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REPORT

Medical Risk in the Future Force Unit of Action

Results of the Army Medical Department Transformation Workshop IV

David E. Johnson, Gary Cecchine

Prepared for the United States Army

RAND ARROYO CENTER and RAND HEALTH

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Preface

This report documents the Army Medical Department's (AMEDD) continuing process of identifying medical issues in the Army's transformation to the Future Force. It contains an assessment of the AMEDD Transformation Workshop IV, conducted at the RAND Corporation Washington office on 10–13 February 2004. The report describes the organization of the workshop, objectives and issues, the scenario used, and the analysis methodology employed. Finally, the report provides observations and conclusions. The methodology employed and the results should be of general interest for medical force planners, both within the Army and across the Department of Defense.

The Commanding General, U.S. Army Medical Department Center and School, sponsored this work, which was conducted jointly by RAND Arroyo Center's Manpower and Training Program and RAND Health's Center for Military Health Policy Research. RAND Arroyo Center, part of the RAND Corporation, is a federally funded research and development center sponsored by the United States Army. Comments and inquiries should be addressed to the authors.

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Summary

This report documents the Army Medical Department's (AMEDD) process of identifying and addressing medical issues related to the Army's transformation to the Future Force. It describes the AMEDD Transformation Workshop (ATW) IV, conducted at the RAND Corporation Washington office on 10–13 February 2004, and includes an analysis and discussion of the workshop results. The purpose of this workshop was to continue the assessment, begun in ATWs I–III, of the medical risks associated with emerging Army operational concepts and the capacity of the AMEDD to mitigate these risks. The principal focus of ATW IV, however, was to begin the process of establishing data on the casualty demand that must be addressed by echelons above the Unit of Action (UA) Health Service Support (HSS) system. Thus, the principal purpose of ATW IV was to provide analytical support to the AMEDD to assist it in designing the HSS system above the UA level.

Background

The Army's transformation to the Future Force not only posits dramatically different equipment, it also envisions radically new ways of fighting. One aspect of future Army operations that is of particular importance is the employment of widely dispersed units moving rapidly around the battlefield. These operational concepts potentially pose significant challenges for the units that support the combat elements. In 1998, the AMEDD began an analytical effort to gain insight into the challenges for HSS posed by emerging Army transformation concepts. Over the next few years, AMEDD conducted two games and several workshops to provide further insight into how it could best support the Army as it transformed.

AMEDD Transformation Workshop IV

In collaboration with the Center for AMEDD Strategic Studies, RAND designed, organized, facilitated, and provided analytic support to the fourth in a series of ATWs, conducted on 10–13 February 2004. The workshop was supported by two teams (A and B) of subject matter experts (SMEs), who examined the ability of an envisioned UA HSS structure to support Future Force combat operations. The AMEDD Center and School provided casualty data, which was derived from JANUS simulation results provided by the U.S. Army Training and Doctrine Command (TRADOC) Analysis Center (TRAC). In the scenario that supported the simulation, a Future Combat Systems (FCS)-equipped Maneuver UA was engaged in twelve hours of combat operations against a brigade-equivalent threat force. The dimensions of the engagement area were as large as 75 by 85 kilometers.

The results of this UA-level simulation were the most current available for ATW IV. How representative they are of what might occur in future operations is unknown, and this argues that the Army should conduct more simulations across different scenarios to validate and expand the utility of these outcomes for its force structuring and concept development efforts.

At the conclusion of the workshop, each SME team was asked to answer the following questions:

- What was the disposition of casualties (casualty outcomes) at the end of the scenario?
- What was the status of the HSS system at the end of the scenario?
- How many casualties require further evacuation and treatment at echelons above the UA?

ATW IV teams also focused on three principal issues:

- Where do first responders and combat medics fit in the overall future concept for combat casualty care, and what treatment capabilities (treatment technologies and skills) will medics require to support this concept?
- What theater military medical infrastructure is necessary to support future military medical operations across the spectrum of operations?
- What are the evacuation requirements to support military operations across the spectrum of operations?

Additionally, the teams assessed the implications of two further issues:

- What are the AMEDD's platform (ground and aerial evacuation and treatment systems) requirements to support the transformed force, and on which of these platforms will telemedicine (and other technologies, e.g., en route care) be advantageous?
- What technologies would significantly improve force health protection (how much are they worth at the margin)?

Workshop Results

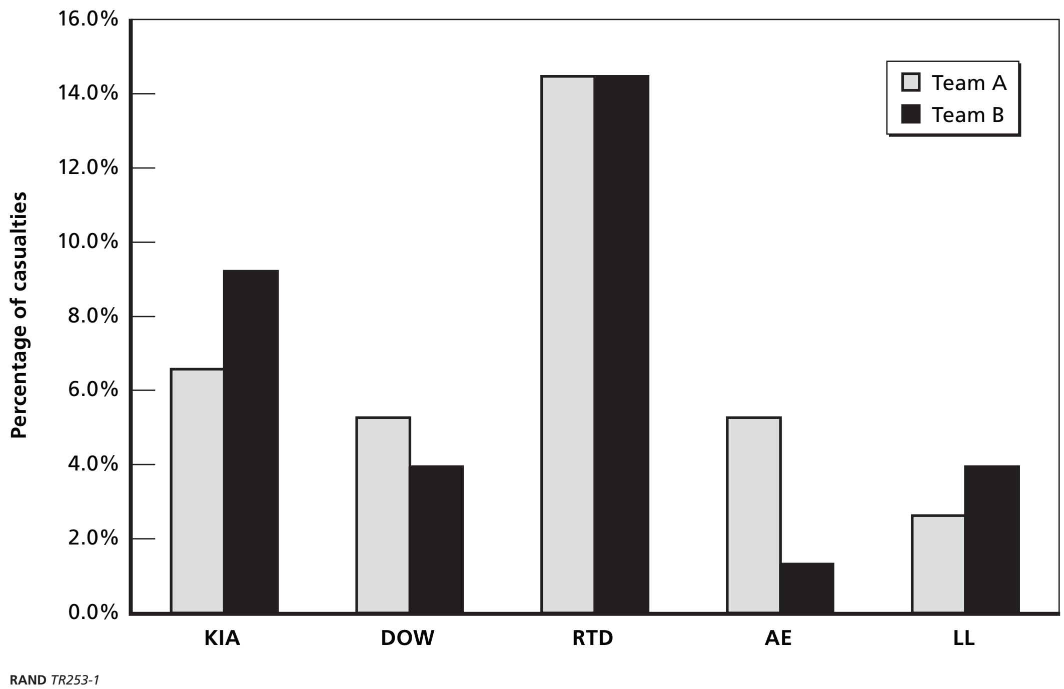
Response to Workshop Questions

Question 1: What was the disposition of casualties (casualty outcomes) at the end of the scenario?[1]

The scenario resulted in 76 wounded-in-action (WIA) casualties during the approximately 12-hour battle. The estimates by the two workshop teams of casualty outcomes at the end of the 12-hour scenario are depicted in Figure S.1.

[1] It is important to note that only U.S. casualties were considered in this workshop. The scenario did not provide any data on civilian or enemy prisoner of war casualties, which would have increased the demand on the HSS system, both within the UA and at echelons above the UA.

Figure S.1
Casualty Outcomes as Determined by Both Workshop Teams at H+12 Hours



NOTE: KIA = Killed in Action, DOW = Died of Wounds, RTD = Return to Duty, AE = Awaiting Evacuation within the UA, LL = Limb Loss.

It is important to note that the results shown in Figure S.1 do not indicate the final disposition of those casualties who are awaiting treatment or being held following treatment (e.g., for evacuation) at H+12. In the time beyond H+12, the percentage of Died of Wounds (DOW) casualties will either remain the same or increase. Casualties are considered to be DOW if they die after reaching a medical treatment facility (MTF); those who die before then are referred to as Killed in Action (KIA).

It is difficult to determine the final disposition of casualties because the capabilities of a future echelons-above-UA HSS system have yet to be determined. Specifically, it was assumed that casualties requiring evacuation from the UA medical company/forward surgical team (FST) were evacuated immediately upon that determination (casualties who had not yet arrived at the medical company/FST by the end of the simulation are classified as awaiting evacuation within the UA).[2] In essence, this approach postulates an echelons-above-UA HSS system with infinite capacity. This assumption served both to support the goal of determining medical demand on echelons above the UA and also to unencumber UA assets. Had this assumption not been made, the medical company/FST would have quickly become overwhelmed, and determining demand for higher echelons would not have been possible. For this reason, the casualty outcomes in Figure S.1 represent only those casualties of the total population of 76 for whom an outcome is definitive. In other words, approximately two-

[2] Technically, soldiers wounded or killed are known as casualties. They are referred to as patients once they have entered the medical system above the level of first responder (e.g., combat medic) care. For simplicity, we use the term casualty throughout this report.

thirds of the casualties had been determined to be ready for Unit of Employment (UE) evacuation. Their disposition will necessarily depend upon medical capabilities at echelons above the UA. Furthermore, all the casualties who are not returned to duty within the UA will eventually have to be cleared by a higher-echelon HSS system. ATW V will continue this line of analysis by assessing the results of a UE-level engagement and its resulting casualties.

Question 2: What was the status of the HSS system at the end of the scenario?

Earlier workshops in this series (ATWs I–III) focused on the capacity of an HSS system and included some assets not available in the current UA (e.g., combat support hospital (CSH)). This workshop was primarily designed to determine the medical demand on echelons above the UA for the workshop scenario; as discussed above, casualties requiring UE evacuation and treatment were assumed to receive it almost instantly. It is therefore difficult to determine the total demand on the UA because the actual backlog on the UA is dependent upon definite higher-echelon capabilities. It is, however, possible to describe the utilization of UA medical assets based on the UA HSS plan and doctrine. For example, an FST is doctrinally intended to stabilize patients for evacuation (the number of patients requiring such resuscitative surgery is generally low: 10 to 15 percent). Workshop teams were able to determine FST surgical requirements based on the nature of the casualties in the scenario. As the battle progressed, the number of needed surgeries increased. One team estimated that it exceeded its surgical capacity within approximately three hours and recovery cot capacity in approximately six hours.

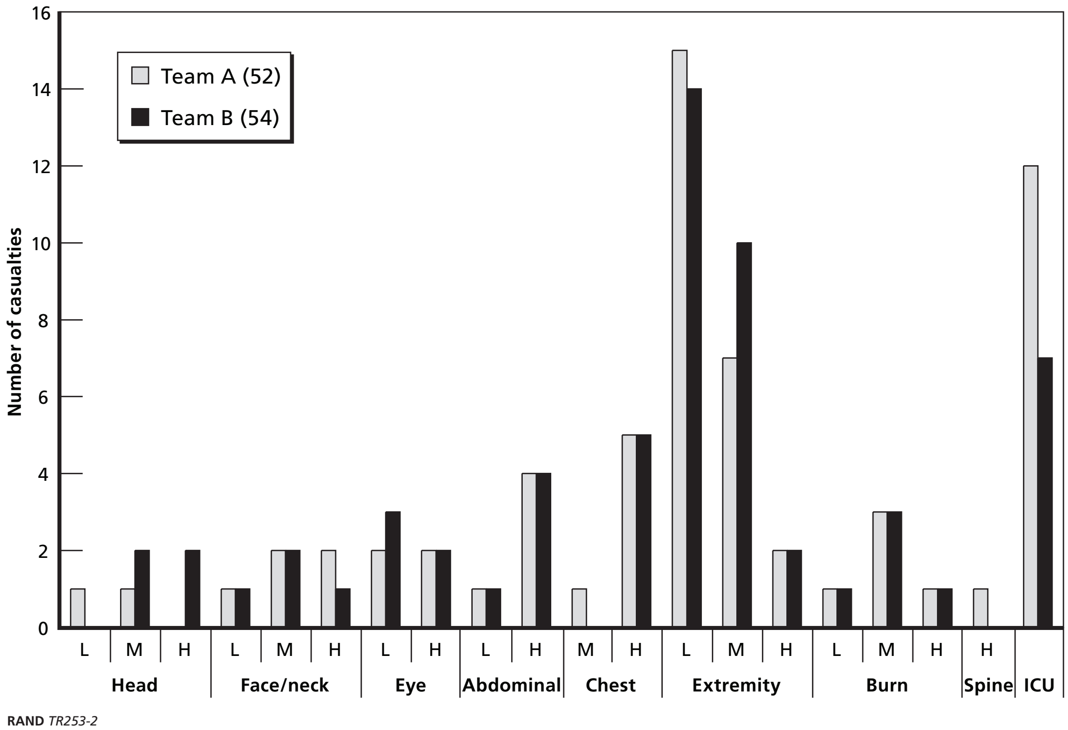
In addition to surgical and post operative capabilities, evacuation assets were generally committed to near their maximum capacity throughout the scenario. The combined mean time from wounding to surgery for both teams was 171 minutes (standard error 16.2, median 164 minutes). The mean times of the individual teams were not significantly different.

The period of time following injury within which a significant number of serious trauma casualties will die without surgical intervention is often referred to as the "golden hour." In this scenario, delay time exceeded an hour in every case (14 and 15 FST surgeries for Teams A and B, respectively), with delay times from wounding to surgery ranging from 69 to 413 minutes. Finally, it is unclear whether additional casualties could have received treatment at the FST but were instead flagged for UE evacuation; the disposition of these casualties is unclear without knowledge of medical capabilities at echelons above the UA. In any event, UA surgical demand was already significant and probably would not have been able to accommodate this additional but unknown demand.

Question 3: How many casualties require further evacuation and treatment at echelons above the UA?

As already noted, a significant objective of this workshop was to estimate the medical demand that would need to be met by echelons above the UA for this scenario. Both teams estimated similar residual demands following casualty evacuation and treatment in the UA; for example, both performed a similar number of surgeries (14 and 15) at the FST, indicating similar decisions about which casualties should be treated in the UA versus higher echelons. Data from both teams was used to estimate the number, type, and severity of casualties requiring evacuation to, and treatment at, higher echelons and is shown in Figure S.2.

Figure S.2
Casualties Requiring Evacuation and Treatment by the UE



NOTE: L = low, M = moderate, H = high wound severity. Team A estimated that 2 chest (H) casualties also have significant abdominal injury; both teams estimated that 2 face/neck (M) casualties also require treatment for significant eye injury. ICU patients are not exclusive of the other categories.

Issue Resolution

Issue 1: Where do first responders and combat medics fit in the overall future concept for combat casualty care, and what treatment capabilities (treatment technologies, level of supply, and skills) will medics require to support this concept?

The assumed proficiency of first responders,[3] especially of combat lifesavers (CLS), and the availability of advanced technologies to control bleeding were judged to be absolutely essential. The reliance on CLS and advanced technologies was intended to address the principal characteristics of the Future Force concept that make HSS challenging: dispersed unit operations. These characteristics resulted in a significant time lapse between injury and care by a medic, if the medic was not collocated with the casualty at the time of wounding. This time lag is especially problematic for bleeding casualties who must be treated quickly. Some SMEs, however, were skeptical that such an advanced level of CLS proficiency could be achieved and maintained.

Issue 2: What theater military medical infrastructure is necessary to support future military medical operations across the spectrum of operations?

[3] First responder care includes self- and buddy-aid, combat lifesavers, and combat medics.

This workshop focused on establishing the UA casualty demand that would have to be addressed by the echelons-above-UA HSS system. Casualties were treated within the bounds of UA capabilities, and those who did not return to duty became a component of the demand for an above-UA HSS system. The estimates of demand resulting from this workshop will be useful in determining theater medical infrastructure requirements.

As in ATWs I–III, each team indicated that perfect situational awareness—based on advanced communications technologies—was a key capability because it enabled optimal allocation of medical assets. That is, knowing the location and severity of casualties in real time would allow for remote triage, resulting in the precise and appropriate allocation of both evacuation and treatment assets.

Issue 3: What are the evacuation requirements to support military operations across the spectrum of operations?

Wide unit dispersion made air evacuation essential to facilitate an efficient, timely casualty evacuation. To this end, each team used air evacuation at or near full capacity.

Issue 4: What are the AMEDD's platform (ground and aerial evacuation and treatment) requirements to support the transformed force, and on which of these platforms will telemedicine (and other technologies, e.g., en route care) be advantageous?

As with issue 3 above, air evacuation platforms were critical in the effort to clear the battlefield of a widely dispersed UA engaged in rapid operations. These assets became increasingly important as the distance between point of wounding and the UA medical company/FST increased over the course of the engagement.

Issue 5: What technologies would significantly improve force health protection (how much are they worth at the margin)?

Although the impact of the medical technologies employed in the workshop was not addressed as an independent variable, team members noted that the Warfighter Physiological Status Monitor (WPSM) and advanced hemostatic agents were particularly valuable in combat casualty care. The WPSM provided casualty location and the capability for remote triage to support the regulation of heavily taxed medical assets across a dispersed battlespace. The advanced hemostatic agents, often administered by combat lifesavers, extended the time available to evacuate casualties to the required level of care. Without these two technologies, casualties' outcomes would have been worse.

Acknowledgments

We gratefully acknowledge the assistance of all the participants in the workshop for their contributions to its success. We also are indebted to the RAND researchers who served as facilitators and analysts during the workshop: John Bondanella, Richard Darilek, Eric Landree, Martin Libicki, Terri Tanielian, and Anny Wong. Thanks also to Anita Duncan for her efforts in coordinating the administrative matters for the workshop. We also want to express our appreciation to the RAND support staff, whose efforts once more enabled a smoothly functioning workshop.

Finally, we want to thank our reviewers, Frank Camm and John Gordon. Their thoughtful comments and suggestions made this report better.

Acronyms

AE	Awaiting Evacuation
AFV	Armored Fighting Vehicle
AMEDD	Army Medical Department
ANOVA	Analysis of Variance
AO	Area of Operations
ATW	AMEDD Transformation Workshop
BMIST	Battlefield Medical Information System Telemedicine
C4I	Command, Control, Communications, Computers, and Intelligence
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CAB	Combined Arms Battalion
CLS	Combat Lifesaver
CSH	Combat Support Hospital
DEPMEDS	Deployable Medical Systems
DNBI	Disease and Non-battle Injuries
DOW	Died of Wounds
EMT	Emergency Medical Treatment
FCS	Future Combat Systems
FDDMTF	Forward-Deployable Digital Medical Treatment Facility
FPOL	Forward Passage of Lines
FSB	Forward Support Battalion
FST	Forward Surgical Team
H+12	H Hour + twelve hours
HSS	Health Service Support
ICU	Intensive Care Unit
IT/IM	Information Technology/Information Management

KIA	Killed in Action
LL	Limb Loss
MANPADS	Man-portable Air Defense System
MCO	Major Combat Operation
MEDEVAC	Medical Evacuation
MRMC	[U.S. Army] Medical Research and Materiel Command
MSR	Main Supply Route
MV-T, MV-E	Medical Vehicle–Treatment, Medical Vehicle–Evacuation
NAI	Named Area of Interest
RTD	Return to Duty
SASO	Stability and Support Operation
SMART MC3T	Special Medical Augmentation Response Team for Medical Command, Control, Communications, and Telemedicine
SME	Subject Matter Expert
SSC	Smaller-scale Contingency
TALSS	Transportable Automated Life Support System
TRAC	[U.S. Army] Training and Doctrine Command (TRADOC) Analysis Center
TRADOC	[U.S. Army] Training and Doctrine Command
UA	Unit of Action
UE	Unit of Employment
WIA	Wounded in Action
WIN-POC	Warfighter Information Network—Proof of Concept
WPSM	Warfighter Physiological Status Monitor

CHAPTER ONE

Introduction and Background

This report documents the Army Medical Department's (AMEDD) process of identifying and addressing medical issues related to the Army's transformation to the Future Force. It describes the AMEDD Transformation Workshop (ATW) IV, conducted at the RAND Corporation Washington office on 10–13 February 2004, and it includes an analysis and discussion of the workshop results.

The purpose of this workshop was to continue the assessment, begun in ATWs I–III, of the medical risks associated with emerging Army operational concepts and the capacity of the AMEDD to mitigate these risks. Medical risk, as used in this report, is defined generally as the number, severity, and fate of U.S. Army casualties incurred during combat operations.[1] The principal focus of ATW IV, however, was to begin the process of establishing data on casualty demands that must be addressed by an echelon above Unit of Action (UA) Health Service Support (HSS) system. Thus, the principal purpose of ATW IV was to provide analytical support to the AMEDD to assist it in designing the HSS system above the UA level.

ATW IV built on the work of the baselining ATWs I–III and used a similar methodology.[2] The objective for ATW IV was to examine postulated UA capabilities to provide combat casualty care during an operation. As with ATWs I–III, each casualty was individually tracked through the HSS system. In ATW IV, however, casualties were not tracked outside the UA. They were treated within the UA and either returned to duty or became a demand on an echelons-above-UA HSS system. Aside from assessing the performance of the UA HSS system, a principal focus of ATW IV was on determining the residual UA medical demand that would be the responsibility of an echelons-above-UA HSS system to meet. The results of this process will lead to identification of the gaps between Army and AMEDD concepts and capabilities at the UA level. They will also provide an analytical basis for designing echelons-above-UA HSS systems.

Background of AMEDD Transformation Efforts

The Army's transformation to the Future Force not only posits dramatically different equipment, it also envisions radically new ways of fighting. One aspect of future Army opera-

[1] Technically, soldiers wounded or killed are known as casualties. They are referred to as patients once they have entered the medical system above the level of first responder (e.g., combat medic) care. For simplicity, we use the term casualty throughout this report.

[2] Johnson and Cecchine (2004).

tions that is of particular importance is the employment of widely dispersed units moving rapidly around the battlefield. These operational concepts potentially pose significant challenges for the units that support the combat elements. In 1998, the AMEDD began an analytical effort to gain insight into the challenges for HSS posed by emerging Army transformation concepts. Over the next few years, AMEDD conducted two games and several workshops to provide further insight into how it could best support the Army as it transformed.

The RAND Corporation has been involved with the AMEDD transformation efforts since 1998, providing analytical support to the games and workshops and an assessment of the issues they yielded. In 2002, the AMEDD Center and School asked the RAND Corporation to develop an analytic process and to conduct workshops to support the assessment of the ability of envisioned HSS concepts to support Army Future Force operations. The first series of workshops, ATWs I–III, focused on determining medical risk within a UA. The second series, ATWs IV–V, will begin the process of assessing the casualty demand that an echelons-above-UA HSS system will have to address. Thus, these workshops will provide analytical support to AMEDD efforts to design the HSS system above the UA.[3]

Organization of This Report

This report is organized into four main chapters. Following this brief introductory chapter, Chapter Two describes the workshop design, including its organization, objectives, and methodology. Chapter Three presents the results of the workshop deliberations with respect to the status of the HSS system within the UA at the end of the scenario and the medical demand that would be placed on echelons above the UA. Chapter Four provides our overall observations and conclusions based on the results of ATW IV. The report also includes six appendixes, including a list of workshop participants, their roles, a detailed narrative of the scenario utilized, a description of medical technologies employed, an excerpt from the casualty tracking worksheet used in the workshop, and an example of a trauma registry form used in the workshop.

[3] The background and results of the first three workshops (ATWs I–III) are documented in Johnson and Cecchine (2004).

CHAPTER TWO

AMEDD Transformation Workshop IV Design

This chapter provides an overview of the AMEDD Transformation Workshop IV design, including the structure, scenario, sequence of events, objectives, and methodology. In collaboration with the Center for AMEDD Strategic Studies, RAND designed, organized, facilitated, and provided analytical support to the workshops.[1] Participants included subject matter experts (SMEs) from the AMEDD, the U.S. Army Training and Doctrine Command (TRADOC), and the TRADOC Analysis Center (TRAC). The purpose of the workshop was to

- Identify gaps between AMEDD future force HSS concepts and combat casualty care requirements generated from a TRADOC-sponsored UA-level simulation.
- Isolate potential solutions and alternatives for further analysis.
- Provide AMEDD with analytical support for future programmatic decisions.
- Assess medical risks and their mitigation potential.

Organization

At the heart of the workshop organization (see Figure 2.1) were two teams (A and B) of SMEs. Both teams examined the same problem as a check on the methodology, i.e., consistent results between the two teams would validate the methodological approach. Each team was designed to function as a seminar and was supported by a RAND facilitator and data collector.[2] A control/administrative support cell provided overall workshop direction. Finally, the RAND project leaders, facilitators, analysts, workshop designers, and data collectors formed a post-workshop team to conduct analysis of the workshop results.

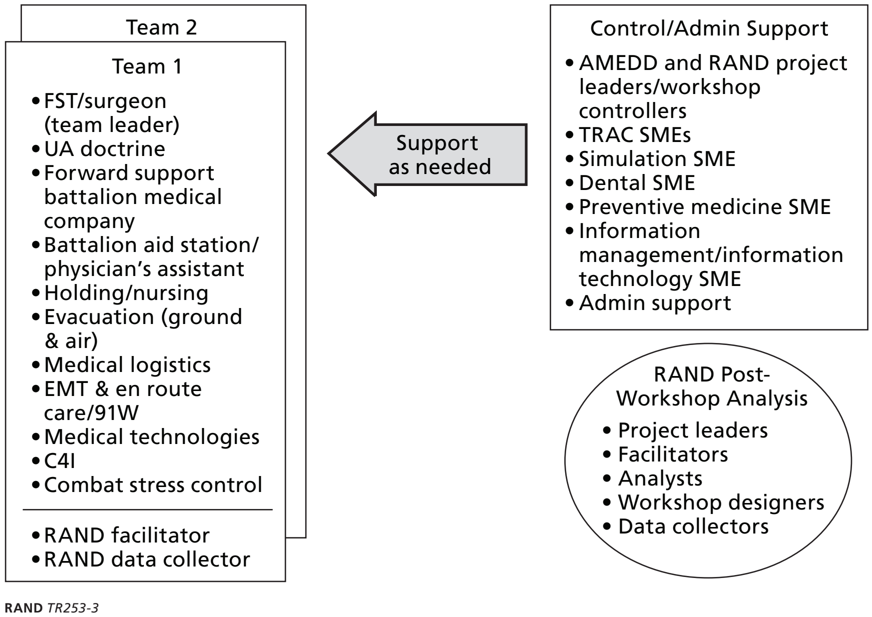
Workshop Teams

The two workshop teams each contained SMEs selected by the AMEDD. Their areas of expertise spanned the functional areas critical to an informed examination of a scenario focused on combat casualty care issues. These areas included Forward Surgical Team (FST) operations and trauma surgery; UA maneuver doctrine; forward support battalion medical com-

[1] The ATWs were designed as a modified version of the RAND "Day After" gaming methodology. Their goal was to present a structured problem to a team of experts to resolve by employing AMEDD's proposed future operational concepts and resources. For a description of the "Day After" methodology, see R.H. Anderson and A.C. Hearn (1996).

[2] A seminar is defined in the *Oxford Desk Dictionary* as a "conference of specialists." This was as intended by the designers of the workshops, in contrast to the normal TRADOC gaming methodology of having participants serve as role players.

Figure 2.1
AMEDD Transformation Workshop Structure



pany operations; battalion aid station and physician's assistant operations; medical holding and nursing; air and ground evacuation; medical logistics; emergency medical treatment, en route care, and combat medics (91W); medical technologies; C4I; and combat stress control. The teams deliberated to reach a consensus on how best to address the combat casualty care demands presented by the scenario and to resolve the issues posed for the workshop. The scenario used in the workshop was provided by TRAC and is discussed later in this report. Each team was headed by an AMEDD trauma physician and facilitated by a senior RAND analyst. Two RAND analysts also supported each team as data collectors. (See Appendix A for a list of ATW IV participants and Appendix B for the responsibilities of the participants.)

Control/Administrative Support Cell

The control/administrative support cell was the locus for workshop direction and other subject matter expertise. Specifically, it had representatives from TRAC and AMEDD. Furthermore, SMEs in dental, preventive medicine, and information management/information technologies were located in the control cell. During the game, however, the majority of the SMEs worked with one of the two teams.

Workshop Objectives and Issues

Objectives

ATW IV built on the work of the baselining ATWs I–III and used a similar methodology.[3] The objective for ATW IV was to examine postulated UA capabilities to provide combat

[3] Johnson and Cecchine (2004).

casualty care during an operation. As with ATWs I–III, each casualty was individually tracked through the HSS system. In ATW IV, however, casualties did not move outside the UA. They were treated within the UA and either returned to duty or became a demand on an echelons-above-UA HSS system. Aside from assessing the performance of the UA HSS system, a principal focus of ATW IV was on determining the residual UA medical demand that would be the responsibility of an echelons-above-UA HSS system to address. The results of this process were expected to lead to the identification of gaps between Army and AMEDD concepts and capabilities at the UA level, as well as provide an analytical basis for designing echelons-above-UA HSS systems.

ATW IV used the results of a TRADOC Future Force UA simulation, and casualty data derived from that simulation by the AMEDD, to assess the adequacy of a postulated AMEDD HSS system designed to support the Future Force. HSS individuals, organizations, and capabilities were assumed throughout the workshop to operate optimally, i.e., they were assumed to always perform to standard and were not degraded by combat action or other means. In short, an objective of ATW IV was to assess the ability of the postulated Future Force HSS systems, performing in "best case" modes, to support a Future Force operation.

Workshop Questions and Issues

At the conclusion of the workshop, each team was asked to provide answers to the following questions:

- What was the disposition of casualties (casualty outcomes) at the end of the scenario?
- What was the status of the HSS system at the end of the scenario?
- How many casualties require further evacuation and treatment at echelons above the UA?

ATW IV teams also focused on three principal issues, identified by AMEDD and based in part on prior RAND research:

- Where do first responders and combat medics fit in the overall future concept for combat casualty care, and what treatment capabilities (treatment technologies and skills) will medics require to support this concept?
- What theater military medical infrastructure is necessary to support future military medical operations across the spectrum of operations?
- What are the evacuation requirements to support military operations across the spectrum of operations?

Additionally, the teams assessed the implications of two further issues:

- What are the AMEDD's platform (ground and aerial evacuation and treatment systems) requirements to support the transformed force, and on which of these platforms will telemedicine (and other technologies, e.g., en route care) be advantageous?
- What technologies would significantly improve force health protection (how much are they worth at the margin)?

Scenario

ATW IV used the results from a TRADOC Standard Operational Scenario (Caspian 2.0 scenario). A detailed description of the scenario is in Appendix C. In this scenario, a smaller-scale contingency (SSC) situation required a strategic response to a distant immature theater. Coalition forces executed a stability and support operation (SASO) that escalated to a high-end SSC operation in which major combat operations (MCOs) were conducted. Upon the failure of deterrence of hostilities, the coalition intervened to restore a friendly government overthrown by a rebellious majority of its military.

In this scenario, Army future forces conducted operations as part of the main effort of the coalition force counteroffensive: decisive operations after a month-plus force build-up in theater. Army ground forces conducted operational maneuver, executing distributed and continuous operations both in open and rolling terrain and in urban and other complex terrain.

The tactical-level simulation that provided the basis for ATW IV depicted a Future Combat Systems (FCS)-equipped Maneuver UA conducting an attack against a brigade-equivalent threat force. The engagement occurred in an area as large as approximately 75 by 85 kilometers. At the operational level, the Unit of Employment (UE) was engaged in a physical battlespace of over 500 kilometers by 225 kilometers.

The results of this UA-level simulation were the most current available for ATW IV. How representative they are of what might occur in future operations is unknown, which argues that the Army should conduct more simulations across different scenarios to validate and expand the utility of these outcomes for its force structuring and concept development efforts.

To support operations, each UA had the following HSS system resources:[4]

- Combined Arms Platoon: 1 combat medic
- Combined Arms Battalion: 1 medical platoon with
  - Treatment squad with 2 FCS medical vehicle—treatment (MV-T)
  - Evacuation section with 5 FCS medical vehicle—evacuation (MV-E) (one initially positioned forward with each maneuver company in the battalion)
- Forward Support Battalion: 1 medical company with
  - Treatment platoon with 3 MV-T
  - Evacuation Platoon with 4 MV-E (one initially positioned forward with each combined arms battalion) and 4 FTTS-U ambulances
  - Patient hold squad with the capability to hold up to 20 patients for 72 hours
  - Attached forward surgical team capable of performing 30 resuscitative surgeries in 72 hours without resupply
  - Attached forward support MEDEVAC team with 3 HH-60L

Throughout the workshop, certain rules pertained to ensure the optimization of the envisioned HSS system. Specifically, none of the medical assets were degraded during the

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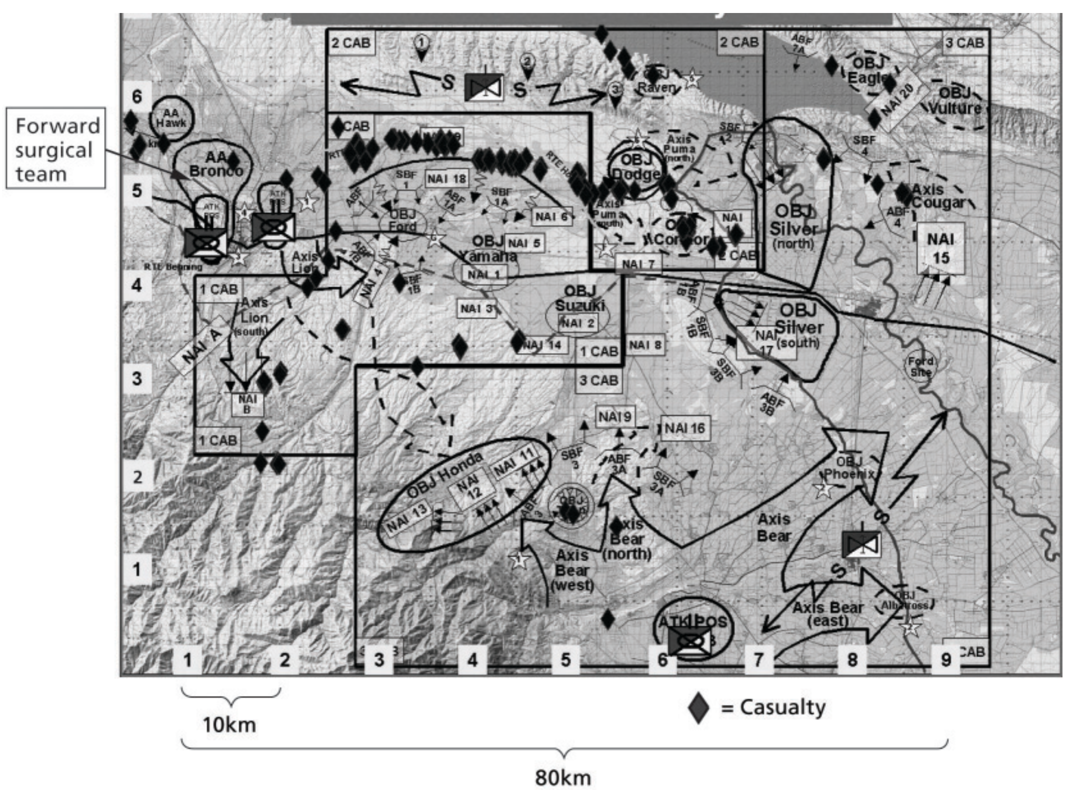
[4] U.S. Army Armor Center, "The United States Army Objective Force Operational and Organization Plan, Unit of Action, Change 1 to TRADOC Pamphlet 525-3-90 O&O," 25 November 2002.

operation, e.g., no medics became casualties, no helicopters were shot down, and C4ISR systems worked perfectly. Additionally, there were no restrictions on medical materiel (Class VIII). Finally, 21 technologies deemed technologically feasible and due to be fielded by 2015 by the U.S. Army's Medical Research and Materiel Command (MRMC) were employed by the teams (Appendix D).

Workshop teams were given casualty tracking worksheets with the location and time of wounding, Patient Condition Codes and associated Treatment Briefs (Appendix E), and trauma registry forms (Appendix F) to assist them in patient regulation and treatment.[5]

The distribution of casualties in the UA area of operations (AO) is shown in Figure 2.2. The FST remained fixed as the battle progressed and is located in the upper left hand corner of the figure. Consequently, casualties (depicted as diamond-shaped icons) occurred as much as 80 kilometers from the FST as the engagement progressed on this dispersed battlefield, causing significant challenges for timely evacuation.

Figure 2.2
Casualty Distribution



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[5] Deployable Medical System (DEPMEDS) Patient Condition Codes describe a disease or injury. Treatment briefs provide an overview of the required medical treatment for each specific case.

Sequence of Events

ATW IV took place over a four-day period (10–13 February 2004) per the following schedule:

Day 1

- Introductory briefings given in plenary session
- Team organization meeting in team rooms and start of deliberations on the scenario

Days 2–3

- Team deliberations

Day 4

- Teams finalized deliberations
- Teams briefed findings in plenary session

The teams were self-organized to deal with the problem presented to them with the assets available. Most of the team members had experience in ATWs I–III. Therefore, they were familiar with the methodology, and team administrative and organizational issues took a minimum of time. The role of the control cell was to provide answers to team questions about issues beyond the competence of the teams' SMEs, e.g., performance characteristics of medical technologies.

Methodology

Casualty data for ATW IV was provided by the AMEDD, which derived it from simulation data provided by TRAC. This analysis yielded 76 casualties during the approximately 12-hour battle. Figures 2.3 and 2.4 show the causes of these casualties and the percentage distribution of wound types, respectively.

Each of the teams in ATW IV addressed the same problem: determine how to employ the UA HSS system to provide combat casualty care for the Future Force UA modeled in the scenario, and identify what residual of the casualty population will require HSS resources at echelons above the UA. The objective for each set of team members was to apply their collective expertise to determine the likely outcome for each casualty by providing the decisions they would make on how to treat each one. The RAND facilitator and the team leader guided their teams in reaching a consensus solution for each casualty. Movement speeds were specified as: dismounted personnel, 3 kilometers per hour (kph); ground evacuation vehicles, 25 kph; and aerial evacuation (UH-60L), 120 kph (no aerial evacuation was permitted forward of the company headquarters due to the surface-to-air missile threat).

The teams were given data about casualties and available HSS resources. Specifically, they utilized the UA HSS organization, materiel, and operational concepts provided by the AMEDD Center and School. Additionally, the teams received casualty tracking worksheets (an excerpt of the worksheet appears in Appendix E) that provided a comprehensive listing of all casualties and included

- The time of wounding for each casualty;
- The location of the casualty;

Figure 2.3
Causes of 76 casualties, ATW IV

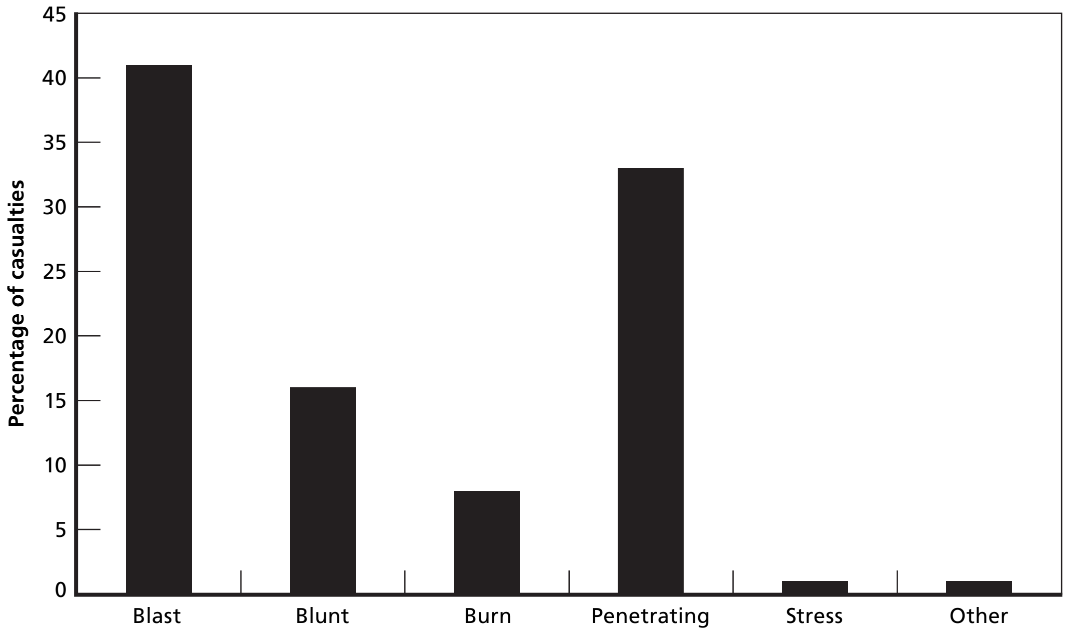

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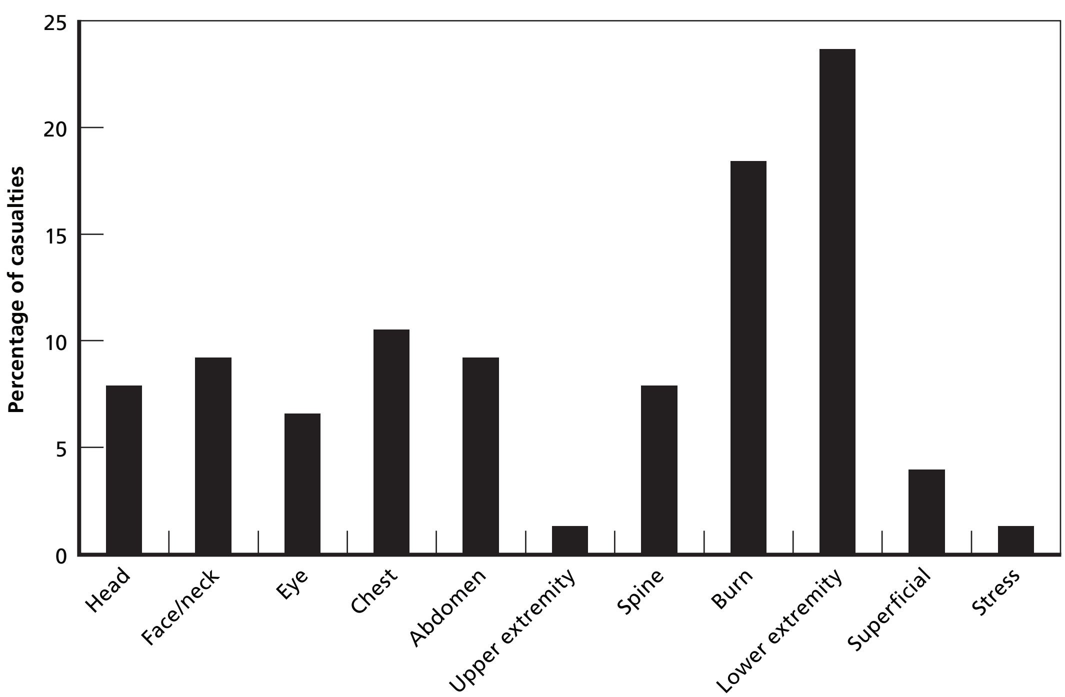
Figure 2.4
Distribution of 76 casualties, ATW IV



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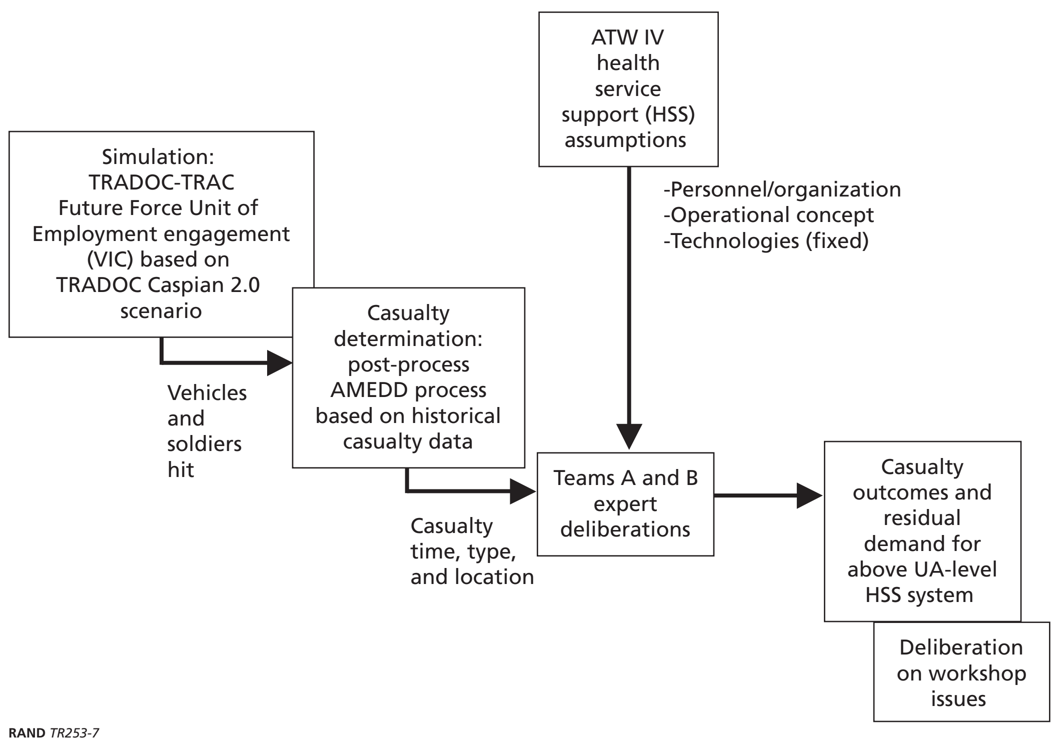
- The location of the company headquarters and the battalion aid station; and
- A description of the injury sustained by the casualty (including a treatment brief and patient condition code).

Finally, the teams were provided with the location of the FST (which remained fixed throughout the workshop.

The teams considered each individual casualty sequentially, in the order the soldier appeared in the scenario and moved through the HSS system. The appropriate SME(s) deliberated on what type of treatment and evacuation was required and feasible at each stage of each casualty's progress through the HSS system, from combat lifesaver/medic through the FST and UA medical company. The teams annotated their actions, results, and observations in the appropriate columns of the casualty tracking worksheet and on the trauma registry form (Appendix F). This methodology is depicted in Figure 2.5.[6] The next chapter of this report details the findings of the workshop teams.

Figure 2.5
AMEDD Transformation Workshops Methodology



[6] In ATWs I–III, the workshop designers employed three teams, working on the same problem with identical resources, to validate the workshop methodology. Given the consistent results across these three teams (reported in Johnson and Cecchine, 2004) the workshop designers reduced the number of teams to two. ATW IV results were consistent between the two teams, further assuring the validity of the methodology. This decision to use two teams instead of three eased the demand on the AMEDD to provide SMEs during a period of high operational tempo without jeopardizing results.

CHAPTER THREE

Workshop Results

This chapter presents the results of the workshop by addressing the issues and questions posed to the participants.

Answers to Workshop Questions

1. What was the disposition of casualties (casualty outcomes) at the end of the scenario?[1]

The scenario generated 76 wounded-in-action (WIA) casualties during the approximately 12-hour battle; the causes and types of these casualties were described in Chapter 2. The workshop resulted in estimates by two teams of casualty outcomes at the end of the 12-hour scenario (Figure 3.1).

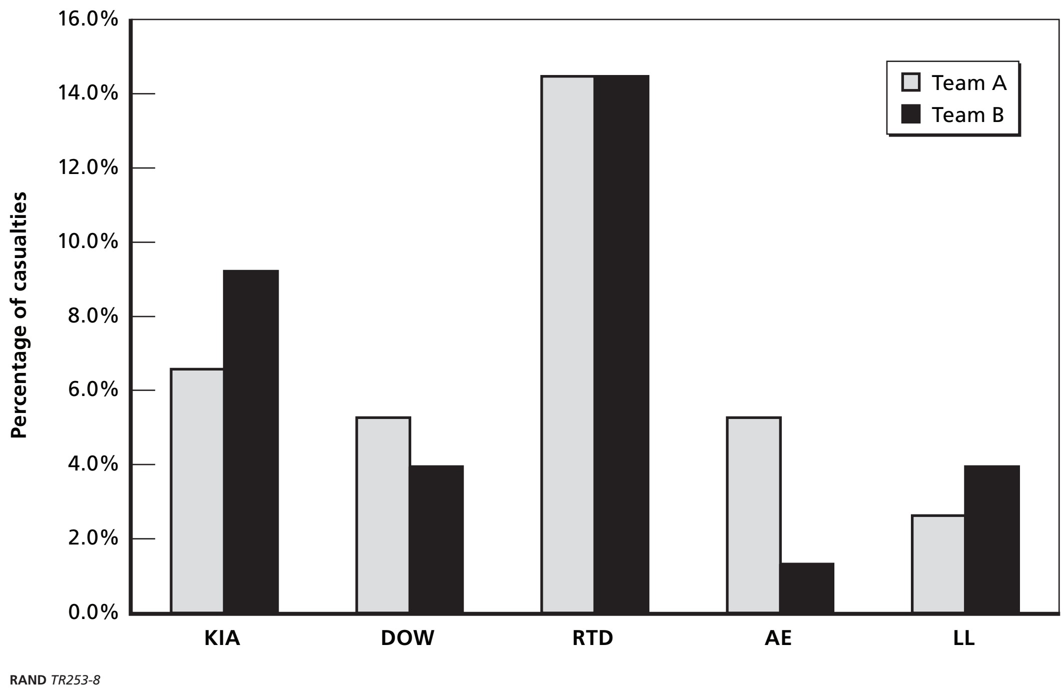
It is important to note that the results shown in Figure 3.1 do not indicate the final disposition of those casualties who are awaiting treatment at the medical company/FST within the UA. In the time beyond H+12,[2] the percentage of DOW casualties will either remain the same or increase. Casualties are considered to be DOW if they die after reaching a medical treatment facility (MTF); those who die before then are referred to as Killed in Action (KIA).

It is difficult to determine the final disposition of casualties because the capabilities of a future echelons-above-UA HSS system have yet to be determined. Specifically, it was assumed that casualties requiring evacuation from the UA medical company/FST were evacuated immediately upon that determination (casualties who had not yet arrived at the medical company/FST by the end of the simulation are classified as awaiting evacuation within the UA). In essence, this approach postulates an echelons-above-UA HSS system with infinite capacity. This assumption served both to support the goal of determining medical demand on echelons above the UA and also to unencumber UA assets. Had this assumption not been made, the medical company/FST would have quickly become overwhelmed, and determining demand for higher echelons would not have been possible. For this reason, the casualty outcomes in Figure 3.1 represent only those casualties of the total population of 76 for whom an outcome is definitive. In other words, approximately two-thirds of the casualties had been determined to be ready for evacuation to higher echelons. Their disposition will

[1] It is important to note that only U.S. casualties were considered in this workshop. The scenario did not provide any data on civilian or enemy prisoner of war casualties, which would have increased the demand on the HSS system, both within the UA and at echelons above the UA.

[2] H+12 denotes twelve hours after the start of the operation.

Figure 3.1
Casualty Outcomes as Determined by Both Workshop Teams at H+12 Hours



NOTE: KIA = Killed in Action, DOW = Died of Wounds, RTD = Return to Duty, AE = Awaiting Evacuation within the UA, LL = Limb Loss.

necessarily depend upon UE capabilities. Furthermore, all the casualties that are not returned to duty within the UA will eventually have to be cleared by a higher-echelon HSS system. ATW V will continue this line of analysis by assessing the results of a UE-level engagement and its resulting casualties.

Alternative Casualty Outcomes

Both teams employed a similar strategy during the workshop to carefully manage HSS assets, while also emphasizing rapid evacuation and treatment. At least two other strategies exist, however: persistence in combat and delayed evacuation. The first strategy emphasizes care as close to the point of injury as possible, with minimal immediate evacuation. Sometimes referred to as "stay and play," when taken to the extreme this strategy relies heavily on advanced technologies—some of which are employed by the wounded soldier himself or auto-employed—in a "paradigm shift from medic-centric to warfighter-centric medical care."[3] The strategy of delayed evacuation emphasizes completing the battle before evacuation and then "clearing the battlefield" of all casualties.

The data from one workshop team were used by the RAND analytical team to estimate comparative casualty outcomes for these three strategies in this scenario, employing only those advanced technologies provided for this workshop (Table 3.1).

[3] Henry (2004).

Table 3.1
Comparative Estimates of Casualty Outcomes for Three HSS Strategies

	HHS Strategy		
Outcome	**Rapid Evacuation**	**Persistence in Combat**	**Delayed Evacuation**
Killed in Action	7/9%	8/11%	17/22%
Died of Wounds	3/4%	2/3%	0
Returned to Duty	11/14%	11/14%	11/14%
Limb Loss	3/4%	3/4%	12/16%
Surgery at FST	15/20%	15/20%	1/1%
Awaiting Evacuation in UA	1/1%	16/21%	1/1%

NOTES: The table entries are number/percentage. The figures shown are numbers of casualties and percentages based on a total casualty population of 76. Casualty figures in some categories may also be included in others; e.g., an amputee may have received surgery at the FST.

The estimates shown in Table 3.1 are at H+12 for the first two strategies and H+15 for delayed evacuation, as the last strategy would not be employed until combat had largely stopped. As shown in the table, a strategy of delayed evacuation until the end of fighting could significantly increase morbidity and mortality. Interestingly, the outcomes for the persistence in combat strategy were similar to those for rapid evacuation. This may indicate that the demand on the UA HSS system was significantly high, such that the attempt to conduct rapid evacuation resulted in a de facto persistence strategy. It should be noted that the same advanced technologies were assumed in both strategies; proponents of the persistence in combat strategy emphasize that even more advanced technologies must be available for success. In this workshop scenario, it is therefore likely that both strategies would also result in a similar demand on the echelons-above-UA HSS system. One caveat to this likelihood is that the disposition of those casualties awaiting evacuation within the UA is unclear. This represents 15 additional casualties in the persistence strategy. The delayed evacuation strategy would in fact result in a lower UE demand but at a significantly higher cost of life and limb.

It should be noted that these estimates are for but one scenario. A more complete discussion or analysis of these various strategies was beyond the objectives and scope of this workshop; however, these estimates are presented because data were available to inform such a discussion.

2. What was the status of the HSS system at the end of the workshop?

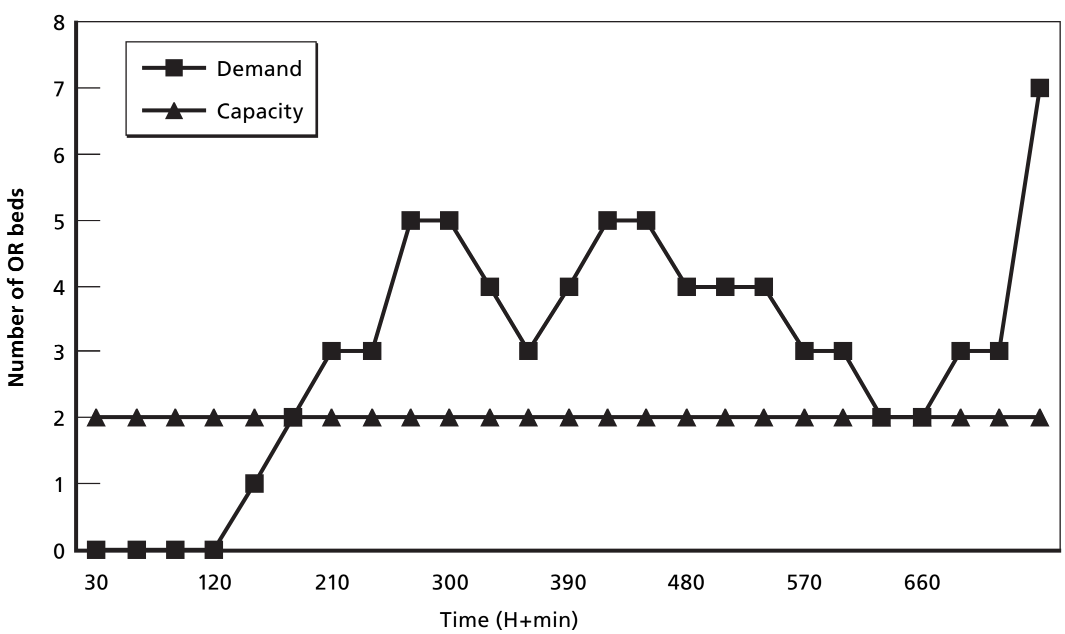
Earlier workshops in this series (ATWs I–III) focused on the capacity of an HSS system, which included some assets not available in the current UA (e.g., combat support hospital [CSH]). This workshop was primarily designed to begin the analysis to determine the medical demand on the echelons-above-UA HSS system, within the bounds of the workshop scenario. As discussed above, casualties requiring UE evacuation and treatment were assumed to receive it almost instantly. It is therefore difficult to determine the demand on the UA with a set of lesser assumptions. That is, the actual backlog on the UA is dependent upon definite capabilities at higher echelons. In this workshop, the capabilities of the above-UA HSS system were essentially assumed to have infinite capacity. Nevertheless, given this assumption, it is possible to describe the utilization of UA medical assets based on the UA HSS plan and doctrine. For example, an FST is doctrinally intended to stabilize patients for evacuation (the number of patients requiring such resuscitative surgery is generally low: 10 to 15 percent). Workshop teams were able to determine FST surgical requirements based on the nature of the casualties in the scenario. As the battle progressed, the number of needed surgeries increased. Estimates of FST demands experienced by one team are shown in Figure 3.2, and demands for recovery cots showed a similar trend, as seen in Figure 3.3.

In addition to surgical and post operative capabilities, evacuation assets were generally committed to near their maximum capacity throughout the scenario. Instead of reporting the cumulative times and distances flown or driven during evacuations, it is more informative to determine the outcomes of the combined HSS system, including evacuation as well as treatment. One such measure is the amount of time it took for a casualty to receive surgery after wounding, for those casualties who required surgery (Figure 3.4).

The combined mean delay time from wounding to surgery for both teams is 171 minutes (standard error 16.2, median 164 minutes). The mean times of the individual teams are not significantly different (ANOVA, $p = 0.31$).

The period of time following injury within which a significant number of serious trauma casualties will die without surgical intervention is often referred to as the "golden hour." In this scenario, delay time exceeded one hour in every case (14 and 15 FST surgeries for Teams A and B, respectively), with delay times from wounding to surgery ranging from 69 to 413 minutes. Further, the term golden hour is more appropriate when discussing the timing of resuscitative care for blunt-trauma victims and does not accurately convey the urgency of care required for the penetrating traumas more characteristic of combat casualties.[4]

Figure 3.2
Demand for Operating Room Tables at the Forward Surgical Team (UA)



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[4] See Zajtchuk and Bellamy (1995).

Figure 3.3
Demand for Recovery Cots in the UA

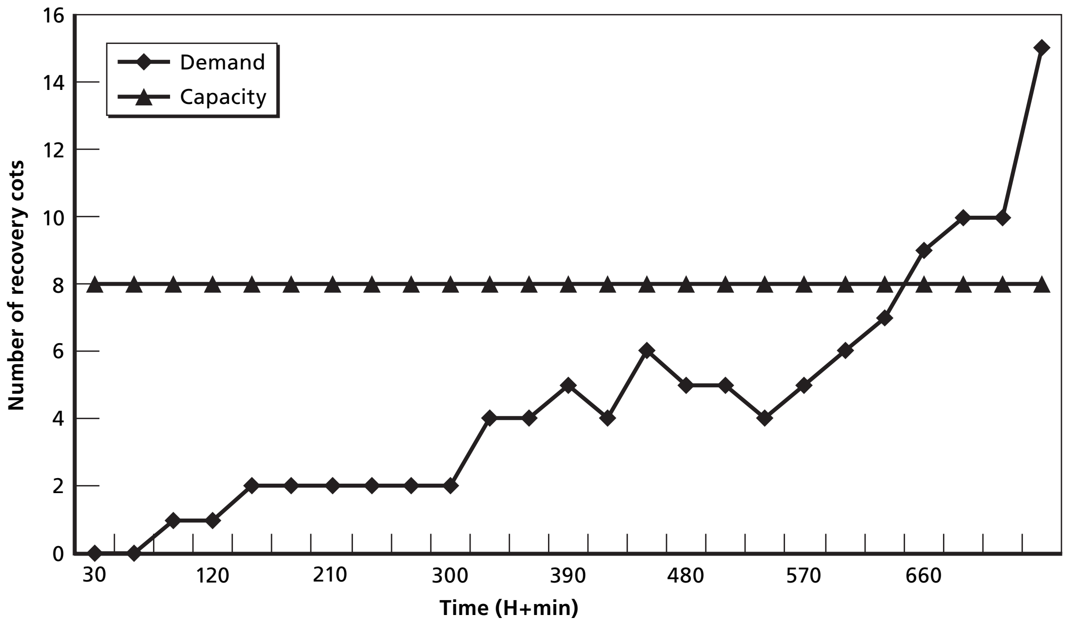

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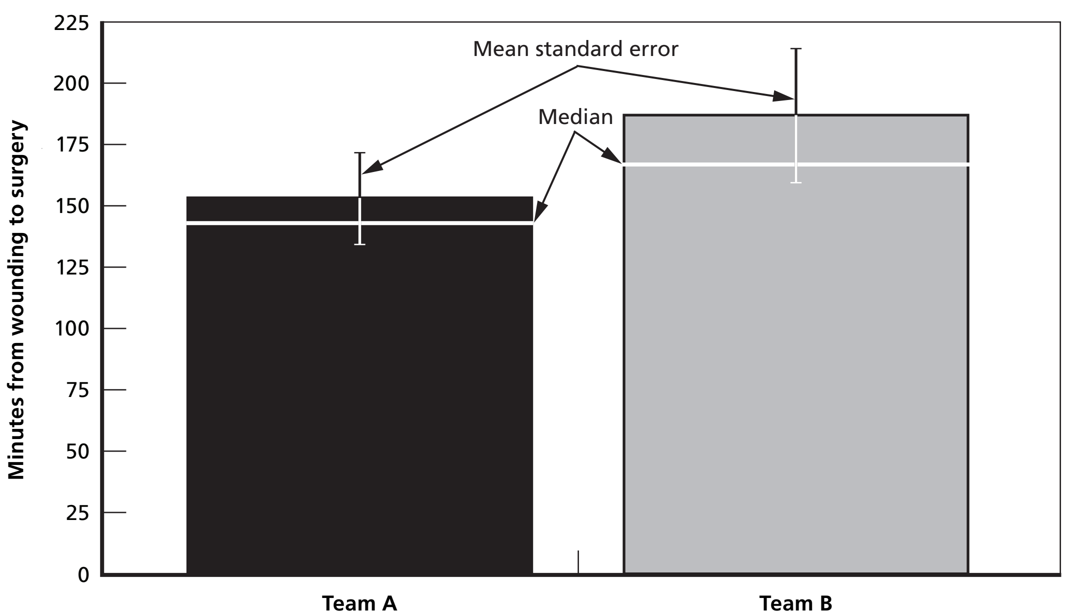
Figure 3.4
Mean Time Delay From Wounding to Surgery



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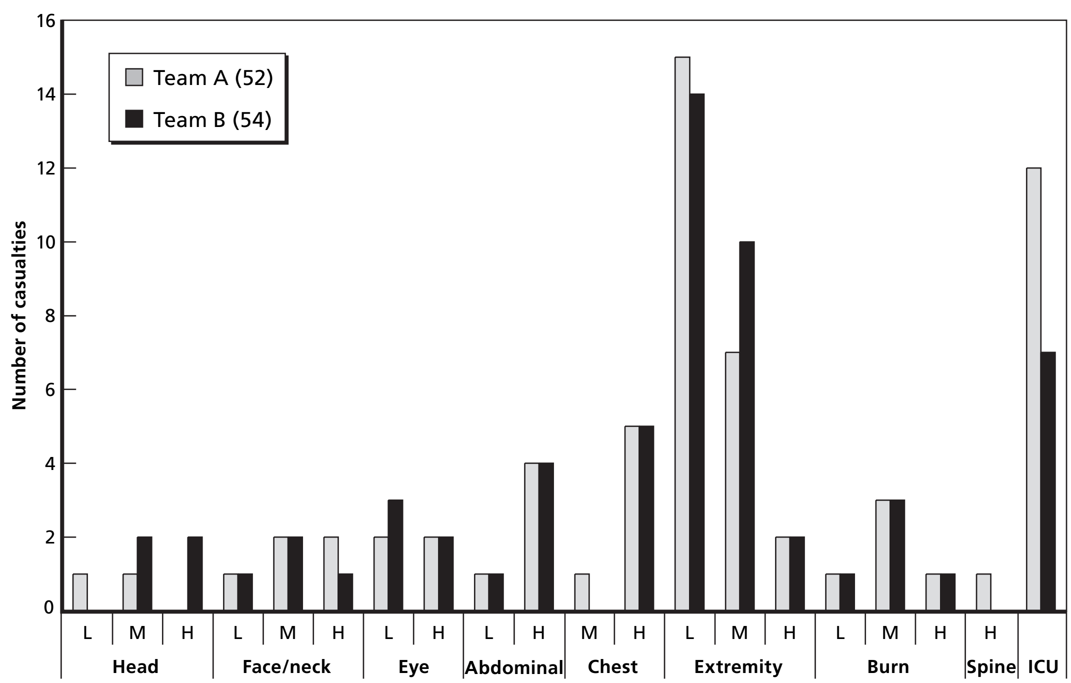
It is unclear whether additional casualties could have received treatment at the FST but were instead flagged for evacuation to an above-UA HSS system echelon; the disposition of these casualties is further unclear without knowledge of UE capabilities. In any event, as shown in Figure 3.2, UA surgical demand was already significant and probably would not have been able to accommodate this additional but unknown demand.

3. How many casualties require further evacuation and treatment at echelons above the UA?

A significant objective of ATW IV was to estimate the medical demand that would need to be met by echelons above the UA for this scenario. Both teams estimated similar residual demands following casualty evacuation and treatment in the UA; for example, both performed a similar number of surgeries (14 and 15) at the FST, indicating similar decisions about which casualties should be treated above the UA. Data from both teams was used to estimate the number, type, and severity of casualties requiring evacuation to, and treatment at, higher echelons (Figure 3.5).

Figure 3.5
Casualties Requiring Evacuation and Treatment by the UE



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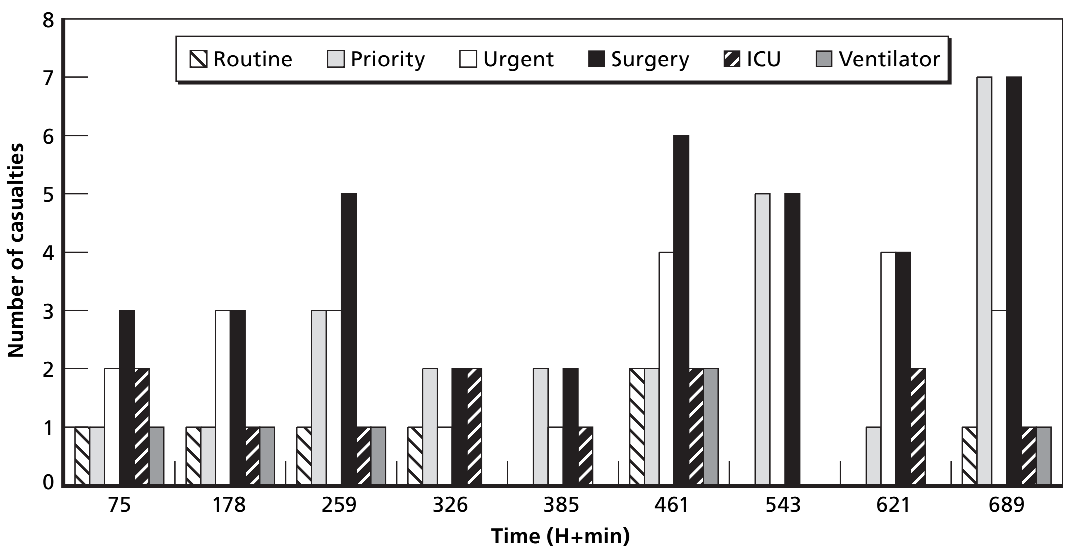
NOTE: L = low, M = moderate, H = high wound severity. Team A estimated that 2 chest (H) casualties also have significant abdominal injury; both teams estimated that 2 face/neck (M) casualties will also require treatment for significant eye injury. ICU patients are not exclusive of the other categories.

In estimating UE demand, it is also important to estimate when patients require evacuation in the context of the battle. Figure 3.6 shows the number of patients requiring evacuation, by evacuation category, at specific times during the scenario. The evacuation categories are as follows:[5]

- **Routine.** Should be evacuated within 24 hours: casualties whose conditions are not expected to deteriorate significantly.
- **Priority.** Should be evacuated within 4 hours: casualties whose conditions could deteriorate to such a degree that they will become urgent casualties, whose requirements for special treatment are not available locally, or who will suffer unnecessary pain or disability.
- **Urgent.** Should be evacuated as soon as possible and within a maximum of 2 hours to save life, limb, or eyesight, or to avoid permanent disability.

Patients requiring surgery (initial or secondary), intensive care, and/or ventilator support are also included, as these requirements may imply additional UE demands. Figure 3.7 shows the cumulative trends of evacuation requirements for these patients during the scenario.

Figure 3.6
Numbers of Patients Requiring Evacuation by UE



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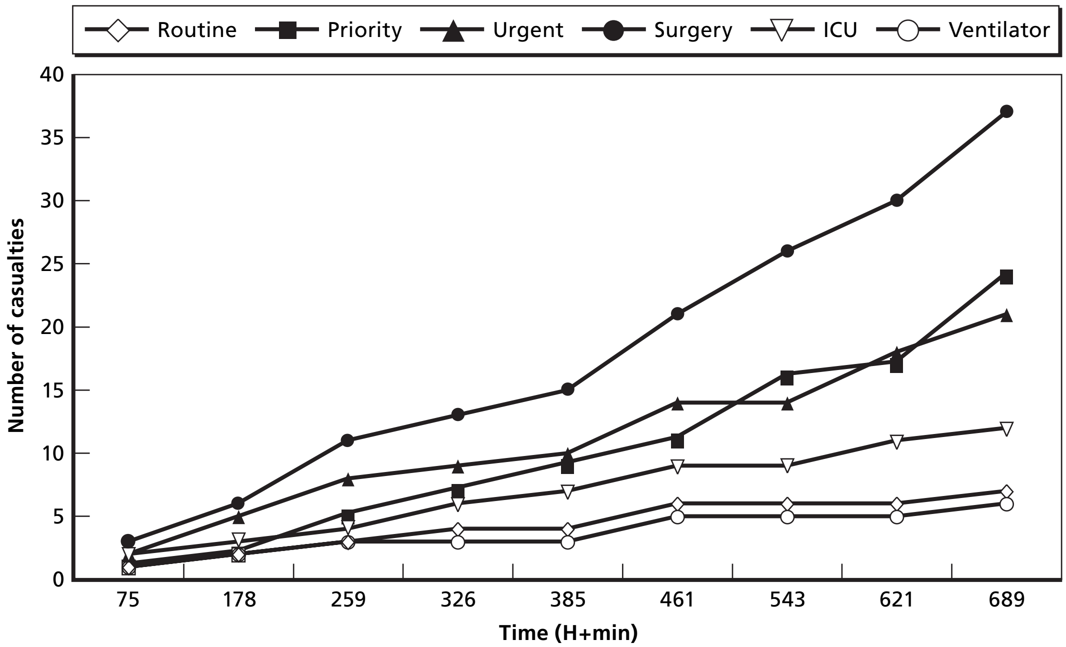
[5] Department of the Army (14 April 2000).

Figure 3.7
Cumulative Numbers of Patients Requiring Evacuation by UE



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Issue Resolution

Issue 1: Where do first responders and combat medics fit in the overall future concept for combat casualty care, and what treatment capabilities (treatment technologies, level of supply, and skills) will medics require to support this concept?

The assumed proficiency of first responders,[6] especially of combat lifesavers (CLS), and the availability of advanced technologies to control bleeding were judged to be absolutely essential. The reliance on CLS and advanced technologies was intended to address the principal characteristic of the Future Force concept that makes HSS challenging: dispersed unit operations. This characteristic resulted in a significant time lapse between injury and care by a medic, if the medic was not collocated with the casualty at the time of wounding. This time lag is especially problematic for bleeding casualties who must be treated quickly.

But some SMEs were skeptical that such an advanced level of CLS proficiency could be achieved and maintained. A related observation was that the role of CLS was unreasonably large, considering the pace of the battle and the high expectation of medical proficiency required.

Issue 2: What theater military medical infrastructure is necessary to support future military medical operations across the spectrum of operations?

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[6] First-responder care includes self- and buddy-aid, combat lifesavers, and combat medics.

This workshop focused on establishing the UA casualty demand that would have to be addressed by the above-UA HSS system. Casualties were treated within the bounds of UA capabilities, and those who did not return to duty became a component of the demand for an above-UA HSS system. The estimates of demand resulting from this workshop will be useful in determining theater medical infrastructure requirements.

As in ATWs I–III, each team indicated that perfect situational awareness—based on advanced communications technologies—was a key capability because it enabled optimal allocation of medical assets. That is, knowing the location and severity of casualties in real time would allow for remote triage, resulting in the precise and appropriate allocation of both evacuation and treatment assets.

Issue 3: What are the evacuation requirements to support military operations across the spectrum of operations?

Wide unit dispersion made air evacuation essential to facilitate an efficient, timely casualty evacuation. To this end, each team used air evacuation at or near full capacity.

Issue 4: What are the AMEDD's platform requirements to support the transformed force, and on which of these platforms will telemedicine (and other technologies, e.g., en route care) be advantageous?

As with issue 3 above, air evacuation platforms were critical in the effort to clear the battlefield of a widely dispersed UA engaged in rapid operations. These assets became increasingly important as the distance between point of wounding and the UA medical company/FST increased over the course of the engagement.

Issue 5: What technologies would significantly improve force health protection (how much are they worth at the margin)?

Although the impact of the medical technologies employed in the workshop was not addressed as an independent variable, team members noted that the Warfighter Physiological Status Monitor (WPSM) and advanced hemostatic agents were particularly valuable in combat casualty care. The WPSM provided casualty location and description, enabling remote triage to support the regulation of heavily taxed medical assets across a dispersed battlespace. The advanced hemostatic agents, often administered by combat lifesavers, extended the time available to evacuate casualties to the required level of care. Without these two technologies, casualties' outcomes would have been worse.

CHAPTER FOUR

Observations and Conclusions

Workshop participants could not assess the complete effect of the casualties examined during ATW IV on the HSS system. This workshop was designed not to determine final casualty outcomes, but to analyze the residual demand a UA will place on the echelons-above-UA HSS system for a specific scenario. Future workshops will continue the assessment of the demand on the echelons-above-UA HSS system by examining the casualties generated within an entire UE.

The remainder of this chapter contains our observations and discussion. Our observations fall into two categories: specific medical observations and the broader implications deduced from the workshop. It is worth noting that these observations are similar to those expressed after ATWs I–III, an indication of their validity, given the commonality of the findings of the four workshops.

Workshop Implications

The workshop implications will be discussed in two categories: workshop implications for the HSS system and workshop implications for the Army.

Workshop Implications for the HSS System

Combat lifesaver competencies. A significant aspect of emerging Future Force operational concepts is the dispersed nature of UA forces. Given the envisioned capabilities of Future Force weapon systems, coupled with the quality of situational awareness, units will be able to control much larger areas of terrain. Additionally, individual systems will be much more dispersed on the battlefield than now—routinely by as much as three to four kilometers. Thus, when a manned vehicle was hit by enemy fire that produced casualties in the workshop scenario, that vehicle was largely isolated from the other vehicles in the unit. Furthermore, these vehicles and their casualties were (in the simulation) left behind as the remainder of the unit continued to move rapidly toward its objectives.

The dispersion of vehicles in this scenario placed a premium on the skills of combat lifesavers (CLS) and their ability to employ the advanced medical technologies used in the workshops to care for casualties until they could be evacuated. This was particularly important because combat medics were frequently unable to get to casualties in a timely manner, either because of the distance to the casualty or because they were already treating another casualty.

In the view of the teams, the CLS skills assumed in the workshops greatly exceed what is expected of a CLS today and in reality approach what is expected of a 91W combat medic. For example, in the workshops, CLS were assumed to apply dressings and tourniquets, clear airways, manage fractures, and administer many of the 21 advanced technologies incorporated in the workshops. From the perspective of casualty outcomes during ATWs I–III, these extraordinarily competent CLS were critical to the effectiveness of the HSS system. The same remained true in ATW IV.

The role and importance of the CLS raises several issues that need further analysis. First, there was broad consensus that the initial and ongoing sustainment training of CLS need to be thoroughly assessed to determine feasibility, considering the proficiency levels demanded by the workshops. In short, is it possible to train a future soldier to be both an infantryman and a highly competent CLS and to maintain both skill sets over time? Second, performing as a CLS will be a secondary role for UA combat arms soldiers, just as it is now. Consequently, CLS will face an inherent tension during combat between providing combat casualty care and fighting. In these workshops, the CLS was assumed to provide care and thus made a significant contribution to favorable casualty outcomes. However, the workshops did not assess the impact of these CLS being taken away from their combat duties.

Role of the platoon combat medic. The workshop teams concluded that the highly dispersed, fast-moving operations called into question the role of the platoon combat medic. The principal issue was the proximity of the platoon medic to casualties. Even though the location and type of injury for each casualty was provided during the workshop, if the casualty was not in the same vehicle as the medic. Consequently, it was not feasible for the medic to move by foot to the casualty. This created a dilemma that was recognized, but not solved, by workshop participants. To move the medic to the casualty, the FCS vehicle carrying the medic would have to be diverted from the mission. Such a decision would degrade platoon combat capability. In the workshop this dilemma was largely solved, as noted above, by investing the unit CLS with extraordinary competence and capabilities, principally in the form of advanced medical technologies. The best assistance the medic could potentially provide in these cases was remote advice to the CLS.

Again, as described in the report on ATWs I–III, the teams also noted that this does not imply that Future Force medics will not play a significant role in other dimensions of force health protection. As they are today, they will be involved in training CLS and other soldiers, performing on-site and remote triage during battle, dealing with disease and nonbattle injuries (DNBI), and myriad other readiness-related duties that have traditionally required combat medics. What this workshop (and ATWs I–III) did point out, however, was the immense difficulty that combat medics will have in providing immediate response in highly dispersed, fast-moving combat operations.

Medical technology. During this workshop, as in ATWs I–III, the utility of advanced medical technologies was not specifically addressed as an analytical issue. Instead, the MRMC provided a list of 21 technologies (see Appendix D) for the workshops that it affirmed would be fully fielded and will perform to stated expectations by 2015. Workshop participants employed the technologies as specified by MRMC. Nevertheless, although the performance of medical technologies was not a stated issue, participants did note several technologies that they believed were critical to combat casualty care during the workshops.

Two critical factors, as frequently noted in this report, made the combat casualty care effort particularly challenging: battlefield dispersion and the distance to surgical capability at the FST or echelons above the UA. Perhaps the most important technology in the workshops for dealing with the dispersion factor was the Warfighter Physiological Status Monitor

(WPSM). The WPSM provided immediate location and injury-type data for all casualties. This information was invaluable in the medical regulation effort, particularly in allocating evacuation assets. The distance factor for urgent casualties was primarily alleviated by the application of a number of advanced hemostatic agents, which prevented fatal hemorrhage while severely wounded casualties were en route to treatment at the FST.

Aerial medical evacuation. On the highly dispersed battlefield portrayed in the workshops, aerial medical evacuation made the difference between life and death for many casualties. Furthermore, its criticality became more pronounced as the battle progressed, because the distance from point of wounding to the FST steadily increased.

Surgical capacity. The main limiting factor in dealing with the casualties in the workshops was surgical capacity. The results of ATW IV, however, indicated that the UA's residual load of casualties requiring surgery would create a heavy demand for above-UA level surgical capacity.

Additionally, one can assume that the demand for surgery and post-surgical care will increase in the future, particularly given recent experiences in Iraq. Emerging casualty data from Iraq is demonstrating the impact that improved soldier protection and advanced medical technologies are having on casualty outcomes. Better body armor and medical technologies combined enable soldiers who would have been KIA in earlier conflicts to survive until they reach an operating table, where their lives are frequently saved. In Iraq, the number of casualties over time has not created an excessive demand on the HSS system, and KIA and DOW rates, among those wounded, appear to be dropping significantly. Nevertheless, this reduction in KIA and DOW rates could create an unprecedented demand on surgical capacity and post-surgical care in the types of operations depicted in the scenario used in ATW IV—a demand that the envisioned UA HSS system has had difficulty addressing in ATWs I–IV.

Finally, as in ATWs I–III, the FST was not able to displace forward as the battle progressed, because it was in a mass casualty mode throughout the duration of the operation. Thus, the time from wounding to operating table gradually increased for casualties as the battle moved progressively further from the FST location.

Workshop Implications for the Army

Several issues arose during ATW IV, which were also noted during ATWs I–III, that are beyond the scope of the AMEDD to address independently. They truly are Army issues.

Lines of communication and rear area security. This same issue was also apparent in ATWs I–III. As the battle portrayed in this scenario progressed, the lines of communication steadily increased and were left largely unsecured as maneuver units pressed on to their objectives. From the perspective of the HSS system, this situation required ground medical evacuation vehicles to move independently to casualty locations, casualty collection points, aerial medical evacuation landing zones, etc., across a battlefield that was neither cleared nor secured. This situation is not dissimilar to the challenges faced by coalition forces during Operation Iraqi Freedom in securing lines of communication behind combat forces rapidly moving toward Baghdad. Additionally, as already noted, the FST had to stay in a fixed location for the duration of the 12-hour battle to perform its mission. One would assume that it, and the FSB medical company, would require some level of defense during this time.

As noted earlier, the workshops assumed there was no attrition of any of the components of the HSS system, in order to portray its capabilities in a "best case" condition. Therefore, the impact of operating in an insecure rear area was not specifically assessed. Nevertheless, it would be reasonable to assume that elements of the HSS system would be attacked, particularly if they moved around the battlefield as single entities. Loss of medical personnel or platforms could only worsen medical outcomes.

The issue for the Army is: How will ground and air lines of communication and rear areas be secured in the wake of rapidly advancing future force combat units?

Unit morale, cohesion, and combat effectiveness on a dispersed battlefield. Again, this issue arose in ATWs I–III, but it surfaced in ATW IV as well. As combat units rapidly advanced, disabled vehicles and their crews were left behind. The growing rear area in which these vehicles and crews found themselves was not secure, and one could assume the crews were still vulnerable to attack from uncleared enemy forces.

Team members believed that the nature of the scenario's battlefield—highly dispersed and not secure—would create problems in the realms of morale, cohesion, and combat effectiveness in a number of ways. First, as already discussed, getting a combat medic to a casualty location was frequently not feasible, and casualties often only received primary care from a CLS. This situation is in contrast to the historic expectation of American soldiers and their leaders: when they call for a medic, one will appear to render aid. Second, given the dispersion of the battlefield and the distance between casualties, medical evacuation platforms, and treatment locations, the elapsed time between wounding and evacuation was generally longer than the Army has come to expect.

Team members believed that the frustration of the twin expectations—that a medic will quickly come to a casualty's aid and that if necessary the wounded person will be rapidly evacuated to the appropriate level of care—could negatively affect morale, cohesion, and combat effectiveness. Furthermore, the possibility of being "abandoned" on a battlefield that has not been secured would only complicate these human factor issues. These are areas of Future Force operations that need investigation.

Conclusion

ATW IV provided valuable insights into the ability of AMEDD's envisioned Future Force HSS system to support a Future Force operation. This workshop also began the process of determining the demand that an echelons-above-UA HSS system will be required to meet in Future Force operations. ATW V will continue this line of analysis by assessing the results of a UE-level engagement and its resulting casualties. Although the results and insights gleaned from ATW IV are unique to a specific scenario and simulation, they do point to the potential medical challenges posed in supporting rapid Future Force operations on a highly dispersed battlefield. The workshop also reinforced the importance of simulating Future Force concepts and the criticality of in-depth, subject matter expert analysis in assessing the outputs of any simulation. In the case of this workshop, every casualty generated by the simulation was tracked from the point of wounding through the UA HSS system by experts in all the components of combat casualty care. Thus, the teams were able to articulate credible casualty outcomes and the challenges facing emerging AMEDD concepts, structures, and technologies in supporting a postulated Future Force UA. The team members stressed that further simulations of additional scenarios and of evolving future force concepts should continue to ensure that the AMEDD can articulate to the Army the medical risks involved in Future

Force concepts and the ability of the future HSS system to mitigate those risks to a level acceptable to the Army. Such analysis will support the design and implementation of a health service support system that is as robust as the operational system it will support.

APPENDIX A

ATW IV Participants

Subject Matter Expert	Team A	Team B
Team Leader/ Surgery	COL Thomas Knuth	COL Kim Marley
Surgery	MAJ Richard Pope	COL David Burris
Nursing	LTC Kathleen Ryan	COL Anita Schmidt
Physician's Assistant	CPT Dawn Orta	1LT Michael Smith
Combat Medic (91W)	MSG Steven Kerrick	SSG Scott Adkins
Combat Stress	COL James Stokes	LTC Willis Leavitt
Evacuation	LTC William Layden	LTC Tim Moore
Logistics	CPT Jennifer Humphries	Mr. Gerry LoSardo
Medical Technology	Mr. David Smart	MAJ Robert Wildzunas
Unit of Action	Mr. Dave Hardin	Mr. Jim Brazaele
Medical Company	CPT James Morrison	CPT Jon Baker
C4I	CPT Kevin Peck	LTC DaCosta Barrow
RAND Facilitator	Ms. Terri Tanielian	Dr. Richard Darilek
RAND Data Collectors	Dr. Martin Libicki	Mr. John Bondanella
	Dr. Eric Landree	Dr. Anny Wong

Control Cell

COL L. Harrison Hassell	Workshop Control, AMEDD C&S
Dr. David Johnson	Project Leader, RAND
Dr. Gary Cecchine	Project Leader, RAND
COL Raj Gupta	Medical Technology, MRMC
Mr. Pat McMurry	Analyst, AMEDD C&S
Mr. Fred Watke	Analyst, AMEDD C&S
Mr. Quinn Elliott	Analyst, AMEDD C&S
Mr. Mike Ingram	TRAC—Fort Leavenworth, Kansas
Ms. Gladys Garcia	TRAC—Fort Lee, Virginia
COL Robert Leeds	Dental
LTC David Sweeney	Preventive Medicine
Mr. Tommy Morris	IT/IM

APPENDIX B

ATW IV Participant Positions, Roles, and Responsibilities

Position	Role and Responsibilities
Forward Surgical Team/Surgeon and Team Leader	Serves as the SME for battlefield resuscitation and stabilization of casualties with life, limb, or eyesight-threatening injuries. Serves as workshop team leader.
UA Commander	Serves as the SME for UA operations. Identifies and records decisions required by the UA commander pertaining to HSS.
Forward Support Battalion Medical Company Commander	Serves as the SME for forward support battalion (FSB) medical company operations. Identifies and records decisions required by the FSB medical company commander pertaining to HSS.
Battalion Aid Station/Physician's Assistant	Serves as the SME for battalion aid station operations and battlefield application of advanced trauma management of BI casualties. Identifies and records decisions required by the battalion aid station commander pertaining to HSS.
Holding/Nursing	Serves as the SME for medical holding operations for soldiers who return to duty (RTD) within 72 hours from the FSB medical company.
Evacuation (ground and air)	Serves as the SME for ground and air MEDEVAC operations.
Medical Logistics	Serves as the SME for UA-and-below medical logistics operations.
Emergency Medical Treatment and En Route Care/91W	Serves as the SME for battlefield treatment of injury casualties at the point of injury and en route treatment during ground evacuation.
Medical Technologies	Serves as the SME for advanced medical technologies employed in the workshop.
C4I	Serves as the SME for UA C4I systems. Identifies and records information about the preferred means to communicate and make decisions about HSS.
Combat Stress Control	Serves as the SME for management of combat stress casualties. Identifies and records observations pertaining to combat stress control for UA-and-below operations.
Facilitator/RAND	Serves as the workshop team facilitator.
Data Collector/RAND	Serves as data collector for the RAND Casualty Tracking Worksheet. Records salient details of team discussions as identified by the facilitator.

Control Cell

Position	Role and Responsibilities
Center for AMEDD Strategic Studies/ Game Direction	Serves as the control cell leader. Responsible for overall conduct of the workshop. Confers with other control cell members to provide control information for workshop teams.
RAND Project Leaders	Provide oversight of data collection and analytical plan. Administrative support of the workshop. Prepares the workshop final report and briefing.
TRAC—Fort Leavenworth, Kansas	Serves as the SME for the Caspian 2.0 scenario.
TRAC—Fort Lee, Virginia	Serves as the SME for combat service support analysis.
AMEDD Analysts	Assists workshop teams with use of the Asset Management Tool, Theater Trauma Registry, and DEPMEDS PC Code database.
Dental	Serves as the SME for dental treatment. Identifies and records observations pertaining to dental treatment for UA-and-below operations.
Preventive Medicine	Serves as the SME for preventive medicine. Identifies and records observations pertaining to preventive medicine for UA-and-below operations.
Information Management /Information Technology	Serves as the SME for handheld systems to capture battlefield healthcare information during UA-and-below HSS.
Medical Research and Material Command/Game Direction	Serves as MRMC SME for UA medical material development. Provides input to game direction.

Scenario, ATW IV

The TRADOC Standard Operational Scenario (Caspian 2.0) that served as the basis for ATW IV describes a smaller-scale contingency (SSC) situation requiring a strategic response to a distant immature theater. In this case, Blue executes a stability and support operation (SASO) that escalates to a high-end SSC operation in which major combat operations are conducted. Upon the failure of deterrence of hostilities, Blue intervenes to restore a friendly government overthrown by a rebellious majority of its military.

Blue faced a variety of operational-level missions and tasks. The most important of them was to help reinstate the friendly government requesting assistance. This mission focused the Blue force on isolation of the strategic center of gravity (capital region). Blue also had to defeat anti-government enemy forces in the country. Blue was further tasked to deter any third country intervention on the side of the rebellious forces. They also had to cut the lines of communication (LOC) from the capital region toward the south to this regional power. Finally, Blue forces had to ensure the ability to conduct follow-on operations.

In this scenario, Army future forces conducted operations as part of the main effort of the Blue force counteroffensive—decisive operations after a month-plus force build-up in theater. Army ground forces conducted operational maneuver, executing distributed and continuous operations both in open and rolling terrain and in urban and other complex terrain.

Simulated Operations

The tactical-level simulation and scenario employed in ATW IV depicted an FCS-equipped Maneuver Unit of Action (UA) conducting an attack against a brigade-equivalent threat force. The engagement occurred in an area as large as approximately 75 by 85 kilometers.

Operational Environment

Physical conditions. Several salient features characterize the physical terrain in the scenario: foothills and rugged mountainous terrain, urban and other complex terrain, a large reservoir, rivers, and an irrigation complex in a large, extensive valley flood plain consisting of canals and ditches. The mountainous portion of the UE area of operations (AO) is less populated and less occupied by defending forces (other than reconnaissance assets). Portions of the AO are urbanized with a somewhat sprawling network of villages, towns, and cities situated among the maneuverable, but restricted, mobility corridors in the region. There are pockets of highly compartmentalized terrain throughout the zone.

Threat forces. Enemy forces in the AO included three corps, organized around twelve maneuver brigades. There were over 40,000 troops, 2,000 AFVs, 450 air defense systems, and 600 artillery systems simulated in this AO. Red also employed about 3,800 man-portable air defense systems (MANPADS) across its forces.[1]

Threat concept. The focus was on preservation of political and military power; the enemy planned to defend primarily from urban and other complex terrain throughout the AO. Most of Red's conventional forces remained concealed in well-prepared defensive positions in the urban areas in an attempt to preserve combat power and to draw Blue forces into these spaces for an urban fight. Red forces expected the urban fight to negate the technological advantage of Blue forces, increase Blue casualties, and slow Blue's momentum, all aimed at degrading Blue's will to fight and carry on the operation. All Red forces tied their defenses into both natural and man-made obstacles, primarily the rivers, lakes, and compartmentalized terrain spaces. The Red defense coordinated these obstacles with their surveillance-strike complex, fires complexes, and an integrated air defense system (IADS) to ensure that Blue forces entering the obstacles and enemy perimeters were identified and targeted with both indirect and direct fires. Red focused their surveillance on the more open maneuver corridors into the country in an attempt to target Blue forces as Blue attacked across this region. Red planning included the exploitation of displaced persons and other civilians in the battlespace to complicate Blue maneuver, fires, and logistics. The battlespace was further complicated by the proliferation of MANPADS.

Joint Forces

CFACC. The Combined Force Air Component Command in this scenario included two Air Expeditionary Forces. These AEFs included strategic "enabler" or common user assets, such as long-range mobility and space forces. The CFACC utilized an abundance of various combat aircraft and munitions to fulfill strategic attack, joint suppression of enemy air defense, air superiority, and counter-land roles. Additionally, key Air Force intelligence, surveillance, and reconnaissance assets (U2, E-8 Joint STARS, F-3 AWACS, and RC-135 Rivet Joint) played a critical role in setting conditions for the operation.

JFMCC. The Joint Force Maritime Component Command included one carrier vessel battle group tailored to the scenario. The CVBG provided multiple combat capabilities with their fighter aircraft, surface vessels, air and missile defense assets, and submarines. This carrier provided an air basing capability that augmented land-based air assets around the periphery of the theater and the threat country, and provided additional air assets to the CFACC.

CSOTF. The Combined Special Operations Task Force also included the joint psychological operations task force, and the joint civil-military operations task force. Overall, the CSOTF focused on special reconnaissance, direct action, civil affairs, and psychological operations activities. In all of these, special operations forces reinforced, augmented, and complemented conventional forces in theater. They also conducted independent operations, including a hostage rescue that initiated Blue operations.

CFLCC. The Combined Force Land Component Command included one Army UE and one Marine expeditionary brigade. The simulation focused on the operations of the Army UE as the main effort of the theater decisive operations.

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[1] Some forces remained neutral and are physically separated from rebellious forces.

AMEDD Transformation Workshop IV: Unit of Action Tactical Engagement Problem

Blue forces in simulation consisted of an FCS-equipped UA Maneuver Brigade and augmentation (slice) from the Unit of Employment. A UA Maneuver Brigade conducted offensive operations to destroy enemy forces and seize key terrain, shaping the battlespace to facilitate decisive follow-on operations. The UA faced elements of three brigades of an enemy corps in its AO.

The JANUS-simulated operation began at 2100 and ended about 12 hours later. Both workshop working groups examined the casualty events that resulted during this operation. To provide context for the workshop, participants were given the following UA mission statement, commander's intent, and key elements of the UA operations plan.

UA Mission Statement

1st UA attacks no later than 1900 hours 26 March to secure a route over the V-K canal for the purpose of allowing 2nd UA to conduct a forward passage of lines (FPOL) and continue the attack across the Kura River to seize objective Silver; on order clear a main supply route in order to support the 2nd UA; on order clear enemy in zone to facilitate the transition of local government.

Commander's Intent

Purpose:

Complete FPOL with 2nd UA on a secure route and a main supply route (MSR) established for follow-on forces.

Key Tasks:

- Pass the 2nd UA early in the fight so that the enemy brigade east is in contact simultaneously with our fight.
- Clear an air corridor to allow Comanche's freedom of movement across the AO.
- Control decisive terrain in the foothills on southern flank of the AO of the 3rd Combined Arms Battalion (CAB) and establish beyond-line-of-sight and overlapping sensor coverage.
- Destroy or neutralize BM21s and 2S19s in southern mountains prior to massing to clear urban areas.
- Destroy or neutralize air defense that can prevent joint close air support.
- Gain overlapping sensor coverage so that no enemy forces that we isolate or bypass can reposition or affect resupply routes.
- Completely isolate one enemy company or town at a time and give the enemy brigade commander multiple other problems throughout his AO so he cannot focus on that town/force.

End State:

Secure a route and secure crossing sites over the V-K canal, and enough space east of the canal secured to allow 2nd UA to transition to combat formation protected from direct and observed indirect fire prior to initiating its attack over the Kura River; provide a MSR secure for 1st and 2nd UAs; isolate enemy forces so we can defeat them in depth.

Key Elements of the Operations Plan

Phase one will set the conditions to secure a route through the AO. This phase will begin with the aerial envelopment by 3rd CAB to the south and subsequent maneuver into their attack position. 3rd CAB will clear objective Honda in order to destroy or neutralize BM21s and 2S19s in the southern mountains before massing to clear urban areas in the center of the UA AO and control decisive terrain in the foothills on the southern flank of 3rd CAB's AO in order to establish beyond-line-of-sight and overlapping sensor coverage. 2nd CAB will clear BM21s in named area of interest (NAI) Bravo in order to destroy or neutralize threat artillery before securing a route through the AO. UA unmanned assets will isolate objectives Ford and Yamaha to prevent threat freedom of action and maneuver. This phase ends with objective Honda cleared, BM21s/2S19s neutralized in the vicinity of NAIs 11, 12, and 13, and objectives Ford and Yamaha isolated.

During phase two, Blue will secure a route through the AO, secure crossing sites over the V-K canal, and secure the area east of the canal to allow 2nd UA to transition to combat formation protected from direct and observed indirect fire before its attack onto objective Silver. This phase begins with 3rd CAB having cleared objective Honda, 2nd CAB having cleared NAI Bravo, 1st CAB set, and unmanned systems having isolated objectives Ford and Yamaha. 1st CAB will secure route Hood, secure objective Dodge, and secure crossing sites over the V-K canal in order to pass the 2nd UA through onto objective Silver. 1st CAB will also clear an air corridor in order to allow Comanche's freedom of movement across the AO and destroy or neutralize air defense that can prevent joint close air support. 3rd CAB will secure crossing sites over the V-K canal and secure space east of the canal in order to allow 2nd UA to transition to combat formation protected from direct and observed indirect fire before its attack onto objective Silver. 2nd CAB will continue to isolate objectives Ford and Yamaha and gain overlapping sensor coverage in the area of interest so that no enemy forces that we isolate or bypass can reposition or interfere with Blue resupply routes. This phase will end when objective Dodge and route Benning are secured and all units are set for FPOL of 2nd UA/UE.

Phase three is the FPOL of 2nd UA. This phase begins when all units are set in hasty defensive positions oriented on objective Silver and ends with 2nd UA/UE FPOL complete.

Endstate for this operation:

A secured route and secure crossing sites over the V-K canal and enough space east of the canal secured to allow 2nd UA to transition to combat formation protected from direct and observed indirect tire before initiating its attack over the Kura River. A secured MSR for 1st and 2nd UA. Enemy forces isolated so Blue can defeat them in depth.

APPENDIX D

Medical Technologies Employed in ATW IV

The following advanced medical technologies were deemed by MRMC to be feasible and due to be fielded by 2015, and were employed by the workshop participants. These technologies, and their descriptions, were developed for use during ATWs I–III. MRMC asked that the same technologies be used for ATW IV. Their status has not been updated since ATW III. Descriptions for each of these technologies, as provided by MRMC in March 2002, follow.

1. Warfighter Physiological Status Monitor (WPSM)
2. Universal Red Blood Cells for Severe Hemorrhage
3. Universal Freeze-Dried Plasma
4. Spray-on Protective Bandage
5. Machine Language Translation
6. Liquid Tourniquet
7. Lightweight Extremity Splint
8. IV Hemostatic Drug
9. Intracavitary Hemostatic Agent
10. Enzymatic Wound Debridement
11. Battlefield Medical Information System Telemedicine
12. Advanced Resuscitation Fluid
13. Advanced Hemostatic Dressing
14. Warrior Medic ("biocorder")
15. Hemoglobin-Based Oxygen Carrier
16. Field Therapy Utility Pack for Laser Eye Injury
17. Digital Information and Communications System
18. Transportable Automated Life Support System
19. Teleconsultation/Teledermatology
20. High-Intensity Focused Ultrasound
21. Forward-Deployable Digital Medical Treatment Facility

1. Warfighter Physiological Status Monitor

Summary: Networked array of physiological sensors embedded in the Objective Force Warrior (OFW) suit and transparent to the soldier. Data management algorithms in the soldier computer reduce near-real-time physiological data from the sensors to information useful to medics and commanders.

Capabilities and indications for use: Monitoring capability includes remote triage (determination of life signs, blood pressure, respiratory function, neurological status, ballistic wounding alert) and force health protection monitoring (thermal stress risk, hydration state, sleep status, mental alertness status, metabolic status/energy reserve, altitude adaptation, and potential exposure to toxic chemicals and materials on the battlefield).

User(s): Every soldier equipped with the OFW suit.

First fielding date: FY11.

Distribution: Monitoring capability in every OFW suit.

Training: No training required. Complex physiological data will be reduced to easy-to-understand information for medics and commanders about the physiological status of individual soldiers and units.

Cube and weight: Sensors will add about a pound to the OFW suit.

Cost: MRMC medical research will provide the sensor specifications and data management algorithms. The OFW suit developer will develop or purchase the sensors and include the data management algorithms in the soldier computer.

2. Universal Red Blood Cells for Severe Hemorrhage

Summary: The product is non-type-specific red blood cells for battlefield blood replacement.

Capabilities and indications for use: The successful product will eliminate the need for blood typing, reduce the logistics footprint, and can be used in a far-forward environment to improve organ oxygenation in severe hemorrhage and to stabilize combat casualties in scenarios of delayed evacuation.

User(s): Physician assistant, surgeon.

First fielding date: 2015.

Distribution: 10 units at battalion aid station PA. 50 per FST.

Training: Training in proper indications for use and in intravenous access and administration.

Cube and weight: 0.75 pound per 250 ml unit with administration set and packaging.

Cost: $150 per unit.

3. Universal Freeze-Dried Plasma

Summary: The product is freeze-dried plasma that is not type-specific and is packaged for rapid reconstitution and administration on the battlefield by the combat medic or the physician assistant.

Capabilities and indications for use: The product is freeze-dried (lyophilized) plasma that is not type-specific and is packaged for rapid reconstitution and administration on the battlefield for control of hemorrhage. The product can be carried without significantly adding to the medic's battlefield load and when reconstituted and administered will provide functional activity similar to native plasma. The product will eliminate the need for blood typing, will reduce the logistical footprint, and can be used in a far-forward environment for casualty resuscitation.

User(s): Combat medic, physician assistant, surgeon.

First fielding date: 2012.

Distribution: 4 units per combat medic and PA, 50 units per FST.

Training: Training in indications for use; training in intravenous access and administration.

Cube and weight: Each unit will come as prepackaged intravenous bag (with IV setup) with 2 compartments, one containing freeze-dried plasma, the other sterile water for injection. The two compartments must be joined and mixed for use. Each package will be 250 ml and weigh 0.75 pound. No maintenance is required.

Cost: $50/unit.

4. Spray-on Protective Bandage

Summary: A spray-on, self-sanitizing, flexible bandage that will reduce or eliminate blood and fluid loss; will reduce or eliminate pain associated with motion; and will protect wounds from environmental contamination.

Capabilities and indications for use: The spray-on bandage may be self- or buddy-applied and will enhance wound stabilization for 2 or more days after injury. The bandage will be applicable to large and small wounds and will be self-sanitizing (antimicrobial) and capable of reducing or stopping blood and fluid losses (including compressible hemorrhage and amputation stumps after minimal tourniquet control); reducing or eliminating pain during motion; and protecting wounds from environmental contamination. May be used in conjunction with enzymatic/chemical debridement.

User(s): Combat lifesaver, combat medic; PA; surgeon.

First fielding date: 2010.

Distribution: One tube per soldier. One tube covers wounds up to 50 percent of total body surface.

Training: Minimal training required; will be applied directly to wound surface.

Cube and weight: Final form not established. Attempts are being made to deliver dressing as a powder that will use wound liquid (blood, serum) to polymerize on wound surface.

Cost: $50 per unit.

5. Machine Language Translation

Summary: The goal of the machine language translation project is to build and deliver a 2-way machine voice translation system on a small, rugged, handheld computer/Personal Digital Assistant.

Capabilities and indications for use: Machine language translation uses computers to translate free speech from one language into another: for example Spanish into Ukrainian. A handheld computer with this technology will enable deployed medical personnel to communicate/interact with and provide immediate care to non-English-speaking patients (e.g., during humanitarian assistance operations, unconventional operations, etc.). This device will also enhance the situational awareness of military personnel, and improve the speed and precision in coalition/ally collaboration (and decisionmaking) via automated translingual access to Command, Control, Communications, Computers, and Intelligence (C4I).

User(s): Combat warfighter, medical personnel (medics, physician's assistant, and physicians) and other military personnel that may interact with an indigenous population (e.g., chaplains, military police, civil affairs).

First fielding date: July 2003.

Distribution: The device has been tested in Operation Enduring Freedom and Operation Iraqi Freedom with the civil affairs units, medical personnel, etc.

Training: The military personnel need to be trained on the system and the system needs to be trained to their voice.

Cube and weight: Height: 5.3 in; width: 3.3 in; depth: 0.62 in; weight: 6.7 oz, recognizer board: 9 oz.

Cost: $1,800 for each unit; the cost includes the cost of the rugged PDA and also the rugged recognizer speech board.

6. Liquid Tourniquet

Summary: A lightweight polymerizing gel that will be used for compressible hemorrhage or amputation. If a tourniquet is required to stop extremity bleeding, it will only be applied for the time necessary for placement of gel into/onto the wound surface and gel polymerization (less than 15 minutes). Expected to result in much greater survival and function of muscle and tissue currently lost by long-term placement (greater than 2 hours) of current tourniquet system. Will allow stabilization of wounds for several days under battle conditions.

Capabilities and indications for use: Will allow compressible hemorrhage to be buddy- or self-treated. Gel will be applied directly to wound and compressed by field dressing or by temporary use of standard one-handed tourniquet with placement of gel on stump and removal of tourniquet. Material will provide several days of wound stabilization and protection from environmental contamination.

User(s): Soldier, combat medic, PA, FST. Will be packaged as component of and distributed with field dressing and one-handed tourniquet.

First fielding date: 2010.

Distribution: One per current field dressing and tourniquet.

Training: Hands-on training will be required.

Cube and weight: Device will be less than 0.25 pound; one use disposable.

Cost: $10 for field dressing and $50 for tourniquet per use.

7. Lightweight Extremity Splint

Summary: The lightweight extremity splint will allow soldiers with immobilized and nondisplaced fractures to continue their mission and soldiers with serious open fractures to be stabilized and unit transportable for several days under battle conditions.

Capabilities and indications for use: The splint will be fabricated from new, lightweight material(s) and will be deployable far forward in the battle area. The field medic or "buddies" on the battlefield or medical officers at the forward surgical team, or equivalent, will use it for open fractures and external fixation splints. The lightweight extremity splint will enable the soldier with a single upper extremity fracture to remain functional, perhaps even operating an individual weapon until evacuation. A war fighter with a lower extremity fracture will be able to ambulate with crutches and perhaps one other person instead of requiring a stretcher and 2 or more stretcher bearers. In both cases, the functional capabilities of a team with an extremity fracture will be improved.

User(s): Buddy care, combat lifesaver, combat medic, PA, surgeon.

First fielding date: 2010.

Distribution: One arm and one leg splint per 10 soldiers.

Training: Hands-on training will be required. Device will be a balloon sleeve with a pressure limiting valve and self-contained flexible air pump.

Cube and weight: Device will be less than 0.25 pound; one use disposable.

Cost: $100/set (one leg/one arm).

8. IV Hemostatic Drug

Summary: An IV agent that will safely enhance the ability of the combat casualty with hemorrhage to form natural clots and stop hemorrhage on the battlefield.

Capabilities and indications for use: The hemostatic drug is an IV agent that will safely enhance the ability of the combat casualty to form natural clots and stop hemorrhage on the battlefield. The agent will effectively treat casualties who have experienced serious hemorrhage.

User(s): Combat medic, physician assistant, surgeon.

First fielding date: 2010.

Distribution: 2 doses per medic and PA, 20 per FST.

Training: Users must be trained in proper indications for use, i.e., uncontrolled, especially, noncompressible hemorrhage.

Cube and weight: 20 ml syringe per dose.

Cost: $500 per dose.

9. Intracavitary Hemostatic Agent

Summary: The intracavitary hemostatic agent will be provided in foam, gel, or liquid form that can be introduced into a body cavity via a large-bore needle (without surgery) to slow or stop internal hemorrhage.

Capabilities and indications for use: In the far-forward environment, the intracavitary hemostatic agent will be especially useful to stop internal bleeding.

User(s): Combat medic, PA, surgeon.

First fielding date: 2015.

Distribution: 2 doses per combat medic, 5 per PA, 20 per FST.

Training: Training in proper indications and techniques for use.

Cube and weight: 50 ml per dose, preloaded syringe; 4 oz per dose including packaging.

Cost: $400/dose.

10. Enzymatic Wound Debridement

Summary: A spray-on, self-limited enzymatic/chemical and analgesic debridement system for chemical and burn injuries prior to covering with a spray-on bandage.

Capabilities and indications for use: The spray-on enzymatic/chemical debridement system may be self- or buddy-applied and will enhance wound cleaning and stabilization for 2 or more days after injury. Debridement will be applicable to large and small wounds and may be used before application of or, perhaps, integrated with the spray-on bandage.

User(s): Soldier, combat lifesaver, combat medic, physician assistant, surgeon.

First fielding date: 2010.

Distribution: 50 ml tube per soldier and stored at first PA level.

Training: Minimal training requirement. Debridement will be self-limiting.

Cube and weight: 50 ml; flexible tube; less than 0.1 pound.

Cost: $10 per tube.

11. Battlefield Medical Information System Telemedicine (BMIST)

Summary: BMIST is a wireless hand-held assistant designed to record the essential elements of a medical history and physical examination and then provide the medical analysis and decision support for first responders. It uses a wireless, flexible, and scalable personal data assistant that can be used by military health care providers at all levels of care from the foxhole to the medical center. It is the ideal tool to meet the military objective of providing useful medical informatics and telemedicine support for first responders across the spectrum of military health care operations and continuum of support levels of care.

Capabilities and indications for use: BMIST enables first responders (and other health care staff) to quickly and accurately capture, integrate, transmit, and display data from medical histories/physical examinations, medical reference libraries, diagnostic and treatment decision aids, medical sustainment training, and medical mission planning using a wireless, hand-held assistant. To meet the needs of first responders with varying levels of expertise and experience, BMIST will support a user interface that includes help windows and decision rationale. BMIST will also provide the flexibility to adapt to evolving medical procedures and protocols, as well as to accommodate additional or new medical databases and mission requirements. When adequate communications are available, BMIST will support real-time "teleconsultation" between the first responder and expert medical staff (e.g., physician) residing in different locations.

User(s): Combat lifesaver, combat medic, PA, battalion/brigade surgeon.

First fielding date: Summer 2002 (initial prototype field tests).

Distribution: One per combat infantry medic.

Training: Minimal (estimated under 1 hour for untrained users, the interface is user friendly and is an intuitive part of their business process).

Cube and weight: The Pocket PC Platform is 5.3 in by 3.3 in by 6.2 in, 6.7 oz; BMIST is software.

Cost: Hand-held commercial $500 per unit, software undetermined (estimate under $100 per license if commercialized).

12. Advanced Resuscitation Fluid

Summary: A resuscitation fluid that sustains wounded soldiers and preserves organ integrity and function even in the face of small-volume fluid resuscitation and hypotension.

Capabilities and indications for use: The advanced resuscitation fluid will require less fluid to maintain critical levels of blood pressure and tissue perfusion. It will reduce the mortality and late morbidity associated with trauma and serious blood loss by reducing vascular injury and immune system activation caused by decreased blood perfusion and oxygen radical generation during tissue reoxygenation. The fluid will be well suited for small-volume resuscitation for trauma and blood loss with delayed evacuation for up to 72 hours.

User(s): Combat medic, PA, and surgeon.

First fielding date: 2015.

Distribution: 6 units of this resuscitation fluid will be distributed to each medic in the Future Force for far-forward resuscitation, 10 units to each battalion aid station, and 20 units to each FST.

Training: The advanced resuscitation fluid will be used as current resuscitation fluids so no additional training will be required.

Cube and weight: 500 cc bags weighing 0.5 kg, including packaging and administration set.

Cost: $50/500 ml unit.

13. Advanced Hemostatic Dressing

Summary: The advanced hemostatic dressing will stop lethal severe arterial or large venous hemorrhage within 2 minutes. In the far-forward environment, this will be most useful for compressible hemorrhage.

Capabilities and indications for use: The advanced hemostatic dressing will stop lethal severe arterial or large venous hemorrhage within 2 minutes. It may be applied externally or internally. It will be used in the far-forward environment, especially for compressible (external) hemorrhage, and in the FST.

User(s): Soldier, buddy aid, combat lifesaver, combat medic, PA, surgeon.

First fielding date: 2007.

Distribution: One per soldier, 5 per combat medic and PA, 20 per FST.

Training: Hands-on training for all users.

Cube and weight: 0.25 pound per dressing, size of current bandage. No maintenance requirement.

Cost: $100 per dressing.

14. Warrior Medic ("Biocorder")

Summary: A hand-held device used by combat medics to detect or collect and analyze physiological and metabolic information in combat casualties. The sensors and other capabilities of the Biocorder will interface with physiologic sensors that are part of the WPSM and will provide supplementary physiological data for use by the combat medic for casualty management. Results of analysis are displayed as well as the recommended actions to be taken by the medic.

Capabilities and indications for use: The Biocorder provides the combat medic with the capability to collect casualty data and provides assistance and guidance to the medic for best casualty management. The Biocorder will enhance casualty management far forward on the battlefield by providing real-time physiological and vital signs information to the medic. Return to duty of minor casualties will be accelerated. Evacuation demand will be reduced and/or more accurately targeted to appropriate casualties. The Biocorder will be capable of communicating with the physiological sensors in the WPSM. The Biocorder will monitor and log ECG, cardiac output, blood pressure, peripheral resistance, heart rate, respiratory rate, oxygen saturation, body temperature, acoustic heart and lung sounds and blood chemistries. The Biocorder will be equipped to drive miniature IV infusion pumps based on blood pressure for both resuscitation and drug infusion.

User(s): Combat medic, PA, surgeon, nurses.

First fielding date: 2015.

Distribution: One per combat medic, 3 per FST, 10 per holding company, 1 per ambulance, 50 per CSH.

Training: Physicians and nurses, combat medic (2 hrs), unit-level maintenance (2 hrs), depot-level maintenance (5 hrs).

Cube and weight: Hand held 6 in by 6 in by 2 in (.04 cu. ft) weighing < 1 pound.

Cost: 5,000 units * $2,000/unit = $10M.

15. Hemoglobin-Based Oxygen Carrier

Summary: The hemoglobin-based oxygen carrier will provide a temperature-stable alternative to red blood cells.

Capabilities and indications for use: The hemoglobin-based oxygen carrier will provide an alternative to red blood cells that can be deployed far forward. The product will remain stable and functional in a wide range of ambient temperature conditions and can be rapidly administered to provide replacement of oxygen-carrying capacity in casualties who have experienced significant blood loss on the battlefield. The product will effectively stabilize patients with severe blood loss during extended evacuation delay.

User(s): Combat medic, PA, surgeon.

First fielding date: 2007.

Distribution: 4 units per combat medic and PA, 50 per FST.

Training: Training in indications for use and in intravenous access and administration.

Cube and weight: Each unit with administration set is 0.75 pound with packaging.

Cost: $400/unit.

16. Field Therapy Utility Pack for Laser Eye Injury

Summary: Field therapy utility pack containing a diagnostic card and therapeutics that can be easily administered by a combat medic immediately after injury to prevent secondary retinal degeneration and vision loss.

Capabilities and indications for use: Provides diagnostic tools for rapidly assessing injury severity, retinal location, and presence of hemorrhage. Provides treatments that can curtail degenerative processes and conserve vision.

User(s): Combat medic.

First fielding date: 2009.

Distribution: One kit per combat medic.

Training: Combat medic requires training to use diagnostic tools and administer therapeutic agents.

Cube and weight: About 1 pound.

Cost: Unknown.

17. Digital Information and Communications System

Summary: The goal of the digital information and communications system is to create and support a medical global information grid that will extend far forward into a combat zone.

Capabilities and indications for use: The digital information and communications system consists of two major components: the Special Medical Augmentation Response Team for Medical Command, Control, Communications and Telemedicine (SMART MC3T) package and Warfighter Information Network—Proof of Concept (WIN-POC). The SMART MC3T package will enable soldiers to establish medical communications (e.g., self-sufficient Internet and telephony coverage) capability in remote areas where communication infrastructure is unavailable or not functional. This capability will enable support to deployed specialty teams (e.g., trauma/critical care, stress management) and provide on-scene commanders with a real-time "reach-back" capability to medical specialists and/or commanders. This global information grid will be extended by WIN-POC, which is a mobile, powerful communications node mounted on a field vehicle. WIN-POC will provide seamless, broadband communications from forward-deployed areas to Theater and National Military Command Headquarters and Military Health System Medical Centers worldwide. It will function as a platform for multiuser broadband medical command-and-control communications and telemedicine connectivity. The entire system provides a seamless, modular, expandable, and secure manner in which to rapidly acquire, transfer, and display critical medical and logistical information in a battlefield (or other operational) environment.

User(s): Combat medic, nurse, PA, battalion/brigade surgeon, medical support personnel, and other medical commanders.

First fielding date: November 1999–October 2000, initial acquisition and integration of digital communication systems; October 2000–November 2001, Technology Integration testing and evaluation at AMEDD Exercise 2000, TX and Joint Readiness Training Center Advanced Warfighter Experiment, Fort Polk, LA; November 2001–October 2008, identify, acquire, and integrate wireless technologies to facilitate improvement of the quality of care provided by AMEDD deployable organizations to forward-deployed military personnel.

Distribution: Forward-deployed medical units for the SMART MC3T; and brigade support areas for the WIN-POC.

Training: 5 days training for the SMART MC3T; 2 weeks to 30 days for the BRSS; 3 months to 1 year for the WIN-POC.

Cube and weight: 76 pounds, 6 cubes for the complete set (for SMART MC3T).

Cost: SMART MC3T: $385K FY02, $269K FY03–06; WIN-POC: $300K FY02, $350K FY03–06; BRSS: $150K per unit; WIN-POC: approximately $1.1M each vehicle.

18. Transportable Automated Life Support System (TALSS)

Summary: A portable, self-contained, lightweight (<40 pounds), protected environment for one casualty, capable of providing sustained monitoring and automated life support for combat casualties for up to 72 hours on the battlefield.

Capabilities and indications for use: The TALSS provides automation of life support functions, providing computer-driven closed-loop control of ventilation, fluid, drug, and oxygen administration. The system optimizes the patient's treatment, while minimizing resource utilization. The automated capability of the TALSS is a force multiplier for the small FST staff and for the 91W staffing the ambulance by freeing them to care for other casualties once they have stabilized a seriously injured casualty. The system will also provide data-logging and telecommunication capability to facilitate record keeping and to enable real-time communication of patient data to the receiving hospital for assistance with monitoring and decisionmaking from a remote location. The TALSS will provide increased and improved holding capability at the FST as well as extended critical-care capability within the ground ambulance platform by providing automated life support for the critically injured awaiting and during evacuation.

User(s): PA, surgeon, medics (91W), nurses (91C).

First fielding date: 2015.

Distribution: 4 per FST, 10 per holding company, 10 per ambulance company, 30 per CSH.

Training: Medical personnel (1 hr), unit-level maintenance personnel (2 hrs), depot-level maintenance (24 hrs).

Cube and weight: 40 pounds, 5 cu ft., 4 cu ft. resupply bag.

Cost: 500 units * $100K each = $50M.

19. Teleconsultation/Teledermatology

Summary: Teleconsultation is the application of information and telecommunications technologies to facilitate delivery of medical treatment across all barriers. Teledermatology is a proven, clinically focused teleconsultation system designed to enable dermatology interactions between various parties located anywhere in the world.

Capabilities and indications for use: Dermatology is one of the most frequently performed telemedicine consultations within (and outside of) the Army. Currently, initial teledermatology prototypes have been deployed at 4 Army medical centers and over 60 Defense Department clinics worldwide. An advanced or "next generation" system will facilitate secure, more efficient, real-time and/or store and forward distance consultation and treatment. A more portable teledermatology system will better serve highly mobile, dispersed forces engaged in a variety of operations (e.g., humanitarian assistance, unconventional warfare), thereby facilitating force readiness and effectiveness, and in general, promote (force) health protection.

User(s): Combat medic, nurse, PA, battalion/brigade surgeon, dermatologist (specialty).

First fielding date: April 1999.

Distribution: 4 Army medical centers and over 60 Defense Department clinics worldwide.

Training: User training on software application and digital camera photography is provided onsite by a local trainer.

Cube and weight: Commercial-off-the-shelf/government-off-the-shelf software installed on COTS central processing unit with current browser capability and digital camera.

Cost: Workstation: ~$4,000 (includes one workstation, one digital camera, and software). Server: ~$12,000 (includes one server and software).

20. High-Intensity Focused Ultrasound

Summary: The high-intensity focused ultrasound device will provide cauterization of both internal and external bleeding structures without damaging overlying tissues. The device will feature a computerized Doppler guidance system designed to locate and focus on hemorrhaging structures.

Capabilities and indications for use: The high-intensity focused ultrasound device functions by focusing ultrasonic waves to cause cauterization of bleeding structures without damaging overlying or surrounding tissues. The hand-held device features a computerized Doppler guidance system designed to locate and focus on hemorrhaging structures. In the far-forward environment, the device will have the capability to successfully manage both external and internal bleeding.

User(s): PA, surgeon.

First fielding date: 2012.

Distribution: One per battalion aid station, 2 per FST.

Training: Proper indications and techniques for use.

Cube and weight: 1 cubic foot per unit, 15 pounds per unit.

Cost: $50,000 per unit.

21. Forward-Deployable Digital Medical Treatment Facility (FDDMTF)

Summary: The FDDMTF will provide a lightweight, wireless, digitized forward surgical capability that can be deployed across a range of military operations.

Capabilities and indications for use: The FDDMTF supports Army Transformation by reducing weight and cube, airframe requirements, providing essential care in theater, and reach-back capabilities. Utilizing a 10–25 bed Air Force Expeditionary Medical Support Unit with digitized enhancements as the prototype "core," the FDDMTF provides a lightweight, wireless, digitized forward surgical capability that can be rapidly deployed to (medically) support a range of military operations. The FDDMTF provides 24-hour sick call and emergency medical care plus the following capabilities: medical command and control, preventive medicine, trauma resuscitation and stabilization, limited general and orthopedic surgery, critical care, primary care, and limited ancillary care to a population at risk of 2,000 to 3,000.

User(s): Combat medic, nurse, PA, battalion/brigade surgeon, and various medical support personnel.

First fielding date: 2004.

Distribution: One per Stryker Brigade Combat Team.

Training: Training required for shelter establishment, operation of the communications enhancements, and the use of wireless, digitized medical equipment. The 91W program coupled with upgrades in the biomedical maintenance course would provide the soldiers with the necessary clinical background to function effectively in the facility.

Cube and weight: 50,000 square feet, on 26–30 463L pallets (13K forklift). Figures based on equipment minus transportation assets.

Cost: $1.9M.

APPENDIX E

Casualty Tracking Worksheet Excerpt

The following page contains an extract of casualty tracking worksheets given to workshop teams. The worksheets provided a comprehensive listing of all casualties and included

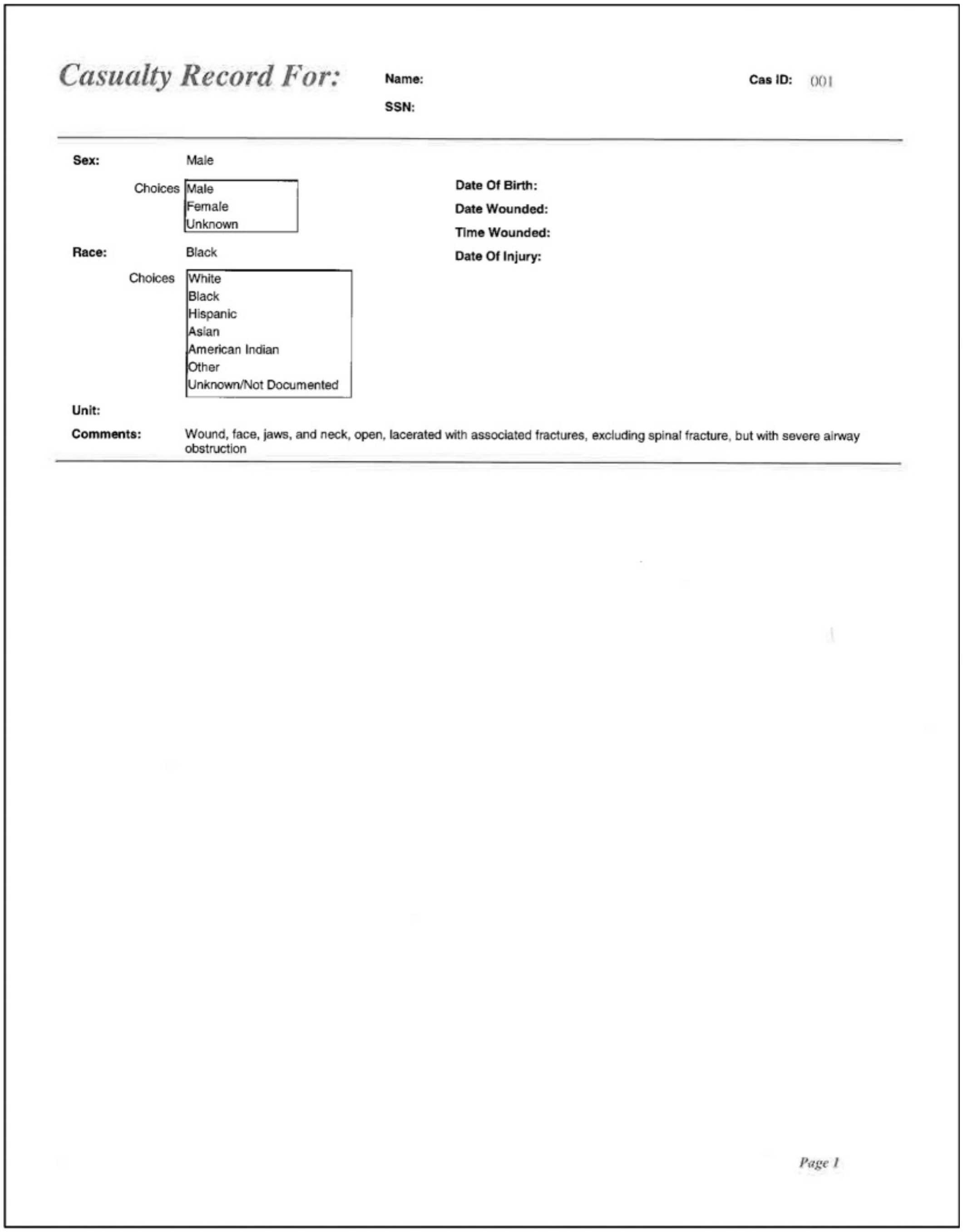
- The time of wounding for each casualty;
- The location of the casualty;
- The location of the company headquarters and the battalion aid station; and
- A description of the injury sustained by the casualty (including a treatment brief and patient condition code).

Time Wound Occurred (min after H Hour)	**Casualty Number**	Locations: Casualty Company Battalion		Treatment Brief #/ Patient Condition		Unit	Time Start Treatment by Medic (H+min)	Time End Treatment by Medic	Identity of Evac Asset Committed	Time Start Evac	Time End Evac	Time Start Treatment at BAS	Time End Treatment at BAS	Identity of Evacuation Assets Committed	Time Start Evac	Time End Evac	Time Start Treatment at Medical Company/ FST	Time End Treatment at Medical Company/ FST	Prognosis and Comments - Also Complete Trauma Registry Form
23	**1**	49234 70217 69836	16206 03646 06397	42	WOUND SHOULDER GIRDLE OPEN WITH BONE INJURY SEVERE - JOINT INVOLVEMENT	1st PLT/ Recon Det/3rd CA BN													
41	**2**	14371 07321 09983	53003 51889 54531	3	CEREBRAL CONTUSION CLOSED WITHOUT NONDEPRESSED LINEAR SKULL FRACTURE SEVERE - LOSS OF CONSCIOUSNESS GREATER THAN 24 HOURS WITH FOCAL NEUROLOGICAL DEFICIT	1st PLT/ B Co. (INF)/ FSB													
75	**3**	17536 19395 19013	29782 47477 47114	17	WOUND FACE JAWS AND NECK OPEN LACERATED WITH ASSOCIATED FRACTURES EXCLUDING SPINAL FRACTURES SEVERE - WITH AIRWAY OBSTRUCTION	B Section/ 1st ADA BN													
75	**4**	17699 18509 19013	29495 26501 47114	9	CEREBRAL CONTUSION WITH OPEN SKULL FRACTURE SEVERE - WITH INTRACRANIAL FRAGMENTS AND/OR DEPRESSED SKULL FRACTURE; EYELID AND EYEBALL LACERATION WITH RETAINED INTRAOCULAR FOREIGN BODY	1st PLT / B Co./ 1st CA BN													
75	**5**	17704 18509 19013	29491 26501 47114	43	WOUND SHOULDER GIRDLE OPEN WITH BONE INJURY MODERATE - NO JOINT INVOLVEMENT	1st PLT / B Co./ 1st CA BN													
75	**6**	17704 18509 19013	29491 26501 47114	124	WOUND THIGH OPEN LACERATED PENETRATING PERFORATING WITH FRACTURE AND VASCULAR INJURY LIMB SALVAGEABLE	1st PLT / B Co./ 1st CA BN													
120	**7**	23271 10772 10060	51517 47931 51934	52	WOUND FOREARM OPEN LACERATED PENETRATING WITHOUT BONE NERVE OR VASCULAR INJURY MODERATE - NOT REQUIRING MAJOR DEBRIDEMENT	3rd PLT/ D Co./ 2nd CA BN													

APPENDIX F

Trauma Registry Form

The following pages contain facsimiles of the trauma registry form used in the workshop.



Casualty Record For: Name:
SSN:
Cas ID: 001

Sex: Male
Choices: Male / Female / Unknown

Date Of Birth:
Date Wounded:
Time Wounded:
Date Of Injury:

Race: Black
Choices: White / Black / Hispanic / Asian / American Indian / Other / Unknown/Not Documented

Unit:
Comments: Wound, face, jaws, and neck, open, lacerated with associated fractures, excluding spinal fracture, but with severe airway obstruction

Page 1

Casualty Record For:

Name:

SSN:

Cas ID: 001

Time of Arrival:

Level Of Care: 0

Date Arrived:

Time Arrived:

MEDEVAC: Urgent

Choices: Priority, Emergent, Urgent, Routine, Unknown

General Condition: Alert

Choices: Alert, Responds to Verbal Stimuli, Responds to Pain, Unresponsive, ATLS, Unknown

TriageCategory:

Choices: Immediate, Delayed, Routine, Expectant, Unknown

CPR Response:

Choices: Yes, No, Unknown

Unassist Respiratory Rate/Min: 40

Assist Respiratory Rate/Min:

Temp Fahrenheit: 0

Pulse Beats/Min: 130

Systolic BP: 80

Diastolic BP: 40

Eye Opening Score:

Choices:

4	4 = Spontaneous	Adult
3	3 = To Verbal Commands	Adult
2	2 = To Pain	Adult
1	1 = No Response	Adult

Eye Opening:

Verbal Response Score:

Choices:

5	5 = Oriented and Converses	Adult
4	4 = Disoriented and Converses	Adult
3	3 = Innappropriate Words	Adult
2	2 = Incomprehensible Sounds	Adult

Verbal Response:

Motor Response Score:

Choices:

6	6 = Obeys	Adult
5	5 = Localizes Pain	Adult
4	4 = Flexion - Withdrawal	Adult
3	3 = Flexion - Abnormal	Adult

Motor Response:

GCS Total: 0

GCS Qualifier Code:

Choices: Intubated, Intubated and chemically paralyzed, Sedated chemically, No interventions

Revised Trauma Score: 3.361

Transport:

- ☐ Walked Self
- ☐ Walked Aided
- ☐ Carried Hand
- ☐ Carried Stretch
- ☐ Cas Evac Ground
- ☐ Cas Evac Air
- ☐ Cas Evac Air Rotor
- ☐ Cas Evac Air Fixed Wing
- ☐ Med Evac Ground
- ☐ Med Evac Air
- ☐ Med Evac Air Rotor
- ☐ MedEvac Air Fixed Wing

Procedures(1):

- ☐ Procedures None
- ☐ Airway Mgt
- ☐ No Airway Placed
- ☐ Oral Airway
- ☐ Oral ETT
- ☐ Nasal ETT
- ☐ Breathing
- ☐ Mouth To Mouth
- ☐ Bag And Mask
- ☐ Unassisted
- ☐ Mechanical Ventilation
- ☐ Unknown
- ☐ Haemorrahage Control
- ☐ Haemorrahage Control None
- ☐ Haemorrahage Control Field Dressing
- ☐ Haemorrahage Control Direct Pressure
- ☐ Haemorrahage Control Fibrin Bandage Foa
- ☐ Haemorrahage Control Tourniquet

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Casualty Record For:

Name:

SSN:

Cas ID: 001

☐ ETT Not Specified
☐ EOA Esophageal Obturator Airway
☐ Tracheostomy
☐ Cricothyrotomy
☐ Unintentiona lEsophageal Intubation

☐ Line Insert
☐ LineInsert IV
☐ Line Insert Central
☐ Line Insert Interosseous
☐ Line Insert None
☐ Line Insert Unknown

Time Tourniquet Applied

Procedures(2):

☐ Mast

Mast:

Choices: Applied / Inflated / None / Unknown

☐ Chest Wound Mgt
☐ None
☐ Non Airtight Dressing
☐ Airtight Dressing
☐ Needle Thoracostomy
☐ Chest Tube

☐ Splint
☐ None
☐ Cervical Collar
☐ Spinal Board
☐ Improvised Spinal
☐ Splint Formal Extremity
☐ Improvised Extremity
☐ Other
☐ tUnknown

☐ Wound Care
☐ None
☐ Cleaning
☐ Improvised Dressing
☐ Sterile Dressing
☐ Burns Dressing
☐ Other
☐ Unknown

Resuscitation Fluids:

☐ Crystalloids
Amount:
Choices: None / <500cc / 500-2000cc / >2000cc

☐ Colloids
Amount:
Choices: None / <500cc / 500-2000cc / >2000cc

☐ Blood
Amount:
Choices: None / <500cc / 500-2000cc / >2000cc

☐ Blood Sub
Amount:
Choices: None / <500cc / 500-2000cc / >2000cc

Drugs:

Drugs/Routes/Dates/Times:

Drug:	Route:	Date:	Time:

Resuscitative Surgery:

Surgical Find:

☐ Debridement
☐ Fracture Stabilization
☐ Amputation
☐ Laparotomy
☐ Thoracotomy
☐ Neck Exploration
☐ Craniotomy
☐ Hemorrhage Control
☐ Other

Surgical Proc Specify

OR Start Date

OR Start Time

OR End Date:

OR End Time:

Diagnosis:

☐ Head:

☐ Pelvis:

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Casualty Record For: Name: SSN: Cas ID: 001

☐ Neck:		☐ Leg:	
☐ Face:		☐ Foot:	
☐ Chest:		☐ Arm:	
☐ Abdomen:		☐ Hand:	

Complications:

☐ ARDS	☐ Disseminated Fungal Infection	☐ Loss Of Operative Reduction/Fixation	☐ Progression Of Orig Neuro Ilnsult
☐ Aspiration Pneumonia	☐ Dehiscence Evisceration	☐ Myocardial Infarc	☐ Pulmonary Embolus
☐ Bacteremia	☐ Empyema	☐ Pancreatitis	☐ Renal Failure
☐ Cardiac Arrest	☐ Esophagea Intubation	☐ Pneumonia	☐ Urinary Tract Infection
☐ Coagulopathy	☐ Hypothermia	☐ Pneumothorax	☐ Wound Infection
☐ Compartment Syndrome	☐ Intra-Abdominal Abscess	☐ Skin Breakdown	☐ Other
☐ DVT Lower	☐ Jaundice	Specify:	

Outcome:

Date Disposition:

Discharge Disposition:

Choices

- KIA
- DOW
- Return to Duty
- Home
- Transfer to Other Hospital
- Jail
- Nursing Home
- Home Health
- Rehabilitation Center
- Other

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