Improving Nurse Readiness for Combat Casualty Care

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Presenter

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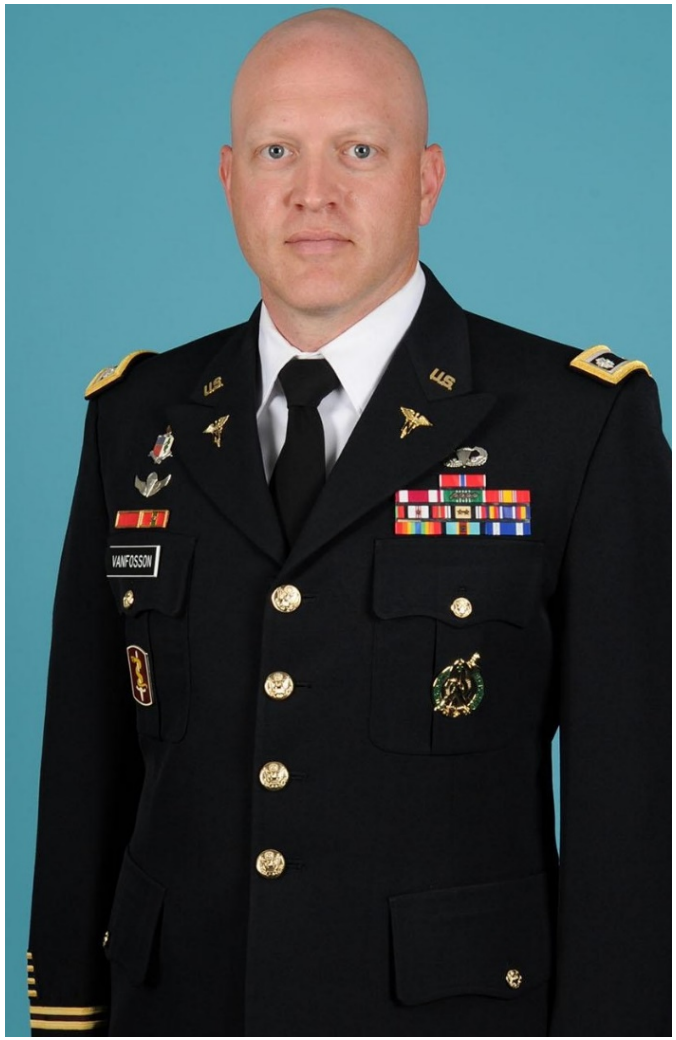

LTC VanFosson's clinical experience has focused on the care of critically injured and/or burned patients. He deployed in support of Operation Iraqi Freedom (2003-2004) with the 28th Combat Support Hospital, serving as a medical-surgical and burn/critical care nurse. He deployed in support of Operation Enduring Freedom (2010-2011) with the 541st Forward Surgical Team (Airborne). Other assignments included: Clinical Nurse Officer in Charge (CNOIC), US Army Institute of Surgical Research; CNOIC, General Leonard Wood Army Community Hospital; AMEDD Recruiter, US Army Recruiting Command; trauma/critical care nurse at Brooke Army Medical Center; and, medical-surgical nurse at Womack Army Medical Center.

In his current role, LTC VanFosson focuses on the care of traumatically injured patients in operational and burn care environments, as well as improving clinician readiness. Additionally, he mentors nurses, physicians, and bench scientists seeking to engage in clinical research and evidence-based practice at the US Army Burn Center.

Disclaimer

LTC VanFosson has no relevant financial or non-financial relationships to disclose relating to the content of this activity.

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Agenda

- Learning Objectives
- Background
  - US Army Institute of Surgical Research (USAISR) and Army Futures Command
  - Nurse scientist role at USAISR
- Conceptual diagram of individual clinical readiness
- Studies to inform nurse readiness
- Impact on nurse readiness efforts
- Key Takeaways
- Acknowledgements
- References

Acronyms

AKI, Acute Kidney Injury

ALI, Acute lung injury

AMEDD, Army Medical Department

ARDS, Acute respiratory distress syndrome

BHT, Battlefield Health and Trauma

CCC, Combat Casualty Care

CSH, Combat Support Hospital

FRST, Forward Resuscitative Surgical Team

FST, Forward Surgical Teams

ICTL, Individual Critical Task List

ICU, Intensive Care Unit

IED, Improvised Explosive Device

ISR, Institute of Surgical Research

KSA, Knowledge, Skills, and Abilities

MASCAL, Mass Casualty

MDO, Multi-Domain Operations

MDW, Medical Wing

MOF, Multiple Organ Failure

MOS, Military Occupational Specialty

NAMRU-SA, Naval Medical Research Unit San Antonio

NHLBI, National Heart, Lung, and Blood Institute

TBI, Traumatic Brain Injury

TIP-TOP, Transition In Practice, Toward Optimum Performance

VILI, Ventilator-Induced Lung Injury

Learning Objectives

At the conclusion of this activity, participants will be able to:

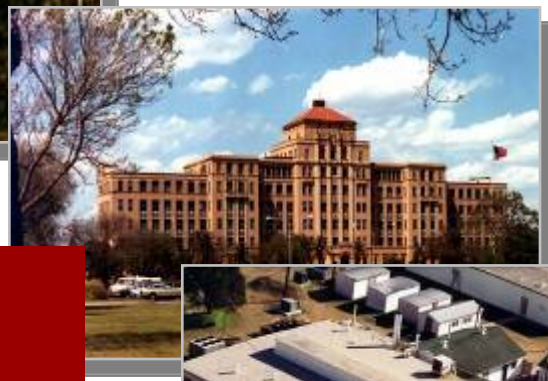
1. Describe unique opportunities for nursing influence of combat casualty care in the Multi-Domain environment

2. Identify mechanisms for developing individual clinical readiness

3. Discuss the impact of USAISR nurse-led/-involved efforts on future nurse readiness efforts across Military Health System

Background

Established as Surgical Research Unit at Halloran General Hospital, Staten Island, New York
1943 – 1947 (Staff 12)



Move to Brooke Army Medical Center (BAMC) – 1947

Renamed US Army Institute of Surgical Research – 1970

JUNE 2019
USAISR realigned with Medical Research & Development Command under Army Futures Command

Army Burn Unit
Brooke General Hospital
1949 – 1996

U.S. Army Institute of Surgical Research
Co-located with Brooke Army Medical Center
1996 to Present (Staff >800)

Photos courtesy of USAISR PAO

Background

- US Army Medical Research & Development Command
  - Six medical research laboratories
  - Science and technology focused on identifying medical solutions for the battlefield
  - Research categories:
    - Military infectious diseases
    - Combat casualty care
    - Military operational medicine
    - Medical chemical and biological defense
    - Clinical and rehabilitative medicine
- Army Futures Command
  - One of four major (4-star) Army commands
  - Aimed at developing solutions for battlefield of the distant future

Background

- The Base Realignment and Closure 2005, established the BHT center at Fort Sam Houston - Brings together all Department of Defense (DoD) combat casualty care research

- Joint Synergy
  - USAISR
    - » Burn Center – DoD's only Burn Center
  - NAMRU-SA
  - 59th MDW
  - BAMC – Only DoD Level I Trauma Center

- USAISR also works closely with Biomedical Advanced Research and Development Authority and NHLBI

Background

Mission

Optimize Combat Casualty Care

Vision

The World's premier research organization enabling readiness and delivering evidence based solutions for optimal care of the combat wounded.

Research – Conduct a comprehensive and sustainable research and development program to deliver knowledge and material solutions to **optimize survival and functional recovery** in combat casualties and civilian patients with trauma and burns, while also providing expert analysis and input to **shape future requirements** and directions **in combat casualty care**.

Burn Center - The nation's leader in **the multidisciplinary care** of, and **translational research** for, severely burned **combat casualties** and those with similar injuries. The Burn Center provides interdisciplinary care by a team of medical professionals providing cutting edge surgical services and promoting optimal recovery, restoration of function, and community reintegration of our burn survivors.

Photo courtesy of USAISR PAO

Background

Increased Relevance of Laboratory Research (6.1-6.3)

Rapid Clinical Translation

Combat Casualty and Burn Research

Development of Military Clinician Researchers

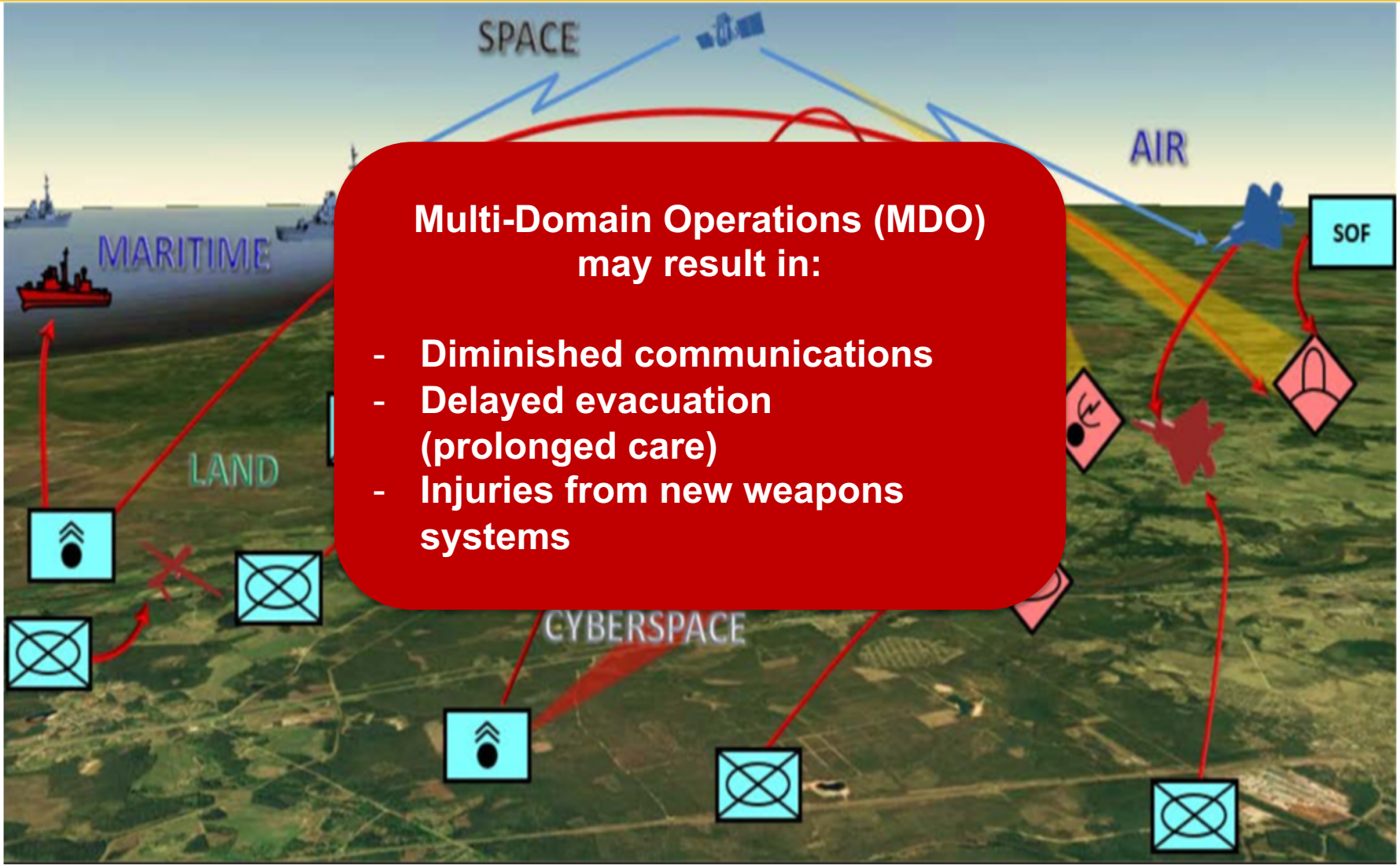
Operational Experience

Clinical Care and Research

Photos courtesy of USAISR PAO

Essential Synergy between Clinical Care, Laboratory Research, and the Battlefield

Background



(US Department of Defense, 2017, 2019)

The Tactical Problem of Prolonged Care in MDO

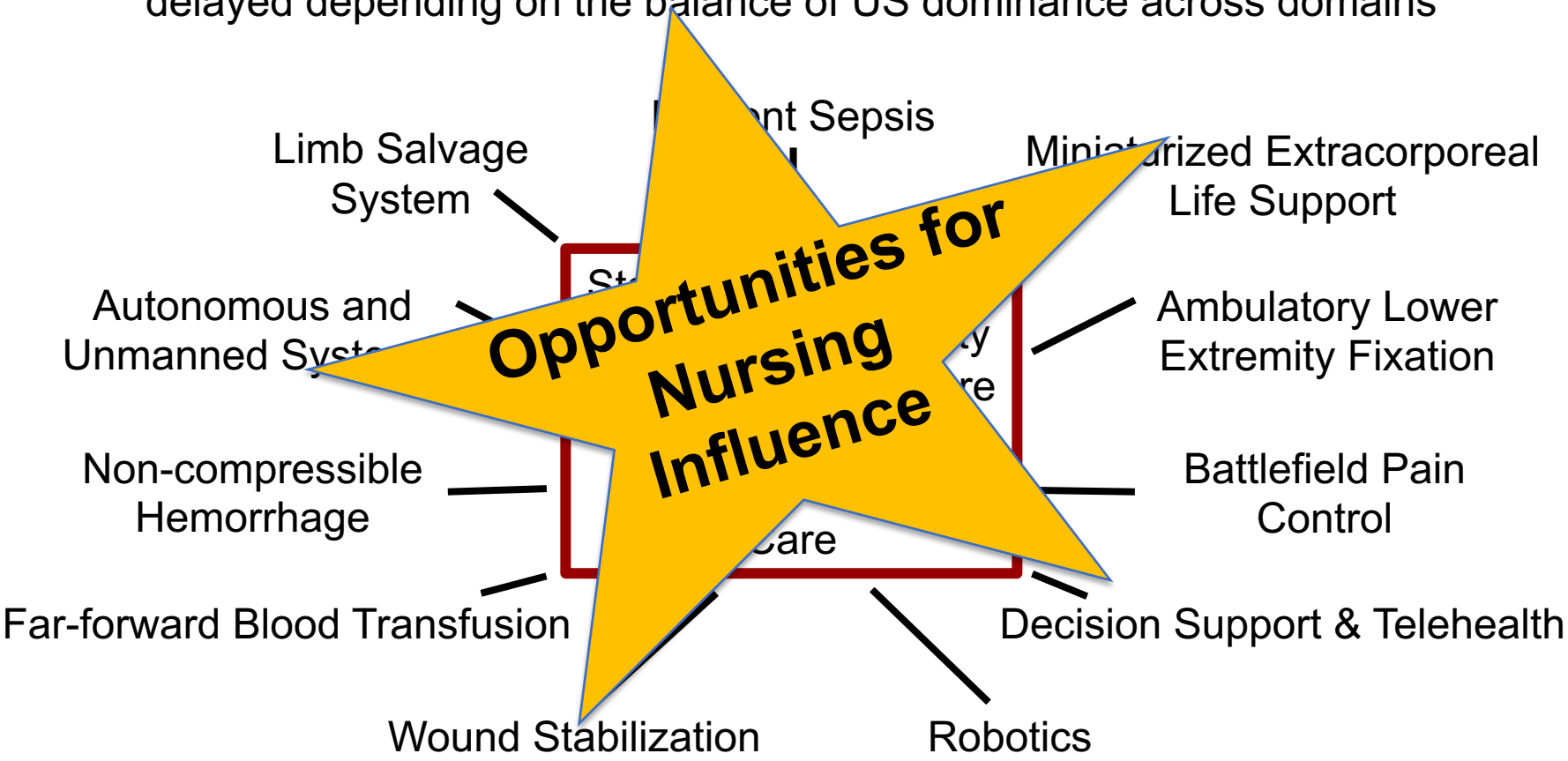
Tactical CCC		Secondary Sequelae
TBI & Loss of Consciousness (LOC)	→	Swelling/Increasing Intracranial Pressure (ICP)
TBI & Confusion	→	Delayed LOC, Intracranial Bleeding
Burn Fluid Resuscitation	→	AKI, MOF, Sepsis, Endotheliopathy, Etc.
Hypovolemic Shock	→	Septic Shock
*Hypo*coagulable	→	*Hyper*coagulable Rebound
Immediate Airway Management	→	ALI/ARDS, VILI
Chest Seal	→	Tension Pneumo/hemothorax
Massive external hemorrhage	→	Internal Bleeding
Tourniquet	→	Tourniquet Conversion
Ischemic Injury	→	Reperfusion Injury
Orthopedic Fixation	→	Compartment Syndrome
Immediate Intense Pain	→	Prolonged Pain & Delirium
Tamponade/Pressure	→	Wound Infection
Blunt Trauma/Crush	→	Rhabdomyolysis, AKI
Spinal Stabilization	→	Prolonged Immobilization

Scope & Scale

Individual Triage/Few casualties	→	MASCAL Triage
Single-point Immediate Triage	→	Dynamic and Evolving Triage
Rare MASCAL	→	Systemic and continuous theater-wide MASCAL

Prolonged Field Care =
Need to Move Medical Capabilities Further Forward

On the multi-domain battlefield, casualty movement may be significantly delayed depending on the balance of US dominance across domains



(Capability Development Integration Directorate, 2017)

USAISR is DoD's Lead Laboratory for Prolonged Field Care of Combat Casualties

Burn Casualties

Joint Theater Trauma Registry

- Total Patients = 86,857
- Burn - 6369 (7.3%)
  - Burn and Explosive, 4248 (4.9%)

(As of 15 Nov 2019, courtesy of Brock A. Graham, JTS)

Photos courtesy of USAISR PAO

Casualties treated at the ISR (2003 – Present)

- Total = 990
  - Afghanistan = 218
  - Iraq = 772
- Primary mechanism of injury: IED
- Mean burn size: ~ 17%

(ISR Burn Registry)

Pre-deployment Training

- Identified capability gap in burn treatment & care for ICTLs & KSAs

- April 2016-April 2019- pre-deployment burn training
  - 18 teams
  - 197 personnel
  - 1200 hours of training
  - CSH, FST, and FRST teams
  - All MOSs
  - Navy & Air Force

- For the vast majority, this is their **only burn experience**

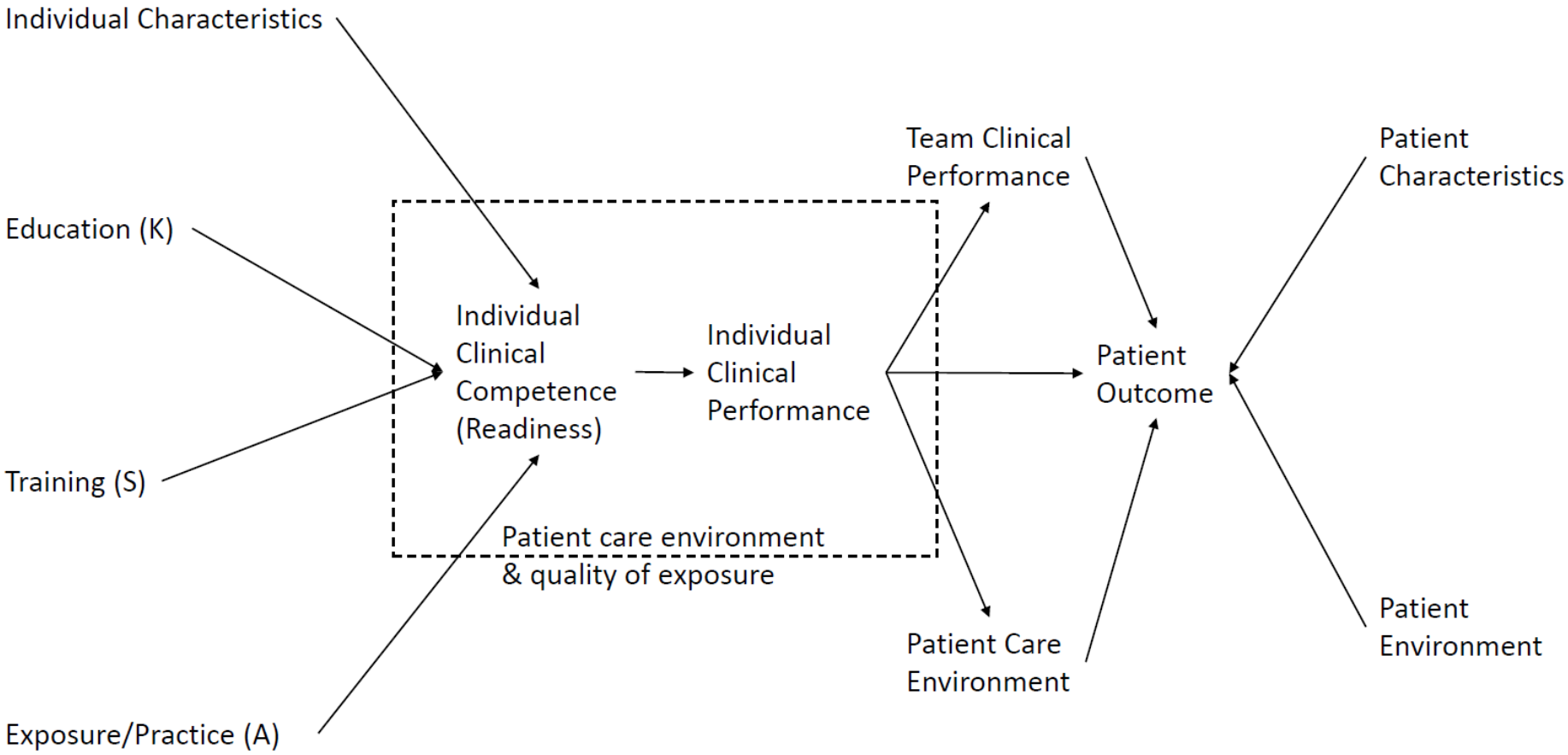
Burn Center as a Training Platform

- **Burns as Universal Trauma Model** (Pruitt, 1985)
- **1 of 75 verified burn centers globally** (www.ameriburn.org)
- **Burn Flight Team – worldwide missions**
- **Integrated Multidisciplinary Team**
- **Comprised of:**
  - **16 ICU and 24 Progressive Care beds,** Respiratory Therapy
  - Two Operating Rooms, Pre/Post Anesthesia Care
  - Outpatient Clinic, In/Out Patient Rehab

Nurse Scientist Role at USAISR

- Nurse scientist assigned to USAISR since 2011
  - COL (Ret) Elizabeth A. Mann-Salinas (2011 - 2017)
  - LTC Chris VanFosson (2017 - Present)
- Department of the Army-funded task area (2014 - 2019)
  - Retrospective analysis of Role 2 surgical teams in Afghanistan
  - Development of combat readiness platform
- Clinical Research Support Department (2019 – Present)
- Conducts combat casualty care-focused research and facilitates evidence-based practice projects

Conceptual Diagram of Individual Clinical Readiness



Studies to Inform Nurse Readiness

Review

A systematic review of the literature to support an evidence-based Precepting Program

Elizabeth Mann-Salinas [a,*], Elizabeth Hayes [a], Johnnie Robbins [a], Jean Sabido [b], Laura Feider [c], David Allen [c], Linda Yoder [d]

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[b] Army Medical Department Center and School, San Antonio, TX, United States
[c] Brooke Army Medical Center, TX, United States
[d] University of Texas, School of Nursing, Austin, TX, United States

http://dx.doi.org/10.1016/j.burns.2013.11.008

- Background:
  - Burn care requires specialized training
  - Evidence-based precepting program needed to achieve minimal competence for newly hired burn nurses
- Method: Systematic review of the literature
- Findings:
  - 43 articles identified to inform development of evidence-based preceptorship program

(Mann-Salinas et al., 2014)

Studies to Inform Nurse Readiness

Developing an Evidence Based Practice Nursing Precepting Program

LTC Elizabeth Mann-Salinas, PhD, RN[1]; Elizabeth Hayes, MSN, RN[1]; CPT Johnnie Robbins, MSN, RN[1]
Jean Sabido, MSN, RN[2]; LTC Laura Feider, PhD, RN[3]; MAJ David Allen, MSN, RN[3]; Linda Yoder, PhD, RN[4]
[1]United States Army Institute of Surgical Research, Fort Sam Houston, TX; [2]Amedd Center and School, Fort Sam Houston, TX; [3]San Antonio Military Medical Center, Fort Sam Houston, TX 78234; [4]University of Texas, School of Nursing, Austin, TX

Evidence Review

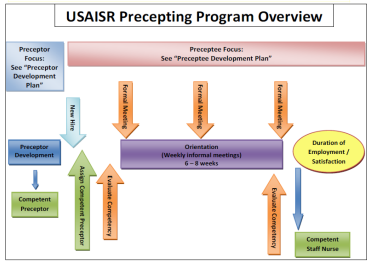
The Army Burn Center is a 40-bed specialty unit, comprised of a 16-bed intensive and 24-bed progressive care unit, with a mission to care for all burned DoD service-members and central Texas civilians. Greater nursing turnover in the burn unit was identified compared to the surgical intensive care unit within the same facility. The lack of a comprehensive and evidence-based precepting program was recognized as a contributing factor to nurse dissatisfaction.

Project Aim

The goal of the current project was to implement an evidence-based precepting program within the Army Burn Center to reduce the incidence of staff nurse turnover within a demanding healthcare setting.

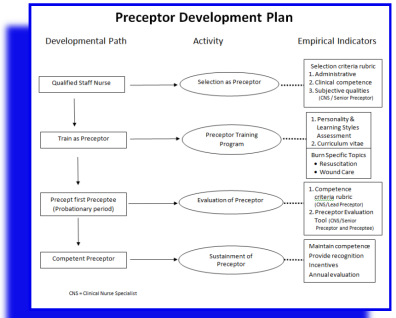
Methods Strategy

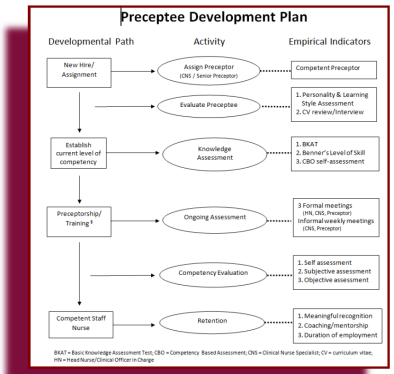
- Training on the Iowa Model of Evidence-based Practice (EBP) to Promote Quality Practice was provided to the Burn Center nursing staff.
- The lack of a comprehensive precepting program served as the driving problem-focused trigger within the Iowa Model for this project.
- A team was formed, to include: nurse scientists, clinical nurse leaders, clinical nurse specialists, lead preceptors, staff nurse preceptors and wound care coordinators.
- A systematic review of the literature was conducted for the period 1995 to 2011 (Medline, CINHAL, SCOPUS, ProQuest for theses/dissertations), focusing on the staff nurse, and using the key words: preceptee; preceptor; preceptorship; personality types; competency; and learning styles.
- A *Preceptor* development program and *Preceptee* training program with competency assessment, ongoing multifaceted evaluation and retention strategies were developed based on the literature review.

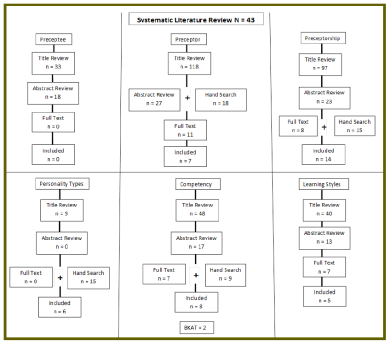


Literature Evaluation and Findings

- The systematic review resulted in a review of 345 articles and inclusion of 43 to support the comprehensive preceptor development and preceptee training programs; developmental paths, specific activities and empirical indicators were defined. A pathway for the program was agreed on and supporting competency evaluation, satisfaction, and documentation tools were created. The program was implemented in June 2012 for all incoming staff nurses.
- Preceptor Train-the-Trainer Vermont Nurses in Partnership (VNIP) course was completed Sept 2012:
  25 Preceptors, 7 Program Facilitators were trained during the 2 day on-site training







Conclusions and Implications

- A standardized preceptorship program encompasses EBP principals that improve patient outcomes, quality and safety of nursing care, clinical excellence, recruitment and retention, and prepares leaders.
- Effective preceptor training builds talent on dual fronts: preceptors gain effective teaching and leadership skills, translating to maximize skill capability and competency of bedside nurses.

Acknowledgements

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- The authors would like to recognize the clinical team members responsible for implementing this important program: Ms Colleen Mitchell, Ms. Hope Greeley, Ms. Sarah Shingleton, Mr. Reuben Salinas, Mr CD Peterson, Ms Micha Barba; Mr Raul Vanegas, LTC Paul Mittelsteadt, and our Project Coordinator, Ms Krystal Valdez-Delgado

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(Mann-Salinas et al., 2012)

An Evidence-Based Approach to Precepting New Nurses

Lessons learned from the implementation of a structured preceptor development program.

AJN ▼ March 2019 ▼ Vol. 119, No. 3

By Michael Barba, MSN, RN, Krystal Valdez-Delgado, BSN, RN, Christopher A. VanFosson, PhD, MHA, RN, Nicole W. Caldwell, BA, RN, Susan Boyer, DNP, MEd, RN-BC, Johnnie Robbins, EJD, MSN, RN, and Elizabeth A. Mann-Salinas, PhD, RN, FCCM

(Barba et al., 2019)

Studies to Inform Nurse Readiness

By Christopher A. Vanfosson, MSN, MHA, RN

Preparing for a Year on the Battlefield
The Road to the Front
Daily Life and 'Dirty' Work
Preparing to Return Home
Welcome Home

(VanFosson, 2010a, 2010b, 2011a, 2011b, 2011c)

Studies to Inform Nurse Readiness

MILITARY MEDICINE, 176, 4:477, 2011

Emergency Canine Surgery in a Deployed Forward Surgical Team: A Case Report

COL Alan L. Beitler, MC USA; MAJ Joseph P. Jeanette, MC USA*;*
MAJ Andrew L. McGraw, VC USA†; MAJ Jennifer R. Butera, ANC USA;*
MAJ Christopher A. Vanfosson, ANC USA; MAJ Jason M. Seery, MC USA**

- Background:
  - No previous documentation of FSTs conducting surgery on working dogs
- Method: Case Report
- Findings:
  - Canine surgery can be safely done at FSTs
  - FST members should be trained in care of military working dogs

(Beitler, Butera, Jeanette, VanFosson, Seery, & McGraw, 2011)

Studies to Inform Nurse Readiness

MILITARY MEDICINE, 176, 12:1447, 2011

Simultaneous Surgeries in a Split Forward Surgical Team: A Case Study

MAJ Christopher A. Vanfosson, AN USA; MAJ Jason M. Seery, MC USA

- Background:
  - No previous documentation of split FSTs conducting two simultaneous surgeries
- Method: Case Study
- Findings:
  - Simultaneous surgeries are possible in split FST
  - Cross-training of all team members essential to be prepared for various contingencies

(VanFosson & Seery, 2011)

Studies to Inform Nurse Readiness

Registered Nurses as Permanent Members of Medical Evacuation Crews: The Critical Link

MAJ Michael W. Wissemann, AN, USA
MAJ Christopher A. VanFosson, AN, USA

- Background:
  - Flight paramedics were not doctrinally available for medevac
  - Training and maintenance of this skillset challenging in Army
- Method: Critical review
- Findings:
  - Emergency/trauma and critical care nurses practice evacuation-related skills daily
  - Presence in Army inventory make them ideal candidates for inclusion on medical evacuation crews

(Wissemann & VanFosson, 2012)

Studies to Inform Nurse Readiness

Evaluation of role 2 (R2) medical resources in the Afghanistan combat theater: Initial review of the joint trauma system R2 registry

(Mann-Salinas et al., 2016)

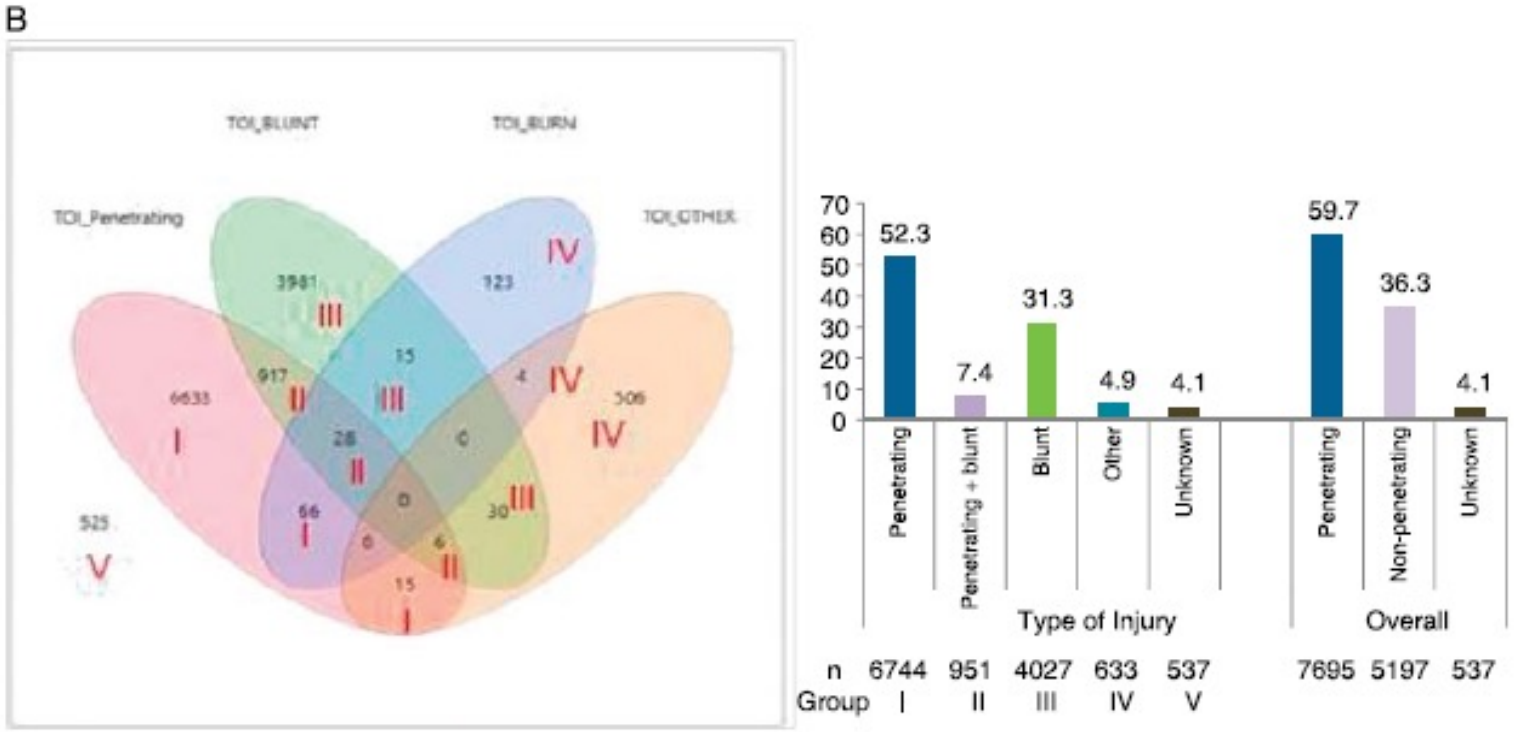

Figure 4. Mechanism (*A*) and type of injury (*B*). *Helo*, helicopter; *TOI*, type of injury.

Studies to Inform Nurse Readiness

A Preliminary Review of the Orthopaedic Injuries and Procedures Performed at Role 2 Facilities in Afghanistan

Jennifer Trevino, MBA[1]; Amanda Staudt, PhD, MPH[1]; MAJ (P) Daniel Stinner, MD[1]; MAJ Jessica Rivera, MD[1]; Mithun Suresh, MD[1]; Krystal Valdez-Delgado, BSN, RN[1]
MAJ James Blair, MD[2]; Col Michael Charlton, MD[3]; COL Jennifer Gurney, MD[4]; Joseph Wenke, PhD[1]; CAPT Zsolt Stockinger, MD[4]; COL Elizabeth Mann-Salinas, PhD, RN[1]
U.S. Army Institute of Surgical Research, JBSA Fort Sam Houston, TX[1]; William Beaumont Army Medical Center, EL Paso, TX[2]
Defense Medical Readiness Training Institute, JBSA Fort Sam Houston[3]; Joint Trauma System, JBSA Fort Sam Houston, TX[4]

Introduction

- During the recent military conflict in Afghanistan (AFG), U.S. Army Role 2 (R2) Forward Surgical Teams doctrinally deployed three general surgeons and one orthopaedic surgeon, leaving an imbalance of surgeons when the teams are split in support of dispersed operations.
- The newly redesigned U.S. Army Forward Resuscitative Surgical Team (FRST) requires two general surgeons and two orthopaedic surgeons for each team.
- Describing orthopaedic injuries and procedures found at R2 Medical Treatment Facilities (MTFs) may improve pre-deployment preparation of future teams and further inform military planners on how to efficiently plan for personnel, equipment, and supply requirements at these facilities.

Objective

The purpose of this study was to perform the first epidemiologic review of orthopaedic injuries and procedures performed at R2 MTFs in AFG.

Methods

- Retrospective data extracted from the Joint Trauma System R2 Database was used for this analysis.

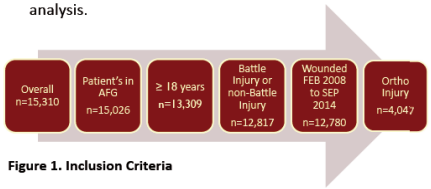

Figure 1. Inclusion Criteria

- Inclusion Criteria: at least one musculoskeletal injury to the shoulder girdle, extremities, spine, or hip/pelvis.
- Descriptive statistics were used to evaluate patient characteristics by demographics, body region of injury, type of injury, and interventions.

Results

Table 1. Demographics

Variable	n	%
Total Participants	4,047	100.0
Age, year, median (IQR)	25	22, 30
Male	3,933	97.2
Battle Injured	3,208	79.3
Patient Affiliation		
U.S. Military	1,326	32.8
non U.S. Military (e.g. AFG/NATO Forces)	1,768	43.7
Civilian or Unknown	953	23.5
Mechanism of Injury		
Explosion	1,976	48.8
Gunshot Wound	1,133	28
Motor Vehicle Crash	402	9.9
Other	309	7.6
Fall	153	3.8
Type of Injury		
Penetrating	2,387	59
Blunt	1,154	28.5
Penetrating and Blunt	305	7.5
Burn	50	1.2
***Combat Mortality Index- Prehospital**		
Mild	2,222	54.9
Moderate	974	24.1
Severe	247	6.1
Critical	152	3.8
Admission Vital Signs, mean (SD)		
Pulse, beats per minute	92.3	23.5
Respiratory rate, breaths per minute	19.6	6.0
Systolic blood pressure, mm Hg	128.7	20.4
Oxygen saturation, %	97.1	5.4
Temperature, °F	98.1	1.3

*Combat mortality index (CMI) was used as a surrogate metric for Injury Severity; CMI uses systolic blood pressure, heart rate, and Glasgow Coma Score.

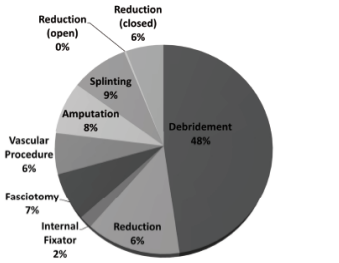

Figure 2. Orthopaedic Procedures Performed (n=3,283)

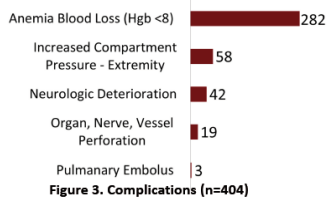

Figure 3. Complications (n=404)

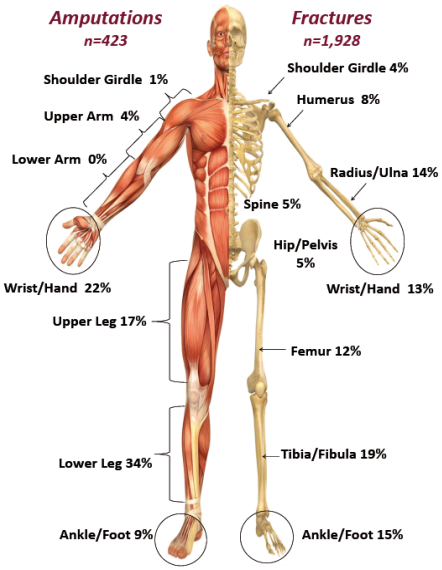

Figure 4. Diagnosed Amputations and Fractures

Table 2. Diagnosed Orthopaedic Injuries

Variables	Total	*Unspecified	Fractures	Amputations	Joint	Muscle	Nerve/ Vascular
Total	5,288	2,095	1,928	423	399	263	180
Upper Extremity	1,977	820	778	137	154	7	81
Shoulder Girdle	149	7	80	3	59	0	0
Upper Arm	568	362	153	16	0	0	37
Elbow	34	0	1	0	33	0	0
Lower Arm	478	203	267	0	0	0	8
Wrist/Hand	602	202	243	94	62	0	1
Other UE	146	46	34	24	0	7	35
Lower Extremity	2,692	1,158	947	272	210	6	99
Upper Leg	765	431	231	72	0	0	31
Knee	120	0	3	0	88	0	29
Lower Leg	1,145	627	371	145	1	0	1
Ankle/Foot	542	94	291	36	121	0	0
Other LE	120	6	51	19	0	6	38
Spine	342	0	97	0	0	245	0
Cervical	157	0	32	0	0	125	0
Thoracic	66	0	30	0	0	36	0
Lumbar	119	0	35	0	0	84	0
Hip/Pelvis	226	93	99	7	27	0	0
Unknown	51	24	7	7	8	5	0

*Unspecified injuries included penetrating wounds and other unknown injuries.

Limitations

- The R2 database represent a convenience sample of patients entered by the R2 providers.
- ICD-9/10 codes were not present in this database, therefore, orthopaedic injuries and diagnosis were identified using keyword terms.
- Complications were likely the result of the underlying injuries, and not the orthopaedic procedures.

Conclusions

- The majority of patients with at least one orthopaedic injury were non-U.S. Military.
- Fractures were the most common orthopaedic injury, comprising at least 1/3 of all injuries captured.
- The vast majority of orthopaedic procedures were surgical interventions, providing additional evidence that supports the proposed changes of adding a second orthopaedic surgeon to the redesigned FRST.
- Understanding the most frequent orthopaedic surgical and non-surgical interventions at R2 MTFs in AFG can be used to help guide FRST planning, pre-deployment training, and allocation of resources.

Acknowledgements

- This project was funded by the Defense Health Program JPC-6 Intensive Forward Surgical Critical Care, Award Number W81XWH-15-2-0085.
- The author(s) acknowledge the Joint Trauma System for providing data for this study.
- This project was conducted under a protocol reviewed and approved by the US Army Institute of Surgical Research Regulatory Office.

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(Trevino et al., 2017)

Studies to Inform Nurse Readiness

A US military Role 2 forward surgical team database study of combat mortality in Afghanistan

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- Background:
  - Analysis of patients cared for at Role 2 surgical units in Afghanistan
- Method: Retrospective analysis
- Findings:
  - 37.4% of patients were US coalition forces; 23.8% Afghan National Security Forces; 21.3% civilian; 13.5% were Afghan National Police; 4.0% were non-US coalition
  - 40.% of patients were critical; 11.2% were severe; 0.8% were moderate; 0.1% were mildly injured
  - Most deaths at Role 2 surgical units were critically (66.3%) or severely (25.9%) injured

(Kotwal et al., 2018a)

Studies to Inform Nurse Readiness

MILITARY MEDICINE, 183, 3/4:134, 2018

A Review of Casualties Transported to Role 2 Medical Treatment Facilities in Afghanistan

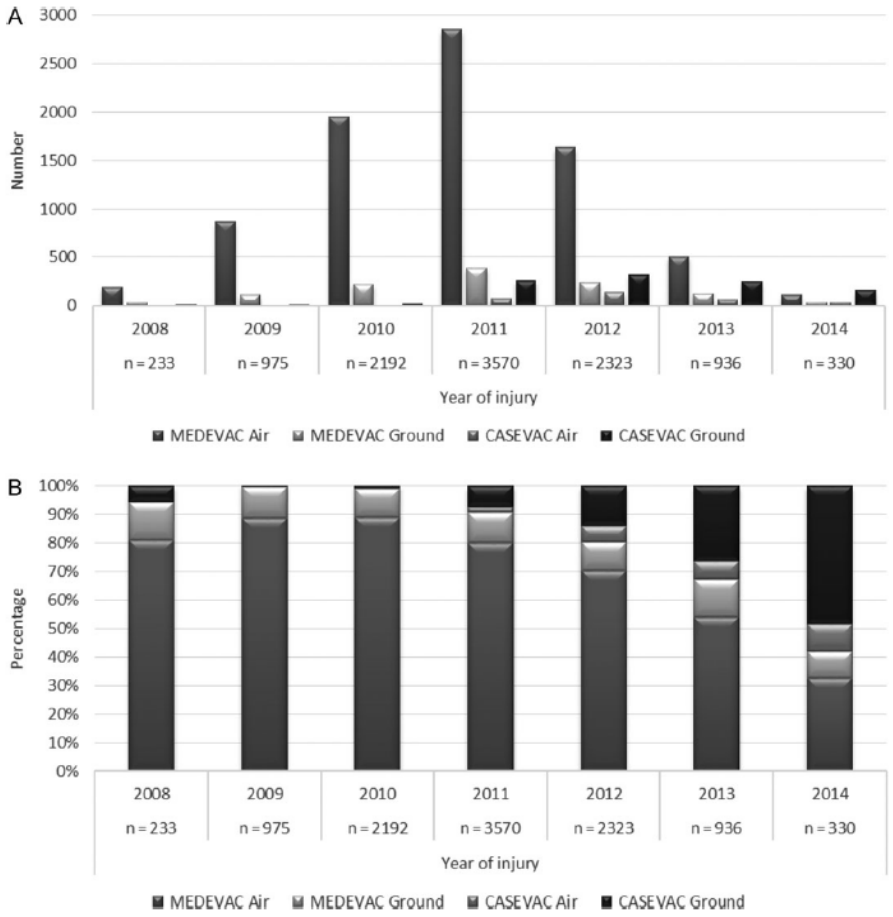

FIGURE 2. Number (A) and percentage (B) of transport type (Medical Evacuation [MEDEVAC], Casualty Evacuation [CASEVAC]) and mode (air, ground) for trauma-eligible adult patients ($n = 10,559$) treated at Role 2 medical treatment facilities during Afghanistan conflict by year, 2008–2014.

(Kotwal et al., 2018b)

Studies to Inform Nurse Readiness

En Route Critical Care

Transfer From a Role 2 to a Role 3 Medical Treatment Facility in Afghanistan

(Staudt et al., 2018b)

Table 2 Diagnoses for eligible adult trauma patients (N=3927) treated and transferred from role 2 medical treatment facilities during Afghanistan conflict by highest level of en route medical attendant[a] from February 2008 to September 2014

	Total (N=3927)	Physician (n=391)	Nurse (n=1394)	Technician (n=554)	Unknown (n=1588)
Diagnosis	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Orthopedic injury, total	1517 (38.6)	174 (44.5)	778 (55.8)	182 (32.9)	383 (24.1)
Fracture	1069 (27.2)	144 (36.8)	536 (38.5)	119 (21.5)	270 (17.0)
Amputation	157 (4.0)	14 (3.6)	91 (6.5)	14 (2.5)	38 (2.4)
Other injury	291 (7.4)	16 (4.1)	151 (10.8)	49 (8.8)	75 (4.7)
Soft tissue trauma	938 (23.9)	77 (19.7)	469 (33.6)	129 (23.3)	263 (16.6)
Penetrating injury, extremity	543 (13.8)	36 (9.2)	287 (20.6)	69 (12.5)	151 (9.5)
Brain injury	521 (13.3)	47 (12.0)	196 (14.1)	83 (15.0)	195 (12.3)
Other injury	275 (7.0)	44 (11.3)	135 (9.7)	24 (4.3)	72 (4.5)
Penetrating injury, other regions	221 (5.6)	21 (5.4)	116 (8.3)	23 (4.2)	61 (3.8)
Gastrointestinal/abdominal injury	193 (4.9)	24 (6.1)	109 (7.8)	12 (2.2)	48 (3.0)
Ears/nose/mouth/teeth/throat injury	138 (3.5)	14 (3.6)	77 (5.5)	12 (2.2)	35 (2.2)
Pulmonary/thoracic injury	138 (3.5)	15 (3.8)	81 (5.8)	13 (2.3)	29 (1.8)
Vascular injury	104 (2.6)	10 (2.6)	65 (4.7)	6 (1.1)	23 (1.4)
Genitourinary/renal injury	91 (2.3)	13 (3.3)	50 (3.6)	5 (0.9)	23 (1.4)
Burn injury	45 (1.1)	3 (0.8)	26 (1.9)	4 (0.7)	12 (0.8)

[a] En route medical attendant was defined as the medical attendant with the highest capability.

Studies to Inform Nurse Readiness

Traumatic Cardiac Arrest in Role 2 Surgical Units in Afghanistan

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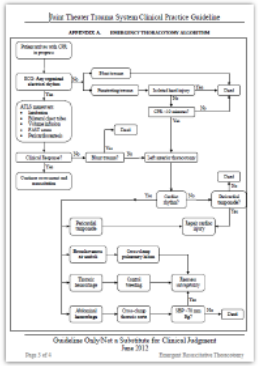
[1]US Army Institute of Surgical Research, JBSA Fort Sam Houston, TX; [2]Department of Medicine, Brooke Army Medical Center, JBSA Fort Sam Houston, TX; [3]Department of Medicine, Uniformed Services University of the Health Sciences, Bethesda, MD; [4]Joint Trauma System, JBSA Fort Sam Houston, TX

Introduction

- Role 2 (R2) surgical units are positioned in far-forward and austere locations with limited resources and patient holding capabilities
- Consequently, casualties treated at R2 are frequently evacuated to higher levels of care, generally in under three hours [1]
- Casualties that experience traumatic cardiac arrest (TCA) consume large amounts of resources, such as massive blood transfusions and require emergent surgical interventions, to include resuscitative thoracotomy and damage control surgery
- Historical survival percentages for TCA patients in the setting of Role 3 combat support MTFs were reported as 8%,11%, and 21.5% [2-4]



Objectives

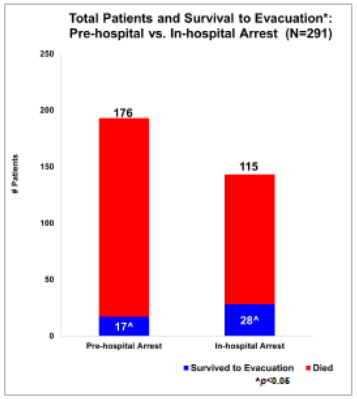
The purpose of this study was to perform an analysis of TCA casualties treated by R2 surgical units in order to maximize their ability to care for these casualties in the future

Methods

- Data were obtained from the Joint Trauma System R2 Database
- Study population:
  - Age ≥ 18 years
  - Experienced trauma with resultant cardiac arrest
  - Treated by R2 surgical unit
  - Injured in Afghanistan, Aug 2008 to Jul 2014
- Analysis included examination of demographics, injury characteristics, and outcomes, stratified by survival to evacuation or died at R2
- 291 patients met the inclusion criteria (2.3%)

Results

	Survival to Evacuation (n=45, 15%)	Died (n=246, 85%)	*p*-value
Age, median (IQR)			0.56
	25 (22-30)	25 (21-30)	
Gender, n (%)			0.85
Male	44 (97.8)	237 (96.3)	
Affiliation, n (%)			0.66
Non-US Military	18 (40.0)	115 (46.8)	
US Military	17 (37.8)	78 (31.7)	
Other	10 (22.2)	53 (21.5)	
Mechanism of Injury, n (%)			0.86
Explosion	20 (44.4)	116 (47.1)	
Gunshot Wound	17 (37.8)	97 (39.4)	
Crash	4 (8.9)	11 (4.5)	
Fall	0 (0.0)	2 (0.8)	
Other	3 (6.7)	13 (5.3)	
Unknown	1 (2.2)	7 (2.9)	
Type of Injury, n (%)			0.02
Penetrating	26 (57.8)	185 (75.2)	
Blunt	6 (13.3)	30 (12.2)	
Penetrating and Blunt	5 (11.1)	19 (7.7)	
Burn	2 (4.4)	5 (2.0)	
Unknown	6 (13.3)	7 (2.9)	
Interventions			
Resuscitative Thoracotomy, n (%)	14 (31.1)	65 (26.4)	0.52
Blood Products Transfused, median (IQR)	16 (5-29)	1 (0-9)	<0.01



*Patients are evacuated from R2 median of 2.5 (IQR 1.2 – 5.5) hours [1]

Battlefield Care
Point of Injury and Role 1

Forward Surgical Care
Role 2

Role 2 - Trauma Bay

Hospital Care Out of Combat Zone
Role 4

Theater Hospitals
Role 3

Role 2 - Operating Room

Discussion

- TCA casualties treated at R2 have a meaningful chance of overall survival to evacuation that increases with arrest occurring at R2
- No differences noted in affiliations and mechanisms of injury between those that survived and died
- There were differences in the type of injury; over 75% of those that died sustained penetrating injuries
- Survival differed between pre-hospital and in-hospital TCA:
  - Importance of location of arrest and surgical capabilities with R2 surgical units
  - Availability of providers to support damage control resuscitation/surgery
  - Access to blood products critical

Limitations

- Database fidelity not as robust as formal registry
- Missing important parameters (CPR time, telemetry, vital signs, pre-hospital interventions, etc.)
- No morbidity outcomes available (e.g. neurologic status or mortality data beyond R2)
- Survivor bias exists as all patients who died pre-hospital may not be included in database

Conclusion

- Damage control resuscitation/surgical capabilities in the far-forward environment may facilitate survival to evacuation from R2 for patients with TCA
- Next steps:
  - Determine long-term morbidity and mortality
  - Further optimization of pre-hospital care

Acknowledgements

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- This study was conducted under a protocol reviewed and approved by the US Army Institute of Surgical Research Regulatory Compliance Division and in accordance with the approved protocol

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(Suresh et al., 2018)

Studies to Inform Nurse Readiness

Optimizing nursing care based on complications and outcomes of Afghan ICU patients

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Jennifer D. Trevino, MBA; Nicole W. Caldwell, BA, RN; Tricia L. Garcia-Choudary, MPH, BSN, RN; COL (Ret.) Elizabeth A. Mann-Salinas, PhD, RN, FCCM
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Introduction

- Role 3 (R3) medical treatment facilities (MTFs) provide the highest level of care in the Afghan theater.
- Critically-injured Afghan casualties are frequently treated in R3 intensive care units (ICUs) for extended durations because of the lack of resources to care for these patients in local facilities.

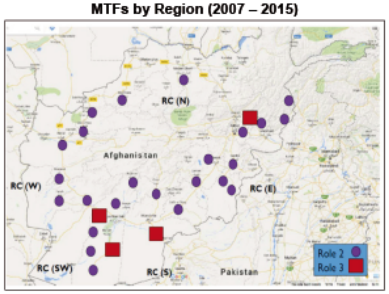
Objectives

The purpose of this study was to assess by MTF the complications and outcomes of critically-injured Afghans treated in R3 MTFs to optimize nursing care delivered in theater.

Methods

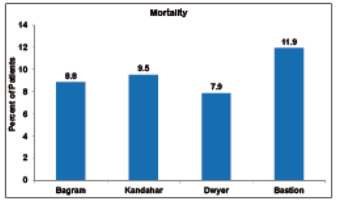
- We performed a retrospective review of Afghan casualties treated only at a R3 MTF.
- Inclusion criteria:
  - age ≥ 18 years
  - treated at one of four R3 MTFs between January 2007 and December 2015
  - treated in the ICU for any portion of their hospitalization
- Data from the Department of Defense Trauma Registry (DoDTR) were used.
- Patients were excluded if documentation indicated treatment at another location prior to arrival at R3 MTF.
- Complications were classified as major, moderate, or minor severity based on survey responses from a panel of military critical care subject matter experts (n=27).

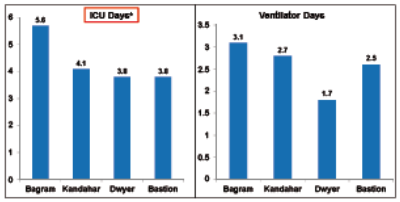
MTFs by Region (2007 – 2015)

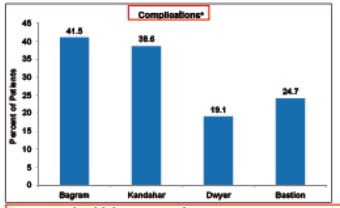


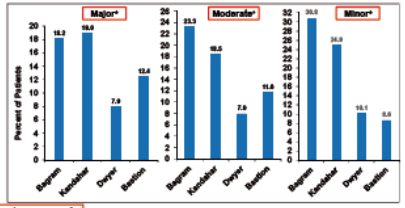
Results

- A total of 1,065 Afghan patients at four sites were included:
  - Bagram (14.9%)
  - Kandahar (17.7%)
  - Dwyer (8.4%)
  - Bastion (59.0%)
- Penetrating injuries were the most common injury type:
  - Bagram (75.5%)
  - Kandahar (76.2%)
  - Dwyer (65.2%)
  - Bastion (79.8%)
- Explosions and gunshot wounds were the most common mechanisms of injury:
  - Bagram (40.9% and 35.8%)
  - Kandahar (51.9% and 25.4%)
  - Dwyer (42.7% and 28.1%)
  - Bastion (48.4% and 40.8%)
- The proportion of patients with injury severity score >16:
  - Bagram (42.8%)
  - Kandahar (52.9%)
  - Dwyer (53.9%)
  - Bastion (44.7%)









*p<0.05; indicates statistically significant differences in findings across all locations using χ^2.

Most Common Complications by Severity

n (%)	Bagram	Kandahar	Dwyer	Bastion
Major				
Pneumonia	8 (12.1)	7 (9.6)	2 (11.8)	20 (12.9)
Pneumothorax	6 (9.1)	7 (9.6)	1 (5.9)	18 (11.6)
Pulmonary Embolus	5 (7.6)	2 (2.7)	0 (0.0)	17 (11.0)
Moderate				
Pleural Effusion*	19 (28.8)	7 (9.6)	1 (5.9)	16 (10.3)
Wound Infection	8 (12.1)	3 (4.1)	0 (0.0)	20 (12.9)
Aspiration Pneumonia*	2 (3.0)	8 (11.0)	2 (11.8)	4 (2.6)
Minor				
Atelectasis*	34 (51.5)	23 (31.5)	2 (11.8)	21 (13.5)
Anemia/Blood Loss	12 (18.2)	8 (11.0)	2 (11.8)	15 (9.7)
Ileus	3 (4.5)	3 (4.1)	2 (11.8)	14 (9.0)

*p<0.05; indicates statistically significant differences in findings across all locations using χ^2.

Discussion

- Differences in ICU days and medical complications of varying severity:
  - More ICU days
  - Access to host nation MTFs varied
  - Different strategic functions of Role 3 MTFs
  - Different ICU staffing models

Implications for Military Nursing

- Nurses assigned to R3 ICUs care for patients with injuries and complications of all severity levels.
- Pre-deployment training and experiences must include caring for complex patients for extended periods of time.

Limitations

- Retrospective analysis of registry data.
- Missing data.
- "Complications" in DoDTR may be consequences or sequelae of injuries.

Conclusions

- Results from this study can hopefully assist leadership on pre-deployment training and education for nurses.
- Future work should focus on optimizing and standardizing ICU care in the combat theater among all providers.

Acknowledgements

- The authors acknowledge the Joint Trauma System DoDTR team for providing the data.
- This work was supported by the Assistant Secretary of Defense for Health Affairs through the Defense Medical Research and Development Program under Award No.W81XWH-15-2-0085. Opinions, interpretations, conclusions and recommendations are those of the author and are not necessarily endorsed by the Department of Defense.
- This research was supported in part by an appointment to the Postgraduate Research Participation Program at the U.S. Army Institute of Surgical Research administered by the Oak Ridge Institute for Science and Education through an interagency agreement between the U.S. Department of Energy and USAMRMC.
- This study was conducted under a protocol reviewed and approved by the US Army Institute of Surgical Research Regulatory Compliance Division and in accordance with the approved protocol.

(VanFosson et al., 2018a)

Studies to Inform Nurse Readiness

Factors associated with trauma patients' length of stay at Role 2 facilities in Afghanistan, October 2009 to September 2014

(Staudt et al, 2018a)

TABLE 2. Median and IQR Time Study Patients Were Treated at Role 2 Facilities in Afghanistan, October 2009 to September 2014

Variables	n	Hours	
		Median	IQR
Total	7,912	2.5	1.2–5.5
Affiliation			
Military, US	3,023	1.9	0.9–4.4
Military, non-US	1,841	3.1	1.5–6.4
Civilian/other	3,048	2.9	1.3–5.9
Injury mechanism			
Explosion	3,972	2.5	1.2–5.3
Gunshot	1,991	3.2	1.5–6.3
Other	1,949	2.0	1.0–4.8
Procedure			
No	5,081	1.8	0.9–4.1
Yes	2,831	4.0	2.3–7.2
Tourniquet use			
No	6,807	2.4	1.1–5.3
Yes	1,105	3.6	1.9–6.3
Blood transfusion			
No	6,427	2.2	1.1–4.7
Yes	1,485	4.5	2.5–7.6
Discharge status			
Returned to duty	2,852	1.4	0.8–2.9
Dead	341	0.9	0.3–2.2
Transferred	4,719	3.6	1.9–6.5

TABLE 3. OR and Corresponding 95% CI for Extended Stay in Study Patients (n = 7,912) Treated at Role 2 Facilities in Afghanistan, October 2009 to September 2014

Variables	Unadjusted			Adjusted		
	OR	95% CI	p	OR	95% CI	p
Affiliation						
Military, US	1.0	Reference		1.0	Reference	
Military, non-US	1.7	1.4–2.0	<0.001	1.4	1.2–1.7	<0.001
Civilian/other	1.4	1.2–1.6	<0.001	1.2	1.0–1.4	0.018
Injury mechanism						
Explosion	1.0	Reference		1.0	Reference	
Gunshot	1.2	1.1–1.4	0.008	1.0	0.9–1.2	0.899
Other	1.1	1.0–1.3	0.065	1.2	1.0–1.4	0.010
Procedure						
No	1.0	Reference		1.0	Reference	
Yes	1.8	1.6–2.1	<0.001	1.6	1.4–1.8	<0.001
Tourniquet use						
No	1.0	Reference		1.0	Reference	
Yes	1.1	0.9–1.3	0.354	0.8	0.7–1.0	0.029
Blood transfusion						
No	1.0	Reference		1.0	Reference	
Yes	1.7	1.5–1.9	<0.001	1.4	1.2–1.6	<0.001
Discharge status						
Returned to duty	1.0	Reference		1.0	Reference	
Dead	0.4	0.3–0.7	<0.001	0.3	0.2–0.5	<0.001
Transferred	1.7	1.5–1.9	<0.001	1.4	1.2–1.6	<0.001

Studies to Inform Nurse Readiness

Analysis of Far Forward Ocular Trauma among Combat Casualties in Afghanistan

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[2]Joint Trauma System, San Antonio, TX

Introduction

- Far forward surgical units in Afghanistan are responsible for performing damage control surgery and resuscitation. Although equipped and prepared to handle the most severely injured casualties, these teams do not specialize in ocular trauma.
- Ocular injuries are often difficult to detect and triage, and if they are missed or mistreated, they may lead to vision loss. Only an ophthalmologist should treat patients for ocular trauma, but this specialty is rarely available on the battlefield.
- Ocular trauma is one of the most under recognized causes of vision loss. Additionally, eyesight is often overlooked among the triad of life, limb, and eyesight.
- Currently, far forward surgical units are instructed to use fox shields as a temporary intervention for ocular trauma and are instructed to transport patients to the next level of care.
- In a prolonged field care situation, expeditious transport may not be possible. Thus, it would be beneficial for medical planners to understand the types of ocular injuries that occur at far forward locations in order to ensure that providers are prepared to diagnosed and manage these injuries prior to further damage or vision loss.

Objective

The purpose of this study was to analyze ocular trauma in Afghanistan identified by far forward surgical teams.

Methods

- Data from the Joint Trauma System Role 2 database was used to identify patients with ocular injuries.
- Adult patients that were injured in Afghanistan from February 2008 to September 2014 were included in this analysis.
- To identify which injuries were likely to cause blindness, an ophthalmologist reviewed all eye injuries and determined those that were 1) likely, 2) possibly, and 3) less likely to result in loss of vision. Loss of vision was defined as permanent or significant loss of vision.
- Only initial ocular injuries were considered for potential causes of loss of vision.
- Non-ocular injuries such as severe traumatic brain injury, arterial gas embolism, and post-hypotensive ischemic optic neuropathy were not considered for potential causes of loss of vision due to dataset limitations.
- Descriptive statistics were used to evaluate patient characteristics by demographics, mechanism of injury, and interventions. Functional capacity index (FCI) was used as an approximate measure of outcomes 12-months following the injury.

Results

- In our dataset, 320 patients with ocular injuries were identified. Of those ocular injuries, 30 were likely to result in vision loss and five possibly resulted in vision loss. Blast injuries accounted for approximately 26 (74%) of those injuries. Injuries likely to result in vision loss included: eye avulsion/enucleation (n=21), retinal detachments (n=2), cornea lacerations (n=3), sclera laceration/rupture or injury (n=2), choroid rupture (n=1), and eye injuries with retained intraocular foreign body (n=1). Injuries that possibly resulted in vision loss included: cornea burn (n=4) and vitreous hemorrhage (n=1). Eye operations included eye exams under anesthesia (n=4), surgical removal of foreign body (n=1), and canthotom and/or cantholpasty (n=5). Of the 30 patients with injuries likely to result in vision loss, 66.7% had a FCI=2, while 13.3% had a FCI=3.

Conclusions

- This comprehensive analysis demonstrated the severity of ocular injuries treated by far forward surgical units in Afghanistan. Within our dataset, approximately 9% of patients were predicted to have significant and permanent loss of vision. Of those injuries that likely/possible resulted in vision loss, 60% were diagnosed with an eye avulsion/enucleation.
- Even in austere settings, severe ocular injuries can occur, so research and planning should continue in assist providers so that they can provide optimal care to casualties that experience these injuries.
- This study should be used to guide clinically-relevant research and training and to resource medical assets on the battlefield.

Further research is needed to improve the quality and safety of care for combat casualties experiencing severe ocular injuries or potential vision loss in a deployed environment.

SAMPLE QR CODE

Table 1.

Eye Injury Description	Bilateral Eye Injury	Single Eye Injury	Not specified	Grand Total
Sclera	13	51	10	74
Sclera, Includes Globe	11	50	10	71
Sclera Laceration; Rupture	1	1	0	2
Sclera injury (Not Specified)	1	0	0	1
Eye Avulsions	3	17	0	20
Whole Area Eye	2	9	0	11
Eye Injury (Not Specified)	2	7	0	9
Eye Inury with Retained Intraocular Foreign Bo	0	1	0	1
Massive Destruction of Whole Face with Eyes	0	1	0	1
Cornea	41	38	14	93
Corneal Abrasion	36	35	14	85
Cornea Burn	3	1	0	4
Cornea Laceration (Not Specified)	0	2	0	2
Cornea Injury (Not Specified)	1	0	0	1
Cornea Laceration Involving Central 3mm of C	1	0	0	1
Retina detachment	0	2	0	2
Vitreous	1	1	0	2
Vitreous Detachment	0	1	0	1
Vitreous Hemorrhage	1	0	0	1
Choroid Rupture	0	1	0	1
Grand Total	60	119	24	203

Table 2.

Procedure Description	Surgical	Non-Surgical	Grand Total
Eye Shield	0	77	77
Eye Exam	11	1	12
Exam of Eye Under Anesthesia	11	0	11
Exam of Eye, Comprehensive without Anesthesia	0	1	1
Irrigation	0	84	84
Irrigation, wound (cleaning)	0	36	36
Irrigation, eye	0	30	30
Irrigation, eye, with removal of foreign body	0	10	10
Irrigation, cornea	0	4	4
Irrigation, anterior chamber (eye)	0	4	4
Removal, Foreign body, Eye,	1	1	2
Other	1	6	7
Canthoplasty (cantholysis)	0	1	1
Canthotomy	0	4	4
Enucleation, Eyeball	1	0	1
Evisceration, Eyeball	0	1	1

Acknowledgements

This work was supported by the Assistant Secretary of Defense for Health Affairs through the Defense Medical Research and Development Program under Award No. W81XWH-15-2-0085. Opinions, interpretations, conclusions and recommendations are those of the author and are not necessarily endorsed by the Department of Defense.

Statements

This study was conducted under a protocol reviewed and approved by the US Army Institute of Surgical Research Regulatory Compliance Division and in accordance with the approved protocol.

(Trevino et al., 2019)

Studies to Inform Nurse Readiness

A REVIEW OF CASUALTIES THAT UNDERWENT PAIN MANAGEMENT BEFORE REACHING ROLE 2 IN AFGHANISTAN

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Introduction

- Analgesia choice is a key early decision made by casualty care providers
- First, do no harm – minimizing iatrogenic resuscitative burden is an ethical mandate
- Significant differences have been found in blood pressure of combat casualties following different analgesic choices[1]
- Balancing sustained combat lethality against proper analgesia will be a concern for the future warfighter[2]
- Prehospital data is lacking, and hampers potential research efforts to improving care in the early, highest-leverage minutes[3]
- The Role 2 Database (R2D) is the largest existing modern prehospital database, and may offer valuable insights on these issues[4]

Objectives

- Examine relationships between analgesic administration and other patient characteristics, particularly mortality and injury severity
- Identify attributes significantly associated with missing vital sign data in the prehospital environment

Methods

- De-identified retrospective review of R2D
  - Inclusion: adult patients injured in Afghanistan
  - Exclusion: patients who sustained isolated disease or mental health/psychiatric diagnoses
- Primary interests were mortality and analgesic administration
  - Morphine
  - Fentanyl
  - Ketamine
  - NSAIDs
- Other variables included
  - Demographics (e.g., age, nationality)
  - Prehospital Combat mortality index (CMI)[5] (Figure 1)
  - Vital signs
  - Time of transport
- Additional analysis was performed to identify patterns related to missing prehospital data
  - Prehospital data were construed as missing if all vital signs were absent in the record: blood pressure, pulse, oxygen saturation and temperature
- Data were analyzed using chi-square, Fisher's Exact, Mantel-Haenzel (M-H), Kruskal-Wallis, or Cochrane-Armitage as appropriate.

Methods

Figure 1. Prehospital Combat mortality index (CMI) is a measure of physiological injury severity that uses clinical variables of heart rate (HR), systolic blood pressure (SBP), and Glasgow coma score (GCS) to develop a score ranging from 0 to 4

Results

- Of 12,780 casualties included in this study, 1,084 (8.5%) received documented analgesia
- Casualties who received analgesia were generally male (98.2%) with a median age of 25 (IQR 21-30)
- Mortality, injury mechanism, CMI-PH and national affiliation were significantly associated with missing prehospital vital sign data
- Time of transport and sex were not associated

Table 1: Demographics of study patients with (n=1,084) and without (n=11,696) documented analgesia.

	Total, n (%)	Analgesia, n (%)	No analgesia, n (%)
Patient Affiliation*			
US Forces	4,667 (36.5)	431 (39.8)	4,236 (36.2)
Non-US Military	4,933 (38.6)	432 (39.9)	4,501 (38.5)
Other	3,180 (24.9)	221 (20.4)	2,959 (25.3)
Category of Injury*			
Battle Injury	9,733 (76.2)	880 (81.2)	8,986 (75.7)
Non-Battle Injury	3,047 (23.8)	204 (18.8)	2,913 (24.3)
Prehospital CMI*			
Mild	7,003 (54.8)	639 (9.1)	6,364 (54.4)
Moderate	2,941 (23.0)	253 (8.6)	2,688 (23.0)
Severe	747 (5.9)	69 (9.2)	678 (6.6)
Critical	537 (4.2)	31 (5.8)	506 (4.9)
Unknown	1,552 (12.1)	92 (15.6)	1,460 (12.5)
Outcome			
Alive - RTD	4,498 (35.2)	288 (26.6)	4,210 (36.0)
Alive - Transported	7,321 (57.3)	771 (71.1)	6,550 (56.0)
Dead	920 (7.2)	25 (2.3)	895 (7.7)
Unknown	41 (0.3)	0 (0.0)	41 (0.03)

Abbreviations: CMI, Combat Mortality Index ; RTD, Returned to Duty
*Prehospital combat mortality index was calculated using prehospital vital signs, or initial vital signs on presentation to Role 2.
*Significant at <0.05 level

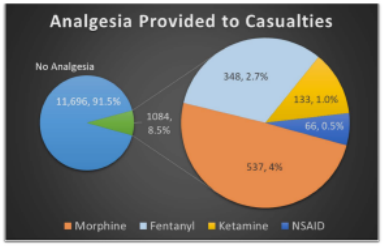

Figure 2. Numbers and percentages of documented pain medications provided to casualties

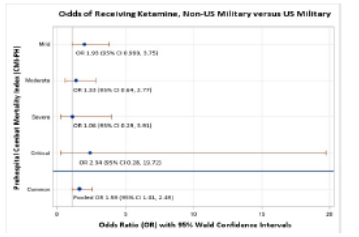

Figure 3. M-H pooled odds comparison, Non-US military versus US Military receiving ketamine

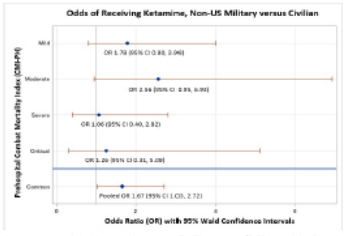

Figure 4. M-H pooled odds comparison, Non-US military versus Civilian receiving ketamine

Table 2: Prehospital/arrival vital signs by analgesic group

	Total (n= 1,084)	NSAID (n=66, 6.1%)	Morphine (n=537, 49.5%)	Fentanyl (n=348, 32.1%)	Ketamine (n=133, 12.3%)
Vital Signs, median [IQR]					
SBP (mmHg)	131 [117-142]	134.5 [128-141]	131 [118-143]	131 [116-141]	129 [114-144]
Unassisted Respiratory Rate (RPM)	18 [16-22]	18 [16-20]	18 [16-22]	19 [16-22]	18 [16-23]
Pulse (BPM)*	89 [77-104]	80 [72-94]	88 [77-102]	90 [78-107]	98 [82-117]
O2 Saturation (%)	98 [96-100]	97 [96-99]	98 [96-100]	98 [97-100]	99 [96-100]
Temperature (°F)	98.2 [97.5-98.8]	98.2 [97.6-98.6]	98.2 [97.5-98.8]	98.2 [97.5-98.9]	98.0 [97.2-98.8]

Abbreviations: IQR, Intraquartile range; RPM, respirations per minute; BPM, beats per minute
*Significant at <0.05 level

Conclusions

- In the R2D, patients had fewer documented administrations of analgesia as physiological severity increased
  - Increased resuscitative needs may preclude administration or documentation
  - Very few patients who ultimately died had documented analgesia (2.7% of 920 deaths)
- Non-US military patients had increased odds of receiving ketamine versus US military or civilians when controlling for overall physiological status
  - Unknown first responder, possible non-US; may simply reflect foreign practice patterns/guidelines
- Most vital signs were similar between anesthesia groups
  - Ketamine group had higher median pulse, consistent with shock indication and sympathomimetic effects
- Patients had fewer documented prehospital vital signs as physiological severity increased
  - Hampers performance improvement and research efforts
  - Deficit calls for a means to automate prehospital vital sign collection

Acknowledgements

- The authors acknowledge the Joint Trauma System R2D for providing data for this study.
- This work was supported by the Assistant Secretary of Defense for Health Affairs through the Defense Medical Research and Development Program under Award No. W81XWH-15-2-0085. Opinions, interpretations, conclusions and recommendations are those of the author and are not necessarily endorsed by the Department of Defense.
- This study was conducted under a protocol reviewed and approved by the US Army Institute of Surgical Research Regulatory Compliance Division and in accordance with the approved protocol

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(Hudson, Staudt, Trent, Hinojosa-Laborde, Ryan & VanFosson, 2019)

Studies to Inform Nurse Readiness

MILITARY MEDICINE, 00, 0/0:1, 2019

Forward Surgical Team Procedural Burden and Non-operative Interventions by the U.S. Military Trauma System in Afghanistan, 2008–2014

(Staudt et al., in press)

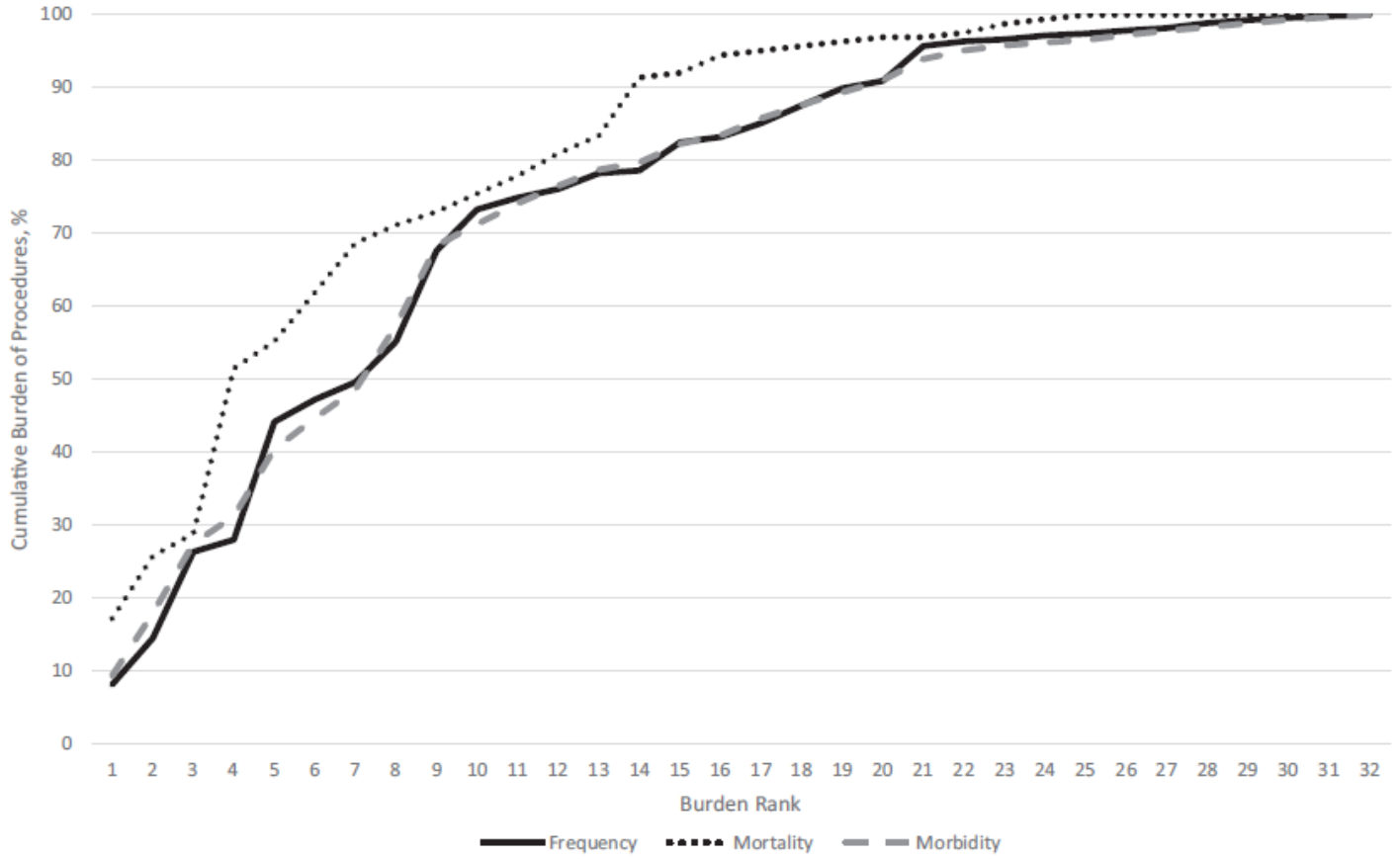

FIGURE 1. Cumulative Burden of Procedures by Burden Rank.

Studies to Inform Nurse Readiness

Evaluation of Pre-deployment Training for Army Nurses and Medics

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Introduction

- Clinicians face several challenges when caring for trauma patients on the battlefield. Combat casualty care may include:
  - Treating patients while under attack
  - Resource constraints
  - Periods of limited visibility/darkness
  - Rugged terrain
  - Extreme temperatures
- Therefore, optimal preparation for clinicians includes exposure to as many combat trauma situations as possible prior to deployment
- Army nurses and combat medics undergo a wide variety of pre-deployment training events
- The literature contains no evaluation of Army nurse or combat medic pre-deployment training

Objective

The purpose of this study was to survey trauma care-oriented Army nurses and combat medics to describe the range of pre-deployment trainings they experienced in order to provide guidance on future pre-deployment training requirements

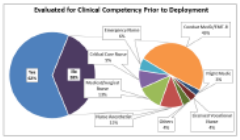
Methods

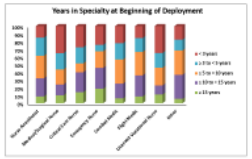
- Survey link sent to military email accounts provided by US Army Human Resource Command
  - Army nurses from active (n=2,344) and reserve (n=2,458) components
  - Active duty combat medics (n=17,535)
- Inclusion criteria:
  - Deployed to a combat theater since 2001
  - Registered nurse (medical-surgical, emergency, critical care), certified registered nurse anesthetist (CRNA), or medic (technician or licensed vocational nurse)
- Intelink.gov survey platform
  - Targeted up to two most recent deployments
  - Captured demographic information, deployment history, and military training received prior to deployment
- Three monthly reminder emails sent to all potential participants
- Survey data analyzed using descriptive statistics

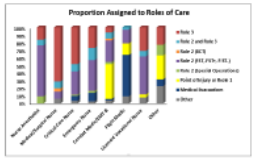
Results

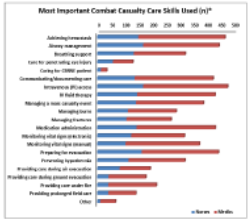
- Of 22,337 emails sent, there were 1,181 respondents (5.3% response rate); 696 (58.9% of respondents) met inclusion criteria

Characteristics of the Participants	n	%
Total Participants	696	100.0
Male	517	74.3
Age		
18 - 24 years	95	13.6
25 - 34 years	329	47.3
35 - 44 years	204	29.3
45 - 54 years	64	9.2
55 - 64 years	4	0.6
Rank		
E-1 to E-4	137	19.7
E-5 to E-6	264	37.9
E-7 to E-9	66	9.5
O-1 to O-3	140	20.1
O-4 to O-6	89	12.8
Active Duty	644	92.5
Area of Concentration or Military Operational Specialty		
Combat Medic	382	54.9
Critical Care Nurse	62	8.9
Emergency Nurse	37	5.3
Flight Medic	33	4.7
License Vocational Nurse	26	3.7
Medical/Surgical Nurse	66	9.5
Nurse Anesthetist	55	7.9
Other	35	5.0
Number of Deployments		
1	269	38.6
2	212	30.5
3	115	16.5
4	58	8.3
5 or more	42	6.0
Location of Most Recent Deployment		
Afghanistan	364	52.3
Africa	13	1.9
Iraq	198	28.4
Kosovo	7	1.0
Kuwait	59	8.5
Syria	17	2.4
Other area (Middle East)	18	2.6
Other area (global)	20	2.9









* Totals may be greater than 696 because participants could select more than one option.

Discussion

- Most nurses and medics were satisfied with the quality of their pre-deployment training (when it occurred)
- Nurses and medics believed they were capable of providing effective combat casualty care
- Combat died of wounds rates started to rise recently,[1] indicating that the trauma system may have previously unidentified limitations
- Currently unable to link pre-deployment training to patient outcomes; success of training is subjective

Limitations

- Survey data only captured pre-deployment training for deployers and not for non-deployers
- Sample not representative of all nurse specialties

Conclusions

- Army nurses and medics felt confident and sufficiently prepared to provide trauma care during their deployments
- Increases in died of wounds rates may indicate that training was not sufficient.
- To better understand the effectiveness of combat casualty care training, the Army must be able to link training events to objective measures, such as patient outcomes.

Acknowledgements

- This project was funded by the Defense Health Program JPC-6 Intensive Forward Surgical Critical Care, Award Number W81XWH-15-2-0085
- This project was conducted under a protocol reviewed and approved by the US Army Institute of Surgical Research Regulatory Office
- Conduct of the survey was approved by the Army Research Institute, Control Number DAPE-ARI-AO-18-01

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(VanFosson et al., 2018b)

Studies to Inform Nurse Readiness

JNPD Journal for Nurses in Professional Development • Volume 00, Number 0, X–X •

Using the Delphi Technique to Determine Core Components of a Nurse Competency Program

- Background:
  - No consensus on components of nurse competency program
- Method: Delphi study of nursing subject matter experts
- Findings:
  - Participants represented broad range of military and civilian nursing experts
  - Identified core elements of nurse competency program
  - Ranked importance of core elements

(Boyer, Mann-Salinas, Valdez-Deglado, & VanFosson, 2019)

Studies to Inform Nurse Readiness

Deployed Nursing Competencies Utilizing Consensus Combat Casualty Care Domains

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Introduction

- On the battlefield, Tri-Service nurses work side-by-side to care for the same casualties, yet each branch of service uses a different pre-deployment competency criteria (Figure 1)
- The Tri-Service Clinical Readiness "Knowledge, Skills and Attributes (KSA) Project" team, directed by the Deputy Secretary of Health Affairs, defined the KSAs specific to the combat environment for deployed medical teams, but with a focus on surgical and physician-based competencies (Figure 2)

Figure 1: Triservice Predeployment standard variability

Objectives

This project aimed to use the evidence-based Clinical Transition Framework (CTF) to identify nursing competencies which are specific to the deployed environment and align with the Military Health System KSA Project domains

Methods

- The Vermont Nurses in Partnership (VNIP) CTF served as the foundation for the development of universal combat casualty care (CCC) nursing Competency Assessment Tools (CAT) (Figure 3)
- The competency tools directly align with the 8 KSA expeditionary domains:
  - wound/amputation/fracture management
  - head and spine injury
  - torso trauma
  - transfusion and resuscitation
  - airway and breathing
  - critical care/prevention
  - other military
  - universal domains (Figure 2)
- These tools were cross-walked with available pre-deployment tools (Navy and Air Force) and expert recommendations (Army) to promote consensus
- Nurse subject matter experts reviewed the developed competency statements for applicability, clarity, and comprehensiveness

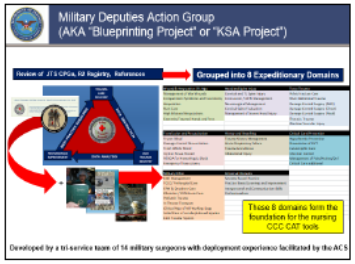

Figure 2: KSA domains of combat casualty care

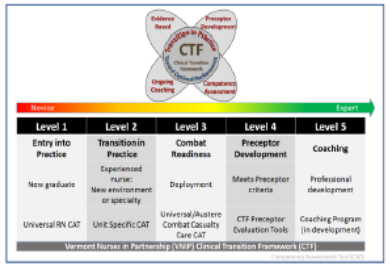

Figure 3: Clinical Transition Framework (CTF)

Results

- Two CATs were created: Role 3 CCC CAT, and Austere CAT (for Role 2 and en-route teams) (Figures 4a-d)
- The CCC CAT covers the 8 domains of expeditionary KSAs and includes 180 specific competency statements
- The Austere CAT includes 36 additional competency statements; focus is on the domains of expeditionary care within a resource-constrained environment and covers operational elements associated with small teams

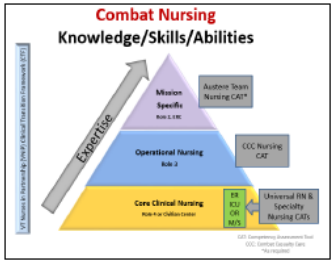

Figure 4a: Combat Nursing KSAs

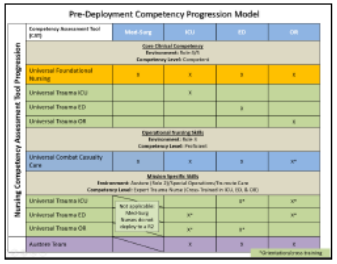

Figure 4b: Nursing Competency Tools for each Role of Care

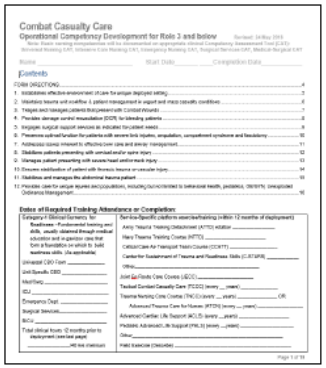

Figure 4c: Combat Casualty Care Tool

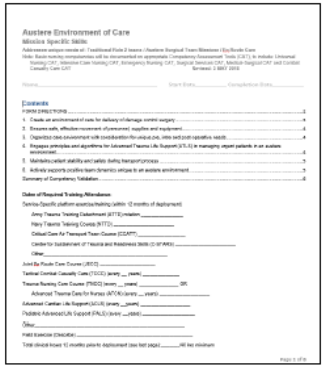

Figure 4d: Austere Environment of Care Tool

Conclusions

- Competency evaluation for nurses should be evidence-based, objective, and standardized for all deployers, regardless of the branch of service or theater of operations
- Readiness may then be objectively evaluated and documented for each nurse using the CAT and Periodic Evaluation Tool (Figure 5)
- Efforts are currently underway to validate these tools during clinical pre-deployment training

Acknowledgements

This work was supported by the Assistant Secretary of Defense for Health Affairs through the Defense Medical Research and Development Program under Award No.W81XWH-15-2-0085

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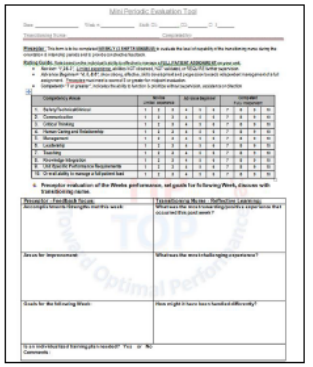

Figure 5: Periodic Evaluation Tool

(Mann-Salinas, Valdez-Delgado, Boyer, Trevino, Caldwell, & VanFosson, 2018)

Studies to Inform Nurse Readiness

Combat Casualty Care Readiness Achieved Following Level 1 Trauma/Burn Clinical Exposure Training

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Introduction

- Combat casualty care (CCC) competency is achieved by practicing CCC skills repeatedly in a real-life application.
- There is limited volume and access to critically injured trauma patients within military treatment facilities.
- The U.S. Army Burn Center, co-located with Brooke Army Medical Center (BAMC; a level 1 trauma center), cares for the most critically ill patients in the DoD; the skills required to care for these patients are likely to improve CCC competency.
- Deployable units/individuals, tri-service, attend a 1-3 week clinical rotation through the U.S. Army Burn Center prior to a deployment.
- Clinical rotation allows providers the opportunity to become familiar with the basic elements of trauma care, receive didactic training, and attend Joint Trauma System case study review sessions.
- There is limited data to describe how sending clinicians through these environments for short-term rotations prior to deployment effects CCC competency.

Objectives

The purpose of this study was to determine the CCC knowledge, skills, and perceived readiness achieved during a short term (1-3 week) level-1 trauma/burn clinical exposure at the U.S. Army Burn Center.

Methods

- A universal CCC nursing competency assessment tool (CAT) was developed using evidence-based principles. This tool incorporated the 8 Knowledge, Skills, and Ability expeditionary domains:
  - *wound/amputation/fracture management, head and spine injury, torso trauma, transfusion and resuscitation, airway and breathing, critical care/prevention, other military, universal domains.*
- CCC competencies that could be achieved during a clinical experience were identified by the U.S. Army Burn Center Education Department.
- Self-reported clinical hours were reported daily on a log by each pre-deployer.
- The Readiness Estimate and Deployability Index Survey (READI), a validated tool, was administered before and after each clinical rotation. Questions were on a 5-point scale, 3-point scale, and bi-variable (yes/no).
- A self-evaluation of the ability to independently care for patients within the burn center was administered before and after training. The rating scale included novice (1-3), advanced beginner (4-6), and competent (7 or above); on a 1-10 Benner's scale.
- Skills/knowledge within the defined nursing competency areas were deployed utilizing the Elsevier's Clinical Performance Manager.
- During their clinical exposure, pre-deployers were assigned to preceptors to facilitate clinical experience.

Results

- From April 2016 to June 2019, 92 pre-deployers completed rotations through the U.S. Army Burn Center.
- Of 169 competencies identified in the universal CCC tool, 53 could feasibly be incorporated into the clinical exposure period.
- Average length of rotation was 10 ± 2.5 days and included both didactic training and clinical exposure.
- In 2019, the program was updated to incorporate online skill review and competency tracking. Since the program update, 31 pre-deployers have participated, making a clinical dashboard prototype feasible.
- Average length of clinical exposure was 41± 6 hours (28-56, n=19) of which 17.8 ± 12.2 hours (0-38) were in critical care (burn intensive care or post anesthesia care unit).
- Readiness in clinical nursing increased 4-14% overall, with the greatest self-reported improvements in training and experience in the areas of hemorrhagic shock, ballistic missile injuries, and burn resuscitation (>10% each).
- In the category of operational nursing, blood transfusion and burn injured patient competencies had the greatest increase in self-reported training and experience, improving 13% and 16%, respectively.
- Initial self-perceived competence in the ability to independently care for patients averaged 5 ± 2.4 (advanced beginner). Post-rotation average was 7 ± 2.6 (competent).

Conclusions

- Clinical exposure is beneficial to military medical personnel, However it is infeasible to cover all CCC competencies during a short, 1-3 week rotation.
- Essential competencies, skills, and abilities should be standardized to ensure competence in caring for a combat casualty is achieved over time.
- Currently, no standard competencies exist for tri-service nurses.

A 1-3 week rotation in a level 1 burn and trauma center improves some aspects of clinical and operational readiness, but is insufficient to cover all combat casualty care competencies for pre-deployers

QR Code will be placed here

Statements

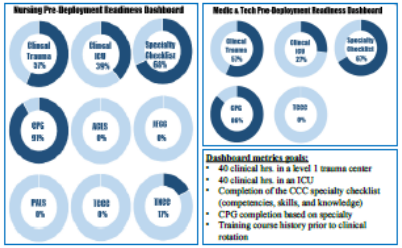
This study was reviewed by the Research Regulatory Compliance Division at the U.S. Army Institute for Surgical Research and was determined to be non-human subject research

Additional Results

- Pre-deployer personnel job code breakdown: Surgeon/Physician/Advanced Care Provider=7; Nurse/LPN=35; Medic=21; Other=29).
- The conversion from paper to electronic documentation resulted in 100% capture of skill and knowledge review (including Joint Trauma System Clinical Practice Guideline content), and provided pre-deployers with 43.5 continuing education hours.

Table 1-Self-reported Competencies on the Readiness Estimate and Deployability Index (READI)	Before n=80	After n=92	% Change
Clinical Nursing (5-point Scale)			
1=No training, no experience; 2=Training, no experience; 3=Training, minimal experience; 4=Training, moderate experience; 5=Training, maximal experience			
Fluid resuscitation of a burn patient (Q21)	2.52 ± 0.87	3.2 ± 1.10	13.6%
Care for hemorragic shock Patients (Q2)	2.94 ± 1.15	3.47 ± 1.14	10.6%
Ballistic missile injuries (Q19)	3.22 ± 1.13	2.74 ± 1.22	10.4%
Care of patients with CRBNE injuries (Q18)	2.16 ± 0.74	2.65 ± 1.00	9.8%
Calculating IV drip without calculator or drug book (Q7)	2.55 ± 1.22	3.02 ± 1.24	9.4%
Field infection control (Q30)	2.64 ± 1.21	3.11 ± 1.15	9.4%
Universal blood donation protocal (Q22)	2.49 ± 1.12	2.96 ± 1.19	9.4%
Implementing triage categories (Q26)	2.93 ± 1.06	3.36 ± 1.15	8.6%
Deciding which patients to see first (Q12)	3.20 ± 1.04	3.60 ± 1.1	8.0%
Use of field ventilator (Q24)	2.52 ± 1.31	2.9 ± 1.42	7.6%
Clinical team leadership (Q27)	2.89 ± 1.29	3.26 ± 1.29	7.4%
Recognition of tension pneumothorax (Q20)	2.91 ± 1.15	3.25 ± 1.23	6.8%
Orthopedic nursing (Q31)	2.26 ± 1.38	2.58 ± 1.37	6.4%
Instituting standing orders (IV, X-rays, fluids, meds) (Q9)	3.12 ± 1.30	3.44 ± 1.25	6.4%
Antepartum/Postpartum care (Q29)	2.45 ± 1.25	2.76 ± 1.29	6.2%
Care for refugee or enemy prisoners of war (Q28)	2.42 ± 1.18	2.66 ± 1.25	4.8%
Care for life threatening injuries (Q14)	3.22 ± 1.19	3.46 ± 1.12	4.8%
Advance Cardiac Life Support without a physican (Q13)	2.70 ± 1.33	2.93 ± 1.44	4.6%
Airway management (Q25)	3.38 ± 1.04	3.59 ± 1.14	4.2%
Neurosurgical nursing (Q32)	2.07 ± 1.24	2.27 ± 1.41	4.0%
Disease, non-battle injuries (Q23)	3.26 ± 1.28	3.44 ± 1.24	3.6%
Operational Nursing (5-point Scale)	**Before**	**After**	**% Change**
1=No training, no experience; 2=Training, no experience; 3=Training, minimal experience; 4=Training, moderate experience; 5=Training, maximal experience			
Burn injured Patient (Q44)	2.03 ± 0.97	2.82 ± 1.21	15.8%
Blood transfusions (Q39)	2.71 ± 1.47	3.34 ± 1.38	12.6%
Field hospital set up (Q49)	2.94 ± 1.40	3.41 ± 1.35	9.4%
Reporting an unlawful act or conduct (Q47)	2.86 ± 1.25	3.29 ± 1.26	8.6%
Roles of care (Q46)	3.01 ± 1.22	3.41 ± 1.19	8.0%
Field sanitation and hygine (Q48)	3.15 ± 1.04	3.52 ± 1.18	7.4%
Evacuation/Transport (Q45)	2.93 ± 1.17	3.25 ± 1.20	6.4%
Physical Assessment Component (5-Point Scale)	**Before**	**After**	**% Change**
1=Low; 2=Somewhat low; 3=Moderate; 4=Nearly high; 5=High			
List five examination techniques to perform physical examination (Q34)	2.82 ± 1.31	3.42 ± 1.26	12.0%
Identify components of physical examination (Q33)	3.39 ± 1.06	3.75 ± 1.14	7.2%
Perform complete nursing assessment and interpret abnormal findings (Q35)	3.1 ± 1.31	3.36 ± 1.39	5.2%

Figure 1- Pre-deployment Nursing and Medic Dashboard



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(Valdez-Delgado et al., 2019)

Impact on nurse readiness efforts

- Informed Joint Trauma System clinical practice guidelines
- Informed clinical readiness training expectations
- Provided medical planners with improved understanding of Role 2 surgical unit capabilities and capacity
- Reinforced need en route care nurses on medical evacuation flights
- TIP-TOP/Clinical Transition Framework across DHA (DHA Readiness Working Group)

Key Takeaways

- Multi-Domain operations will require maximal individual clinical readiness at point of injury through Role 2 surgical teams
- Nurses and nurse scientists are leading the way when it comes to individual clinical readiness preparation
- Individual clinical readiness is informed by:
  - Individual characteristics
  - Educational background
  - Training attended
  - Clinical exposure/practice
    - Patient care environment and quality of exposure
- Individual clinical readiness training/education requirements can/should be informed by data derived from operationally relevant datasets

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