An Analysis and Comparison of Prehospital Trauma Care Provided by Medical Officers and Medics on the Battlefield

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ABSTRACT

Background: Role 1 care represents all aspects of prehospital care on the battlefield. Recent conflicts and military operations conducted on behalf of the Global War on Terrorism have resulted in medical officers (MOs) being used nondoctrinally on combat missions. We are seeking to describe Role 1 trauma care provided by MOs and compare this care to that provided by medics. **Methods:** This is a secondary analysis of previously described data from the Prehospital Trauma Registry and the Department of Defense Trauma Registry from April 2003 through May 2019. Encounters were categorized by type of care provider (MO or medic). If both were documented, they were categorized as MO; those without either were excluded. Descriptive statistics were used. **Results:** A total of 826 casualty encounters met inclusion criteria. There were 418 encounters categorized as MO (57 with MO, 361 with MO and medic), and 408 encounters categorized as medic only. The composite injury severity score (median, interquartile range) was higher for casualties treated by the medic cohort (9, 3.5–17) than for the MO cohort (5, 2–9.5; *P* = .006). There was no difference in survival to discharge between the MO and medic groups (98.6% vs. 95.6%; *P* = .226). More life-saving interventions were performed by MOs compared to medics. MOs demonstrated a higher rate of vital sign documentation than medics. **Conclusion:** More than half of casualty encounters in this study listed an MO in the chain of care. The difference in proportion of interventions highlights differences in provider skills, training and equipment, or that interventions were dictated by differences in mechanisms of injury.

Keywords: *prehospital; medic; healthcare provider; military medicine; war-related injuries*

Introduction

The countries of the North Atlantic Treaty Organization (NATO) have created a common lexicon to describe roles of medical care provided by their military forces as determined by capabilities and functions.[1] Currently, there are four roles of care. Role 1 is the prehospital or unit level care that includes basic sick call and medical treatment, as well as initial trauma care, resuscitation, and life-saving interventions not including major surgical procedures.[2] Role 2 facilities provide advanced trauma management and resuscitation. Depending on the manning level and employment, they may also be augmented by surgical capabilities (e.g., forward surgical team). Role 3 and Role 4 facilities provide the staff and equipment to care for all categories of patients, to include resuscitation, initial wound surgery, specialty surgery, and post-operative treatment.[3] The difference between Role 3 and Role 4 facilities is that the former is usually found in the combat zone and the latter is usually a fixed facility outside of the combat zone.

Role 1 care in maneuver units within the US Army typically have two medical officers (MOs) who provide trauma and resuscitative care: a physician assistant (PA) and a physician. At the battalion or squadron level, the physician is often either a residency trained primary care physician (e.g., family medicine, internal medicine, or pediatrics), emergency medicine physician, or a non–residency-trained general medical officer. These physicians are permanently assigned to units for combat deployments by the modification table of organization and equipment (MTOE) Assigned Personnel (MAP) (legacy term for the US military's Professional Filler System [PROFIS]). The US Marine Corps uses a similar setting, using physicians and PAs with the support of corpsmen and independent duty corpsmen. The US Air Force and US Navy have a variety of personnel in the prehospital setting, at times relying solely on enlisted medical personnel.

In the deployed setting, unit MOs will often establish small clinics or aid stations to facilitate Role 1 care of disease, non-battle injury, and battle injury. Although unit medics will assist MOs at the aid station, most will accompany their respective units on combat missions in order to provide care to battle-injured casualties near the point of injury (POI). During recent conflicts, more MOs have also accompanied their units on missions. However, this has more frequently occurred in Special Operations Forces (SOF) units.

The training and skills of the MO can vary greatly. During the peak years of conflict in Afghanistan and Iraq, many new graduates of PA school were sent to deploying units before having the opportunity to solidify and refine their skills. Nevertheless,

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many PAs who commissioned through the Interservice Physician Assistant Program (IPAP) often have prior military and medical experience as enlisted service members, frequently as medics. In the US Army, physicians assigned through MAP to deploying conventional units are usually hospital or clinic-based physicians with variability in the type and volume of postgraduate training. In other services, units may have a GMO. These physicians generally have just graduated from medical school or completed an internship. While the MO may have a greater foundation of knowledge and experience than medics, they sometimes lack training or real-world experience in performing Tactical Combat Casualty Care (TCCC) in the prehospital environment at or near the POI. Appropriate delivery of TCCC is credited with decreasing mortality in the prehospital combat setting.[4,5] Thus, this study evaluated prehospital battlefield trauma care provided by MOs and compared this care to that provided by medics. We analyzed interventions and outcomes to include survival to discharge based on the type of medical personnel involved in the chain of care.

Methods

Data Acquisition

Protocol H-19-018 was submitted to the US Army Institute of Surgical Research regulatory office who determined this study to be exempt from institutional review board oversight. Data sharing agreement 19-2186 was submitted and executed with the Defense Health Agency (DHA) prior to submitting a request for data to the Joint Trauma System (JTS). Deidentified data on all casualties captured by the Prehospital Trauma Registry (PHTR) from June 2003 to May 2019 were obtained from the JTS, along with outcomes data for PHTR casualties linkable to the Department of Defense Trauma Registry (DoDTR). Due to new DHA requirements regarding deidentified data, only an age range, and not a specific age, were provided for each casualty.

Prehospital Trauma Registry (PHTR)

The JTS PHTR is a data collection and analytic tool designed to provide near real-time feedback to commanders. As previously described, the primary purpose of this tool is to improve casualty visibility, augment command decision-making processes, and direct procurement of medical resources.[6] Additionally, this tool seeks to reduce morbidity and mortality through performance improvement in the areas of primary prevention (tactics, techniques, and procedures), secondary prevention (personal protective equipment), and tertiary prevention (casualty response system and TCCC).[7] The US Central Command JTS Prehospital Directorate collected TCCC cards and TCCC after-action reports (AARs) and transferred information from these documentation tools into the PHTR. The origin of the PHTR has been previously described in the literature.[8,9]

Department of Defense Trauma Registry (DoDTR)

The DoDTR, formerly known as the Joint Theater Trauma Registry, is the DoD's data repository for trauma-related injuries.[10–16] The DoDTR includes documentation regarding demographics, injury-producing incidents, diagnoses, treatments, and outcomes following injuries. The registry includes data on US and non-US military casualties, as well as US and non-US civilian casualties and their treatment from the POI to final disposition. The DoDTR is primarily comprised of patients admitted to a hospital with an injury diagnosis using the *International Classification of Diseases, 9th Edition* (ICD-9) codes between 800-959.9, near-drowning/drowning with associated injury (ICD-9 994.1) or inhalational injury (ICD-9 987.9), and trauma occurring within 72 hours from presentation to a facility with surgical capabilities.

Data Analysis

The dataset was screened for all casualty encounters that documented the type of medical provider. These encounters were categorized as either MO or medic. Encounters without type of medical provider were excluded. If an encounter listed both MO and medic, the encounter was categorized as an MO encounter. We proceeded under the assumption that the care rendered was documented appropriately.

Analyses were performed using Microsoft Excel (Microsoft; www.microsoft.com) and JMP Statistical Discovery from Statistical Analysis System (SAS; www.jmp.com). Continuous variables were reported using means and standard deviations, ordinal variables through medians and interquartile ranges (IQRs), and nominal variables through numbers and percentages. Descriptive and inferential statistics were used, with significance for inferential tests set at $P < .05$.

Results

A total of 826 casualty encounters met study inclusion criteria. These encounters were mostly due to battle injuries (88.3%, 729/826), occurred primarily in Afghanistan (98.8%, 816/826), and in the period from June 2003 through May 2019. There were 418 encounters categorized as MO (57 with MO, 361 with MO and medic), and 408 encounters categorized as medic. Casualties cared for by an MO tended to be members of the host-nation military (66.3%, 277/418), while the majority of those treated by medics were members of the US military (68.1%, 278/408). Within the MO category, 13.6% of the total number of patients were SOF affiliated (Table 1). Casualties within the MO group more often sustained injuries from a firearm (45.2%, 189/418), whereas most patients cared for by a medic had an explosive mechanism of injury (MOI) (52.4%, 214/408). The composite median and IQR injury severity score (ISS) was higher in the medic cohort (9, 3.5–17) than for the MO cohort (5, 2–9.5) ($P = .006$). Also, higher rates of extremity injuries occurred among those in the medic group (28.8% vs. 13.7%; $P = .009$). Of the 36.1% (298/826) of PHTR encounters linked to the DoDTR for outcomes, there was no statistically significant difference in survival to discharge between the MO and medic groups (98.6% [72/73] vs. 95.6% [215/225]; $P = .226$) (Table 2).

With respect to life-saving interventions (LSIs), most proportional differences favored casualties in the MO group: pelvic binder placement (2.6% vs. 0.4%; $P = .021$), endotracheal intubation (ETI) (11.7% vs. 0.4%; $P < .001$), tube thoracostomy (6.4% vs. 1.2%; $P < .001$), intraosseous access (10.2% vs. 5.8%; $P = .020$), and hypothermia kits (41.3% vs. 14.7%; $P < .001$) (Table 3). For hemorrhage control, there were no differences between MOs and medics with respect to providing a hemostatic agent, limb tourniquet, or junctional tourniquet. However, medics did apply more pressure dressings (38.2% vs. 28.2%; $P = .002$). Medics administered blood products more often than MOs (2.7% vs. 0.7%; $P = .031$), while differences in all other medications favored those treated by an MO (Table 4). Every vital sign demonstrated a higher rate of documentation among MOs than medics (Table 5).

TABLE 1 *Demographics of Casualties From the PHTR (N = 826)*

		Medical Officers (n = 418)	Medic (n = 408)	*P* Value
Demographics	18–25 years	11.2% (47)	27.9% (114)	<.001
	26–33 years	11.4% (48)	34.3% (140)	
	34–41 years	2.3% (10)	9.5% (39)	
	42–49 years	1.6% (7)	2.7% (11)	
	50+ years	0.4% (2)	0.9% (4)	
	Unknown age	72.7% (304)	24.5% (100)	
	Male	99.2% (415)	99.7% (407)	.624
Casualty affiliation	US military	27.2% (114)	68.1% (278)	<.001
	US civilian	1.6% (7)	1.7% (7)	
	NATO	0.4% (2)	1.4% (6)	
	Host-nation military	66.3% (277)	24.5% (100)	
	Other	4.3% (18)	4.1% (17)	
Mechanism of injury*	Explosive	41.5% (172)	52.4% (214)	.001
	Firearm	45.2% (189)	29.9% (122)	<.001
	Fragmentation	0.9% (4)	6.8% (28)	<.001
	MVC	2.6% (11)	6.3% (26)	.009
	Aircraft crash	2.9% (12)	0% (0)	<.001
	Fall	1.6% (7)	1.7.% (7)	.963
	Other	5.0% (21)	5.3% (22)	.811
Battle status	Battle	85.6% (358)	90.9% (371)	.018
	Nonbattle	14.3% (60)	9.0% (37)	
Country	Afghanistan	98.5% (412)	99.0% (404)	.549
	Iraq	1.4% (6)	0.9% (4)	

*Casualties could have more than one documented mechanism of injury.
NATO = North Atlantic Treaty Organization; MVC = motor vehicle crash.

TABLE 2 *Data From PHTR Casualties Linkable to the DoDTR (N = 298)*

		Medical Officers (n = 73)	Medic (n = 225)	*P* Value
Injury Severity Score	Composite*	5 (2–9.5)	9 (3.5–17)	.006
Nonserious injuries by body region (AIS 1–2)**				
Serious injuries by body region (AIS 3–6)†	Head/neck	8.2% (6)	11.5% (26)	.423
	Face	0% (0)	0.4% (9)	.568
	Thorax	6.8% (5)	14.6% (33)	.081
	Abdomen	4.1% (3)	11.5% (26)	.070
	Extremities	13.7% (10)	28.8% (65)	.009
	Skin	2.7% (2)	2.6% (6)	.973
Outcome	Survival to discharge	98.6% (72)	95.6% (215)	.226

*Median and interquartile range.
**Percentage and n value.
†Serious injury is defined by an abbreviated injury scale (AIS) of 3 or greater.

Discussion

In this analysis of care provided by Role 1 MOs in the prehospital setting, MOs managed more host nation military casualties, more injuries resulting from a firearm MOI, and casualties with a lower composite ISS. Although only ISS was available from the DoDTR, obtaining a new ISS may better account for injury severity in those injured by firearm as the top three injuries may be located in the same body region. Additionally, MOs performed more LSIs and administered more medications. In comparison, medics managed more US military service members, more injuries resulting from an explosive MOI, and casualties with a higher composite ISS. As medics are forward more often with the troops from their unit, it is likely that if a serious casualty were to occur, it would be one of their own, and they would treat and evacuate directly to a Role 2 or 3 facility. Medics performed fewer LSIs and administered fewer medications compared to MOs, however they applied tourniquets and hemostatic agents at comparable rates. Despite the differences between groups, there was no difference in survival to hospital discharge. However, the mortality data are based off deterministic linkages with DoDTR records, which only linked 17.0% of MO encounters versus 55.0% of medic encounters. Additionally, the DoDTR does not account for those who died in the prehospital setting. It is unknown why there is a difference between MO and medic-linked encounters. However, we believe this may be due to MOs providing more care to host national personnel who were returned to their own healthcare system, whereas US military casualties treated more often by medics are evacuated to

TABLE 3 *Interventions*

		Medical Officers (n = 418)		Medic (n = 408)		*P* Value
Hemorrhage	Hemostatic agent	22.9%	(96)	21.3%	(87)	.569
	Pressure dressing	28.2%	(118)	38.2%	(156)	.002
	Limb tourniquet	26.5%	(111)	24.5%	(100)	.500
	Junctional tourniquet	0.9%	(4)	0.9%	(4)	1.000
	Wound packing	0.7%	(3)	2.9%	(12)	.018
	Pelvic binder	2.6%	(11)	0.4%	(2)	.021
Airway	Nasopharyngeal airway	2.3%	(10)	3.4%	(14)	.374
	BVM	3.5%	(15)	1.7%	(7)	.129
	Endotracheal intubation	11.7%	(49)	0.4%	(2)	<.001
	Cricothyrotomy	1.4%	(6)	2.9%	(12)	.158
	Supraglottic airway	0.4%	(2)	1.0%	(4)	.446
Breathing	Needle decompression	7.1%	(30)	4.1%	(17)	.061
	Chest seal	14.1%	(59)	12.0%	(49)	.369
	Chest tube	6.4%	(27)	1.2%	(5)	<.001
Circulation	IV fluids	52.6%	(220)	16.4%	(67)	<.001
	Intraosseous access	10.2%	(43)	5.8%	(24)	.020
Disability	Backboard	1.4%	(6)	1.7%	(7)	.786
	Blizzard blanket	25.1%	(105)	4.9%	(20)	<.001
	Cervical collar	14.5%	(61)	2.9%	(12)	<.001
	Hypothermia kit	41.3%	(173)	14.7%	(60)	<.001
	HPMK	21.5%	(90)	4.4%	(18)	<.001
	Ready heat blanket	9.8%	(41)	2.9%	(12)	<.001
	Eye shield	4.0%	(17)	1.4%	(6)	.032
	Extremity splint	22.7%	(95)	12.5%	(51)	<.001

BVM = bag-valve-mask; IV = intravenous; HPMK = Hypothermia Prevention and Management Kit.

TABLE 4 *Frequency of Medication Administration*

Medication	Medical Officers (n = 418)		Medic (n = 408)		*P* Value
Any antibiotic	59.3%	(248)	18.3%	(75)	<.001
Fentanyl (any route)	22.7%	(95)	20.8%	(85)	.509
Hydromorphone	15.0%	(63)	0.7%	(3)	<.001
Ketamine (any route)	22.2%	(93)	21.5%	(88)	.866
Morphine	15.5%	(65)	10.5%	(43)	.032
Tranexamic acid	11.4%	(48)	7.8%	(32)	.077
Any blood product	0.7%	(3)	2.7%	(11)	.031

TABLE 5 *Documentation of Vital Signs*

Vital Sign	Medical Officer (n = 418)		Medic (n = 408)		*P* Value
Heart rate	94.7%	(396)	79.9%	(326)	<.001
Blood pressure	91.8%	(384)	74.5%	(304)	<.001
Respiratory rate	92.5%	(387)	76.9%	(314)	<.001
Pulse oximetry	86.3%	(361)	51.9%	(212)	<.001
AVPU	96.6%	(404)	90.2%	(368)	<.001
GCS	87.3%	(365)	57.1%	(233)	<.001
Pain score	26.7%	(112)	18.6%	(76)	.005

AVPU = alert verbal pain unresponsive; GCS = Glasgow Coma Scale.

a US Role 2 Forward Surgical Team or Role 3 Combat Support Hospital in which data are captured by the DoDTR.

In our study, explosives were encountered in more than 50% of casualties cared for by medics. Explosives, particularly improvised explosive devices (IEDs), have been a common MOI in the Afghanistan and Iraq conflicts.[5,17–21] These IEDs often inflict polytrauma with significant wounds to the extremities. As medics accompany personnel on mounted and dismounted operations in which IEDs generate casualties, medics will often treat these casualties and urgently evacuate them directly to Role 2 and 3 facilities. These factors may explain why we found that medics treated more casualties with explosive MOI, extremity injury, and greater injury severity with comparable survival rates to casualties treated by the MO group. However, since the PHTR does not capture situational or tactical data, we are unable to assess the non-medical and operational effects on these encounters.

Airway obstruction has been previously reported as a leading mechanism of death in battlefield fatalities with potentially survivable injuries.[5] In our study, we found that MOs placed more ETIs, while all other airway interventions were comparable between groups, including cricothyrotomy. The ability to perform direct laryngoscopy is within the scope of practice for an MO and is not routinely taught to medics outside of SOF. Moreover, US Army medics do not typically carry medications to facilitate laryngoscopy. Instead, medics are taught to place a nasopharyngeal airway (NPA) and supraglottic airway (SGA) or perform a cricothyroidotomy. The TCCC guidelines recommend cricothyroidotomy over ETI at the POI because most medics are not trained or equipped for ETI. Additionally, cricothyrotomy does not require rapid sequence induction medications to facilitate the procedure, as does ETI.[22] Similar to our results, multiple published studies of military prehospital airway interventions found that MOs performed most ETIs, while both medics and MO performed cricothyrotomies. These studies reported cricothyrotomy success rates of 82%–92%, but did not delineate success rates by provider level of training.[22–25] Unfortunately, we are unable to report success rates given data set limitations.

There is some reporting of LSIs from the battlefield and Role 1 setting. Lairet et al. identified that out of 2,106 patients evacuated from Role 1 to a higher role of care, providers at the receiving facility identified 360 (17%) missed LSIs, including 56 (3%) airway interventions, 24 (1%) chest procedures, 57 (3%) hemorrhage control interventions (of which six were tourniquets), 160 (8%) vascular access interventions, and 63 (3%) hypothermia prevention opportunities.[26] The two most commonly performed interventions were establishing vascular access and hemorrhage control. Our findings also demonstrate that hemorrhage control and intravenous (IV) access/fluids were the most common therapies instituted by MOs and medics. Gerhardt et al. performed an analysis on LSIs by MOs and medics at the POI and battalion aid station (BAS).[27] Similar to our findings, MOs were associated with more advanced interventions, including 89% of the needle or tube thoracostomies, 100% of the ETIs, and 75% of the surgical cricothyroidotomies. Although MO level of training may explain the greater incidence of complex procedures such as ETI and tube thoracostomy, several of the interventions captured in our study are within the scope of practice of medics and we found that MOs performed more of these LSIs than medics. We suspect this may be partially explained by the MO typically leading a resuscitation team comprised of six to eight medics within the controlled environment of the BAS, while some medics may have been at or near the POI delivering care alone with only their aid bag.

Medication administration and adherence to the TCCC guidelines have been poor over the course of the conflicts in Afghanistan and Iraq.[9,28–32] In this study, MOs had higher rates of antibiotic administration. This is consistent with a previous analysis we performed of DoDTR data that demonstrated of 297 prehospital antibiotic administrations, 73.4% were by an MO, however only six (2.4%) were recommended within TCCC guidelines.[31] MOs also administered morphine and hydromorphone more frequently than medics. Although hydromorphone was unlikely to be issued to medics going out on missions, the same cannot be said of morphine and antibiotics. The lower rates of drug administration among medics may be attributed to working on their own at the POI, in which interventions addressing more immediate life-threats, such as tourniquets and tranexamic acid, take priority.

Many MOs and senior medics in the US Army have attended the Tactical Combat Medical Care (TCMC) Course at Fort Sam Houston, Texas, before deployment. The course is offered by the Health Readiness Center of Excellence and is one week in duration. It focuses on Role 1 care, but there is also discussion on Role 2 care. The course is based on known trauma resuscitation methods, lessons learned from past and current combat environments, and from newly developed technology. Additionally, TCMC teaches MOs and senior medics the injury patterns of combat casualties and the constraints in delivering medical care on the battlefield and in urban environments. While the TCMC course is mostly offered to MOs, it does encourage the MOs to bring their medics for a team approach to patient care. Another source of predeployment training is the Brigade Combat Team Trauma Training (BCT3) Course. This course focuses on Role 1 and Role 2 care. The BCT3 course is offered to maneuver unit medical sections. Typically, the deploying medical team will attend the course together. Both TCMC and BCT3 use current CoTCCC guidelines, the Emergency War Surgery book, and the Joint Trauma System (JTS) clinical practice guidelines (CPGs) throughout their curriculum to ensure that MOs and medics have the most up-to-date medical information to lower the preventable death rate on the battlefield. The JTS CPGs and Emergency War Surgery book differ from what is currently recommended by CoTCCC.

Documentation of medical care in the prehospital setting is a well-known limiting factor for improving battlefield medicine.[9,33–35] We found that documentation rates were significantly higher among casualties treated by MOs than medics. This may be in part due to the extensive emphasis placed on documentation throughout clinical training for physicians and PAs. Moreover, the MOs are likely at the BAS, which is a more well-controlled and safer setting. Medics at the POI may be caring for patients in poorly lit conditions with an emphasis placed on rapid evacuation. Therefore, delays in evacuation for documentation may not be feasible and ex post facto documentation via TCCC AARs may not be well emphasized among unit leadership. Additionally, this may suggest that nonmedical personnel should be trained to support the medics at the POI by documenting at their direction.

While 87% of combat deaths occur in the prehospital setting, efforts to improve prehospital care are limited.[5] Mabry and De Lorenzo outlined major challenges to improving prehospital care.[36] Commanders of maneuver units own the battlespace and by proxy the medical care that is provided. Despite this, the service medical commands maintain control over the training and doctrine associated with prehospital healthcare. Another challenge in improving prehospital combat medicine is the system that assigns MOs to deploying units. It is important that military physicians maintain competency through patient care, which many times requires them to work in a hospital as opposed to performing staff duties with a unit. Additionally, physicians that have limited understanding of their medics' abilities and scope of practice may impede adherence to TCCC guidelines.[28–32,37–39] In a recent study, 41% of medical providers had not completed TCCC training.[40] The military would benefit from more physicians with an operational medicine focus and subject matter expertise in battlefield medicine.[35,36,41] Our study demonstrates that physicians were frequently involved in the chain of care for casualties in forward staged areas, further supporting the need for them to be appropriately trained (e.g., a military specific curriculum during graduate and post-graduate training).

Within the US Army, combat medics have constantly changed guidelines and tasks lists. The current version, the Individual Critical Task Lists (ICTLs), is not always well aligned with the TCCC guidelines. The variations between ICTLs and TCCC may cause confusion for the medic providing care at the POI. The ICTLs must be tested annually, which is likely more often than TCCC. In addition to ICTLs, combat medics use the Soldier's Manual and Trainer's Guide (STP 8-68W13-SM-TG), which outlines the required tasks that must be trained on quarterly to annually, for skill levels ranging from 10-30. While the STP is not all-inclusive of the training needed to make a combat medic more effective during battlefield medicine and while conducting DNBI treatment, it does provide a foundation. When noncommissioned officers (NCOs) conduct the training needed to assess the level of proficiency of their medics, they use the STP and ICTLs. However, the problem that arises is that the STP and ICTLs do not always align with the most current CoTCCC guidelines. The STP is published by the Army's Publishing Directorate and can take a long time to be updated. The Army is currently in the process of moving many of the STPs, Training Circulars (TCs), and ICTLs to the Central Army's Registry (CAR) for ease of access and updating. More recently, ICTLs were created for MOs. However, unlike the ICTLs for medics, which have steps or checklists, the ICTLs for MOs are expectations of the skills they should possess. This constant flux is a source of frustration for those who have to perpetually modify their training to meet the goals of an unknown body. To further complicate the situation, this analysis of medic requirements only applies to the US Army. The other components also have requirements and to provide an analysis of each is beyond the scope of this report.

In 2011, the Defense Health Board made the recommendation for TCCC training for deploying personnel.[42] Later, this would become a mandate for all deploying personnel to the US Central Command area of operations.[43] At the time of this study, TCCC training is conducted during the intern year. However, as outlined in Gurney et al., only 46% of the units mandated TCCC training.[40] Furthermore, the study noted that providers' confidence in their medics was associated with medics successfully completing TCCC training.[40] In 2018, the Department of Defense (DoD) published DoDI 1322.24, which mandated that all service members and DoD expeditionary civilian personnel receive standardized TCCC training and maintain proficiency in providing first responder care.[44] Though each service retained the ability to increase the medical readiness training requirement based off of anticipated mission requirements, it remains unclear to what extent this was implemented.

This is a convoluted area of military medicine. Even with TCCC as the standard for Role 1 care, the training is varied across services, by level of training, and within the different levels of training. For instance, in the US Army, if TCMC and BCT3 are using materials and guidelines from Role 2 and 3, it is difficult to establish the benefit and usefulness of TCCC and MOs in the far forward setting. At a minimum, if TCCC is the standard for Role 1 care, then courses should teach to that standard. Moreover, it is challenging to note whether outcomes truly varied beyond that of mortality. Many interventions, such as wound prophylaxis for open fractures, are unlikely to have a mortality benefit and rather the benefit would likely come by way of long-term reduced complications. Most importantly, we must reiterate the inherent bias of the registries. The DoDTR only captures casualties that survived long enough to make it to a facility with surgical capabilities. Thus, the DoDTR would not capture casualties that died in the prehospital setting, which likely represents the casualties that could have benefited from medical personnel with more advanced levels of care. Specific to the PHTR, data capture for this registry is based on completion of TCCC cards or TCCC AARs. Previous studies show abysmally low completion rates and are inherently evident by the totality of only 1,357 casualties captured throughout nearly 16 years of war.[9,45] Given this, we cannot state that there are no differences in outcomes since we do not have adequate data capture, nor do we have sufficient sample size. As such, we can only demonstrate that MOs play a major role in combat casualty care and thus their training needs to reflect this reality.

Limitations of this study include that it is observational and retrospective; therefore, we can only demonstrate correlation and not causation. Prehospital documentation is often limited or missing, therefore the accuracy of the reporting may be of concern.[9] Another limitation which may impact our findings is the time until evacuation to a higher echelon of care or if evacuation even occurred. The less severely wounded may be treated at the BAS and then returned to duty (RTD). It is possible that the MOs provided care and interventions to casualties with minor wounds that were RTD, whereas the medics' patients required a higher role of care. In addition, urgent surgical evacuations bypassed the Role 1 BAS and went straight to a Role 2 or 3 facility with surgical capability. In this study, we also do not know the indications for which interventions were performed. It is possible that patients underwent interventions that were not indicated. Conversely, we do not have data of when a procedure was indicated but was not performed. It is also possible that medics collocated with MOs at the BAS and performed some of the interventions credited to MOs. Furthermore, it is also possible that medics at the POI performed an intervention, evacuated a casualty to the BAS in which an MO was located, and credit for the intervention was given to the MO. In other words, we must clearly state that we only know who was involved in the registry data chain of care. We do not delineate the training level of the specific individual and we do not have clear evidence of who performed each procedure despite our need for categorization. Although our study design required that we categorize each encounter, the registry data does not delineate the training level of the individual (MO or medic) who performed specific portions of the trauma casualty's prehospital care.

Conclusion

More than half of casualty encounters in this study listed an MO as a prehospital battlefield care provider. The percentage of interventions performed differed between MO and medic encounters, which may highlight differences in provider skills, training, and equipment, or that interventions were dictated by differences in mechanisms of injury. Future efforts to align guidelines and recommendations across the military roles of care may offer a more standardized solution for the Role 1 setting.

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Disclaimer
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Disclosures
We have no conflicts to disclose.

Ethics
The USAISR regulatory office reviewed protocol H-19-018 and determined it was exempt from IRB oversight. We obtained only deidentified data. We executed data sharing agreement 19-2186 prior to data transfer.

Author Contributions
ADF, SGS, JFN, and MDA performed data collection, data analysis, data interpretation. SGS, ADF, JFN, MDA, DT, and RSK prepared the manuscript with critical input.

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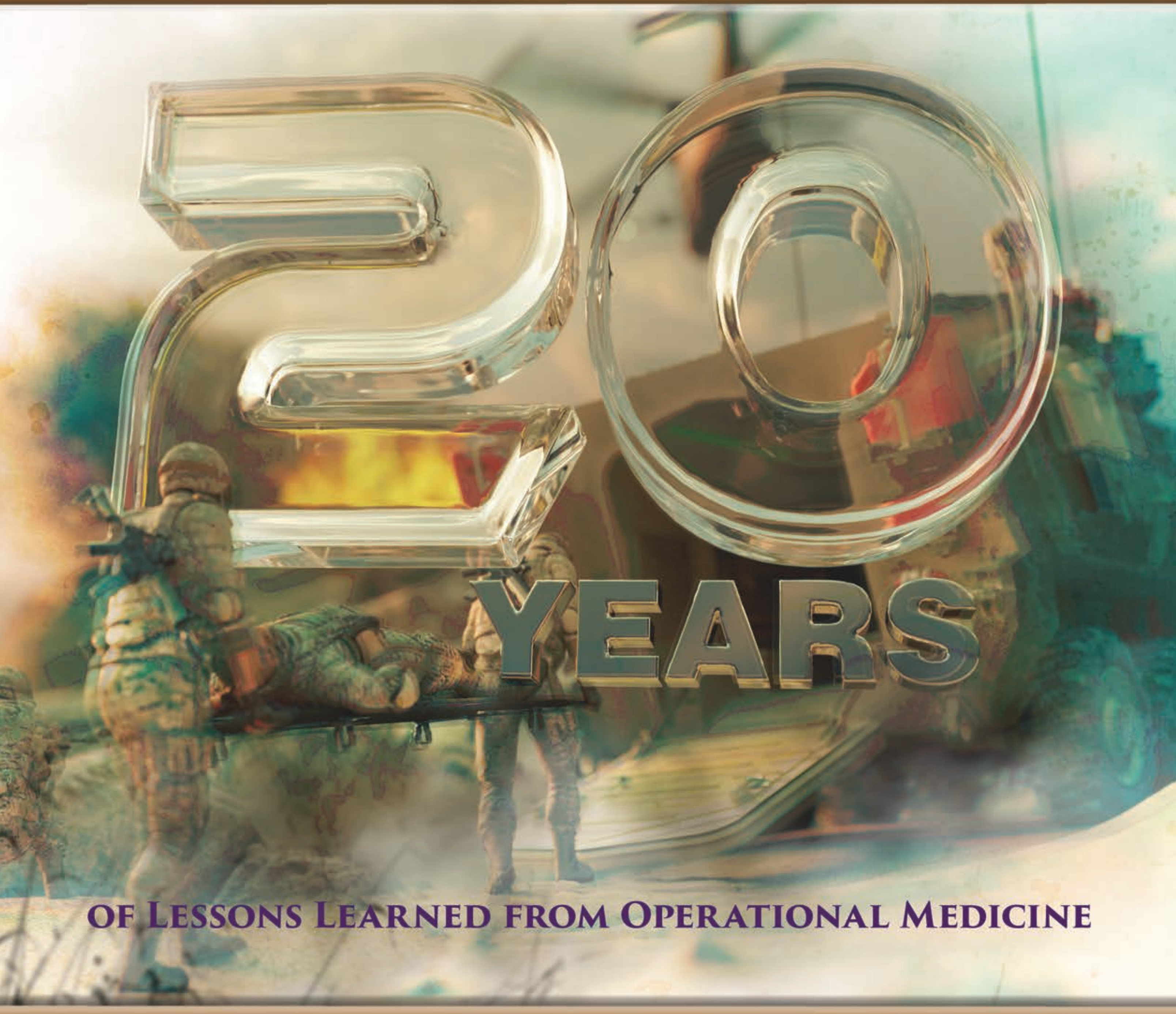

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