agreement. Data are available for 5 years at (include link).	Proposals may be submitted up to 36 months after article publication. After 36 months the data will be available in our university's data warehouse but without investigator support other than deposited metadata. Information regarding submitting proposals and accessing data is at (include link).	

ICMJE, International Committee of Medical Journal Editors.
[a]Reprinted with permission from the Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals at http://www.icmje.org/icmje-recommendations.pdf.[13]

DATA SHARING BRINGS BOTH BENEFITS AND CHALLENGES

The purpose of data sharing is to make research data available for reuse, validation, meta-analysis, and replication.[15] The purported benefits of data sharing include replication of previous findings, comparisons with independent data sets, testing of additional hypotheses, teaching, and improving patient safety.[16] Evidence has shown that data sharing practices may also help correct for publication bias (the publication or non-publication of research findings depending on the nature and direction of the results) and outcome reporting bias (the selective reporting of some outcomes but not others).[17] Individual researchers benefit from data sharing via increased visibility, improved output connections, and reduced inefficiencies. The research community benefits from advances in reproducibility, improved long-term data archiving, and a reduction in unnecessary studies. Society benefits from data sharing by increased innovation, easier access to research, and scientifically informed policy making.[18] Of course, the ultimate goal of responsible sharing of clinical trial data is to increase scientific knowledge that leads to better therapies for patients.[19]

As with any new paradigm, difficulties and weaknesses become apparent in the first attempts to meet new expectations and goals—the higher the expectations, the greater the likelihood there will be challenges in meeting them. The challenges associated with data sharing are real. Researchers are concerned about the barriers to data sharing, even as the benefits are well documented and requirements for doing so come due.[8] Still at issue are the resources required to prepare data for sharing, the potential for other users to misinterpret data, and the possibility that the original researchers—the ones who did all the work to design and conduct the trials—may not be able to publish as many articles using the data as they might otherwise have.[14] In a recent survey of more than 7700 researchers, *Springer Nature* reported that among the medical sciences researchers surveyed (2683 respondents), 39% shared data neither through supplements nor repositories.[8] These respondents identified the following barriers to data sharing:

- "Unsure about copyright and licensing" (44%).
- "Organizing data in a presentable and useful way" (40%).
- "Not knowing what repository to use" (37%).
- "Lack of time to deposit data" (25%).
- "Costs of data sharing" (21%).[8]

Risks, burdens, and challenges also include protecting the privacy of trial subjects, safeguarding intellectual property and proprietary information, checking invalid secondary analyses that could harm public health, providing enough time for researchers to analyze their own data and receive recognition before sharing, and addressing the costs.[19]

The NTRR is working to overcome such challenges and will continue to refine its policies and processes as new issues arise. To address the concern researchers may have that their ability to produce publications will be compromised, the NTRR holds to a 1 year embargo from the time of the first study publication before making data available for sharing. Further, the NTRR will limit access to data by requiring researcher credentials and institutional endorsement. Requesting investigators will be required to have institutional review board approval for their planned secondary analyses. They will be encouraged to collaborate with the contributing investigator and required to cite the original data source (via DOI). Shared data will either be deidentified or be limited data sets with appropriate institutional data use agreements. With these safeguards in place, the NTRR administrators expect to minimize the potential for misinterpreting or misusing the data.

IT'S YOUR NATIONAL TRAUMA RESEARCH REPOSITORY: HELP TO BUILD THIS RESOURCE AND IMPROVE PATIENT OUTCOMES

Data sharing platforms encourage transfer of research data and knowledge between civilian and military researchers, reduce redundancy, and maximize limited research funding.[1] Optimizing the research life cycle now involves responsible data stewardship, as opposed to ownership. The old paradigm—in which individual investigators maintain indefinite ownership of the data resulting from their publicly funded work—results in now unacceptable research waste, including hidden data and irreproducible findings.[20] Single-instance use of research data and the inability to access data resulting from studies limit the impact of trauma research funding. Especially in fields such as trauma, where research funding has never been free-flowing and in the past decade has become even more difficult to come by, it is imperative to make every research dollar count. As the trauma research community seeks to maximize available research funds, the NTRR makes data available for enduring use and will effectively allow for more data analysis and knowledge translation, which can result in improved patient care.

Still in its infancy, the NTRR needs trauma investigators' participation to realize the vision of advancing the field of trauma research to achieve improved outcomes for injured patients. Become a data steward and help build YOUR National Trauma Research Repository. You can find additional information and detailed implementation guidance on the NTRR website (www.ntrr-nti.org).

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Drs. Don Jenkins and Michelle Price from the National Trauma Institute introduce the National Trauma Research Repository (NTRR) an exciting new undertaking that aims to combine data from previous and future trauma research sources, such as PROPPR, PROMMTT, the Glue Grant, DOD, etc. They also discuss how researchers can access these data and contribute their own data to the ever-growing repository. Got a project idea for a large national database? **Check out NTRR** to see if this could work for you.

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Communications Report July-Sept 2018

While our Facebook activity fell off this quarter, our Twitter activity held steady at 19 tweets, garnering 21,960 impressions and engaging 459 users in interactions such as retweeting, liking and responding. By far, the most popular tweets related to an August 6th announcement and link to Michelle's and Dr. Jenkins' appearance on the EAST Traumacast (discussing the NTRR), and one of our initial announcements of the NTRR Launch on July 3rd. NTI's twitter following is up to 1,042. During this period, we posted twice to the NTI blog on the website. Rather than a Q2 E-Newsletter, we issued a Constant Contact stand-alone announcement of the NTRR launch on July 3rd, which saw a nearly 40% open rate—phenomenal by social media standards.

Our NatTrauma.org website traffic during the quarter trended slightly upward, with 1,125 new and returning visitors in July; 1,461 in August; and 1,393 in September. Our Trauma Stats & Facts page and the home page continue to be the most visited.

To coincide with the launch of the National Trauma Research Repository, we ran digital ads in Wolters Kluwer medical journals—including Critical Care Medicine, Nursing Critical Care, Shock Journal, Journal of Trauma Nursing, Journal of Trauma, and others--during the months of July and August. These ads garnered more than 14,000 impressions in each month, although only a handful of clicks—about a dozen each month. At the AAST meeting in September, NTI staffed an NTRR-themed booth, complete with an NTRR demo set up on multiple devices, and ran an NTRR ad in the between-session announcements.

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