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TECHNICAL REPORT

Medical Risk in the Future Force Unit of Employment

Results of the Army Medical Department Transformation Workshop V

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Prepared for the United States Army

ARROYO CENTER and RAND HEALTH

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Summary

This report documents the Army Medical Department's continuing process of identifying medical issues in the Army's transformation to the Future Force. It contains an assessment of the AMEDD Transformation Workshop (ATW) V; describes the workshop's organization, objectives, scenario, and analysis methodology; and provides observations and conclusions.

The purpose of this workshop was to continue the assessment, begun in ATWs I–IV, of the medical risks associated with emerging Army operational concepts and the capacity of the AMEDD to mitigate these risks. ATWs I–III focused on medical risk in a Unit of Action (UA) within a theater that had a defined echelons-above-UA Health Service Support (HSS) system (a 44-bed Combat Support Hospital [CSH]). Based in part on these initial workshops, the AMEDD determined that a 44-bed CSH would likely be insufficient, and it set out to determine what HSS system would be required at echelons above UA. ATW IV assessed the medical risk and demand on an echelons-above-UA HSS system that 76 casualties from a single UA would create during a simulated 12-hour battle. The principal focus of ATW V was to continue the process of establishing the casualty demand data that must be addressed by the echelons-above-UA HSS system. It involved four UAs (and supporting units of employment [UE]) with 429 casualties over a 100-hour simulated battle. Thus, the principal purpose of ATW V 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 across 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.

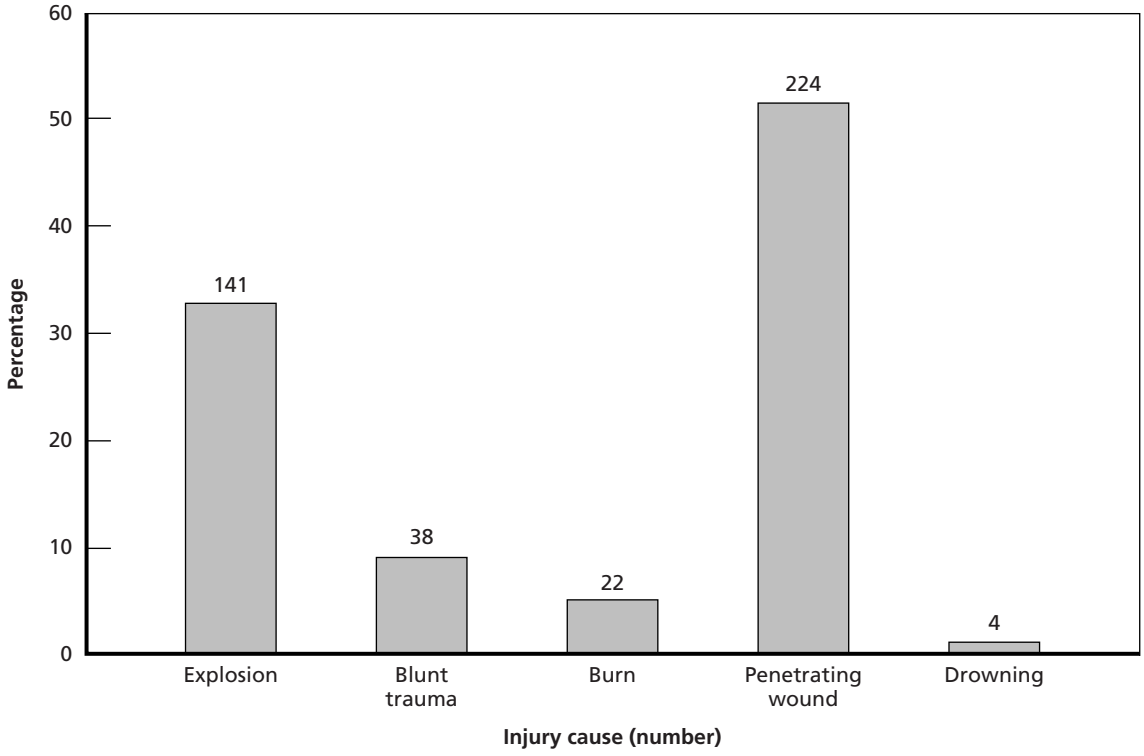
AMEDD Transformation Workshop V

In collaboration with the Center for AMEDD Strategic Studies, RAND designed, organized, facilitated, and provided analytic support to the fifth in a series of ATWs, conducted from 25–28 May 2004. The workshop was supported by subject matter experts (SMEs), who examined the ability of an envisioned UA HSS structure to support Future Force combat operations, as employed in a scenario provided by the U.S. Army Training and Doctrine Command (TRADOC).

Casualties Were Determined Based on an Army Scenario and Simulation Results

Casualty data for ATW V were provided by the AMEDD, which derived it from simulation casualty data, based on a Caspian 2.0 scenario, provided by the TRADOC Analysis Center (TRAC).[1] The approximately 100-hour battle resulted in 429 casualties among the four UAs and soldiers from the UE_x and UE_y in the UA's area of operations (AO).[2] Figures S.1 and S.2 show the distributions of the causes of the casualties and their wound types, respectively.

Figure S.1
Causes of Injuries of 429 Casualties

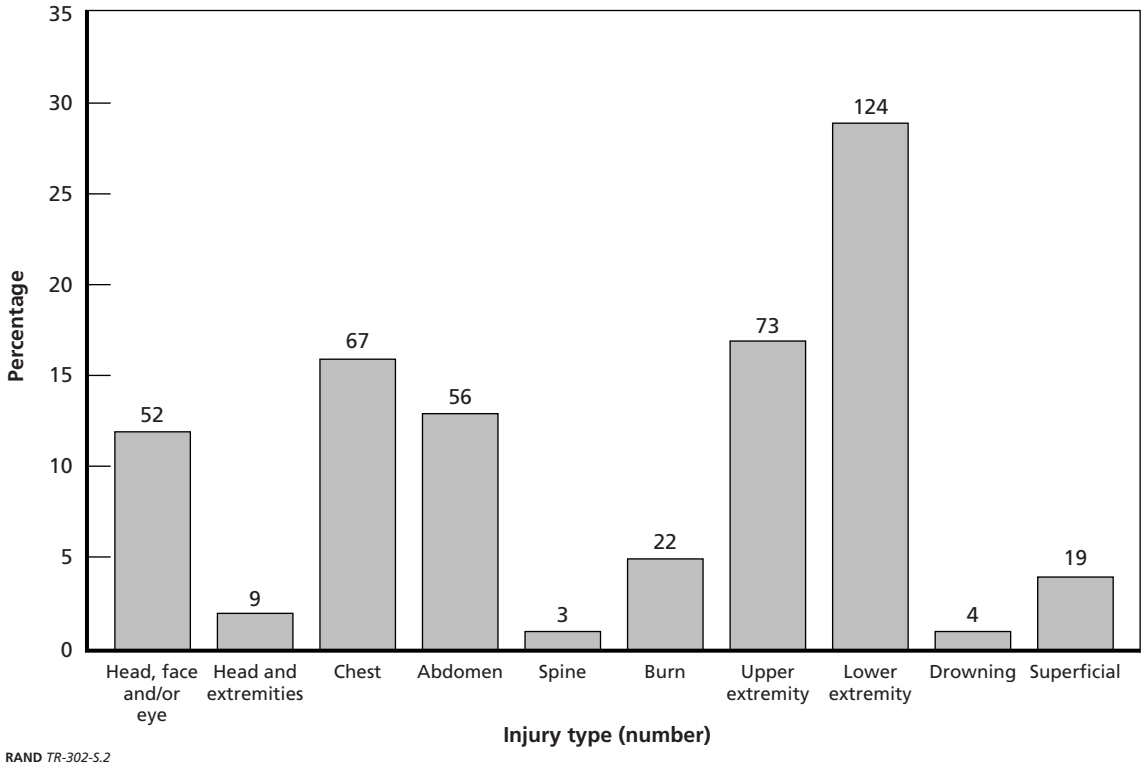


RAND *TR-302-S.1*

[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] UE_x and UE_y are the two command echelons above the UA.

Figure S.2
Types of Injuries of 429 Casualties



RAND *TR-302-S.2*

The simulation for ATW V depicted Future Combat System (FCS)-equipped maneuver UAs, operating as part of a UE_x and UE_y, conducting an attack to isolate the enemy's capital city and defeat enemy forces as part of the overall campaign objective of reinstating a legitimate government. The UE_y operated in a physical battlespace of over 500 kilometers by 225 kilometers.

The results of this UE-level simulation were the most current available for ATW V. How representative they are of what might occur in future operations is unknown, given the limited number of Army Future Force simulations conducted as of time of ATW V. More simulations are necessary to validate and expand the utility of these outcomes for Army force structuring and concept development efforts.

ATW V Questions and Answers

The workshop SMEs were 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 required further evacuation and treatment at echelons above the UA?

What Was the Disposition of Casualties (Casualty Outcomes) at the End of the Scenario?

The Vector-in-Command (VIC) simulation generated 1,102 loss-producing events that resulted in 429 wounded-in-action (WIA) casualties during the approximately 100-hour battle. The percentages of casualties who died of wounds (DOW) and who died prior to reaching a medical treatment facility (killed in action [KIA]) in ATW V were similar to those in previous workshops, even though they were based on different scenarios (Johnson and Cecchine, 2004). This similarity is likely because of the robustness (or lack thereof) of the UA HSS system, the types of combat operations depicted in the scenarios, and similar (and plausible) estimations of casualty distributions based on the simulations.

A significant difference from past workshops was the higher rate of limb loss estimated in ATW V. While some of this difference may be attributed to better methods of estimation, because ATW V participants were directed to document likely amputations more clearly than in past workshops, it is nonetheless worth noting. Limb loss occurred in 58 casualties, representing 13.5 percent of all casualties. A portion of these limb losses were likely unpreventable, based on the description of their wounds. However, 22 casualties were described as having salvageable limb wounds but were amputated nonetheless, representing 38 percent of the total estimated limb loss events.

What Was the Status of the HSS System at the End of the Scenario?

As in previous workshops, the HSS systems in the UAs operated at or near capacity for most of the duration of the scenario. Surgical capabilities were the most taxed: UA Forward Surgical Teams (FSTs) performed 118 surgeries, totaling approximately 114 surgical hours, not including pre- or post-operative procedures. The medical demand, however, was not evenly distributed among the UAs, ranging from 18 to 46 cases among them. Not surprisingly, the FST that performed the most surgeries also experienced the greatest delay times from wounding to surgery. To handle surges in demand, the workshop SMEs carefully managed the triage of surgical patients in consideration of the austere surgical capability, often "bumping" patients in favor of others more critically wounded. This practice, enabled by remote triage capabilities, likely contributed to the elevated risk of limb loss, as a result of delayed surgery of vascular extremity wounds in favor of life-saving surgery for another casualty.

Evacuation assets were also used near capacity during the scenario. The dispersion of the battlefield and number and timing of casualties requiring evacuation and care contributed in some cases to long delays before a casualty reached surgery (for those requiring surgery); however, the surgical load also contributed to this delay, and it is difficult to determine precisely the contribution of evacuation asset availability.

How Many Casualties Required Further Evacuation and Treatment at Echelons Above the UA?

Similar to ATW IV, approximately two-thirds of casualties required evacuation to higher echelons. Of these, nearly 80 percent were classified as "urgent" or "priority," and approximately two-thirds would require surgery at echelons above the UA. Partially because of an early peak in the casualty flow in the scenario, the number of casualties requiring evacuation from the UAs similarly peaks early in the battle. This trend suggests the need for robust HSS capabilities at echelons above the UA fairly early in this scenario.

Workshop Observations and Conclusions

Observations

The complete effect of the casualties on the HSS system is not known at this juncture, because ATW V could examine the effect only on the UA system, given that the HSS system at higher echelons has yet to be fully developed. Similarly, it is important to note that the final disposition of those casualties who are awaiting evacuation to echelons above the UA is not completely certain. In the time beyond H+100 hours,[3] the percentage of DOW casualties likely will either remain the same or increase, given that some seriously wounded casualties awaiting evacuation could die during the wait. In other words, nearly two-thirds of the casualties were determined to be ready for evacuation to higher echelons, and their disposition will necessarily depend upon capabilities at those echelons.

This workshop was designed primarily to analyze the residual demand that multiple UAs will place on the echelons-above-UA HSS system for a specific scenario. Consequently, if a UA could not adequately deal with a casualty, it was assumed that the casualty would be evacuated to an echelons-above-UA HSS system component that could. The HSS system in the UAs was heavily taxed, and the residual demand for evacuation and care at higher echelons was similarly significant.

Conclusions

ATW V provided valuable insights into the ability of AMEDD's envisioned Future Force HSS system to support a Future Force operation. This workshop also continued the process, begun in ATW IV, of determining the demand that an echelons-above-UA HSS system will be required to meet in Future Force operations. Although the results and insights gleaned from ATW V 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 postulated Future Force operations. The team members stressed that further simulations of additional scenarios of evolving Future Force concepts are needed to ensure that the AMEDD can articulate to the Army the medical risks involved in those 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 an HSS system capable of conserving the fighting strength of the Army's Future Force.

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[3] The *DOD Dictionary of Military and Associated Terms* (Joint Doctrine Division, 2005) defines H-hour as "the specific hour on D-day at which a particular operation commences."