A Case Study in Revamping Military Medical Evacuation Education for Large-Scale Combat

SFC Ronald Leek, USA[1]*; CPT Mahdi Al-Husseini, USA*[1,2]*; CPT Michael Knapp, USA*[1]

ABSTRACT

Military medical evacuation education must adapt to meet rapid changes in the operational environment experienced during the Russia-Ukraine War and expected in the Indo-Pacific. The Medical Evacuation Doctrine Course is the U.S. Army's preeminent course on intra-theater medical evacuation and has been revamped to ensure the curriculum is relevant, useful, rigorous, and modern in preparation for large-scale combat operations in multiple theaters. Course changes include a renewed curriculum focus on air-ground medical evacuation integration and casualty evacuation, the development and deployment of a novel medical evacuation wargaming initiative, adding intelligence and operations staff roles to the final practical exercise, a return to analog planning products, and establishing theater-specific training days with targeted readings, discussions, guest speakers, and wargames. These revisions ensure that the next generation of military medical planners is adequately equipped to meet the demands of complex, multidomain operations in future conflicts. Additionally, this case study serves as a template for other military medical courses looking to realign their curricula accordingly.

INTRODUCTION

Warfare is rapidly evolving. Military medical evacuation education must evolve with it. Large-scale combat operations (LSCO) are characterized by peer adversaries competing across multiple domains in high-intensity conflicts at a massive scale. Large-scale combat operations environments are austere and contested. The future employment of forces is therefore expected to be distributed, expeditionary, and joint, with operations executed across vast distances, often without established infrastructure or guaranteed access to airspace. Military medical planners are reevaluating approaches to medical evacuation developed for the counterinsurgency fight of yesteryear, which are conditioned on air supremacy and predictable logistics. Emerging enemy threats, geographic and environmental constraints, substantially higher casualty estimates, and degraded communications severely limit medical evacuation platform mobility on the battlefield and complicate established patient regulating processes. This article documents how the U.S. Army's Medical Evacuation Doctrine Course (MEDC) has pursued several initiatives to ensure the next generation of military medical planners, air and ground ambulance operators, and medical operations officers can rise to meet these challenges, preserve combat power, enable ground force movement and maneuver, and save lives. Throughout, we highlight the inherent complexity of medical evacuation in contested environments and underscore the need for a corresponding education that is relevant, useful, rigorous, and modern.

COURSE BACKGROUND

MEDC is the only U.S. Army course dedicated to planning intra-theater medical evacuation for a variety of operating environments. This 10-day course is open to all components of the U.S. Army and may be attended by officers (O1-O5), warrant officers (WO1-CW5), and noncommissioned officers (E6-E9). Medical Service Corps officers wishing to become an aeromedical evacuation officer (67J) must attend the course to meet the area of concentration qualifications. Warrant officers serving in the National Guard and assigned to a medical evacuation company must be qualified to the fifth digit of their military occupation specialty to receive further promotion, which MEDC provides to them through the additional skill identifier (ASI) H4. The course is also open to U.S. Air Force, U.S. Navy, U.S. Coast Guard, and allied nation medical personnel.

MEDC has spent the last 2 decades preparing 67J and warrant officer students to plan and perform intra-theater aeromedical evacuation operations. Aeromedical evacuation via rotary-wing platforms was the primary means of intra-theater medical evacuation in Iraq and Afghanistan, and therefore the crux of the course. The first 5 days of MEDC were wholly didactic, with numerous PowerPoint presentations and guest speaker briefs, and culminated in a 75-question open-book exam. The last 5 days were dedicated to conducting a single practical exercise (PE), in which students were assigned roles to develop a health service support plan for a brigade operation. The PE culminated in the students briefing a senior leader who acted as the brigade commander. On the backdrop of the U.S. Army's continued transition away from the counterinsurgency doctrine that characterized operations in Iraq and Afghanistan, MEDC too required a substantial transformation and

[1]Medical Evacuation Doctrine Course, Department of Aviation Medicine, Fort Novosel 36362, AL, United States

[2]Aeronautics and Astronautics Department, Stanford University, Stanford 94305, CA, United States

The views expressed are solely those of the authors and do not reflect the official policy or position of the U.S. Army, U.S. Navy, U.S. Air Force, the Department of Defense, or the U.S. Government.

Corresponding author: Mahdi Al-Husseini (mah9@stanford.edu).

doi:https://doi.org/10.1093/milmed/usaf344

curriculum revamp for LSCO. We introduced 4 lines of effort (LOEs): relevance, utility, rigor, and modernity, to guide updates to MEDC lessons, discussions, and activities in support of the future fight. These LOEs are nested within the Army Surgeon General's vision for the Army Medicine of 2028, which is "ready, reformed, reorganized, responsive, and relevant providing expeditionary, tailored, medically ready, and ready medical forces to support the Army mission."[1] **Figure 1** visualizes the original and revamped MEDC timelines. The newly updated MEDC encourages students to think critically about medical evacuation problems through the lens of doctrinal constructs and techniques, while also directly presenting the problems and shortcomings of current practice to facilitate classroom discussion. MEDC highlights the critical role military medical planners must play in keeping the pace with rapid changes on the battlefield and innovating, lest resources be divested and mistakes of the past repeated.

LOE 1: Relevance

LOE 1 aligns medical evacuation lessons, discussions, and activities with expectations of future conflict. The course's short length requires instructors to prioritize the most critical material. Specific classes were targeted for aggregation to create space in the training calendar for new lessons and discussions. For example, Medical Company (Air Ambulance) Operations, General Support Aviation Battalion, Roles and Training of the Critical Care Flight Paramedic, and Rescue Hoist were originally individual lessons designed to provide 67J students insight into air ambulance company operations and capabilities. These lessons collectively took more than 6 h to teach and were mostly contextualizing in nature. Although still useful, the heavy focus on an intra-theater aeromedical evacuation masked substantial ground medical evacuation and casualty evacuation integration requirements. By combining the air evacuation material into a period of 3 h, the course instructors were able to introduce a new lesson on casualty evacuation. The casualty evacuation lesson introduces requirements for planning and coordinating casualty evacuation, different levels of casualty evacuation support, multi-modal casualty evacuation platforms, and casualty evacuation during mass-casualty events as described in Army Techniques Publication 4-02.13.[2] Teaching medical planners to integrate casualty evacuation into a health service support plan will support the maneuver units ultimately responsible for planning and executing casualty evacuation operations in an environment that is expected to strain current medical evacuation capabilities.

LOE 2: Utility

A driving force in the curriculum revamp is ensuring course content provides useful knowledge and practical skills with real-world application for a wide audience. LOE 2 pursued the development of (1) useful digital and analog course products and (2) interactive activities that enable group learning and address specific medical evacuation tasks. Before the MEDC revamp, the PE senior leader brief was conducted exclusively using PowerPoint to convey and display information. Although technically sufficient, reliance on a centralized digital deck permitted students to plan in isolation and neglected the types of analog products commonly used in austere environments. Students often failed to coordinate with other medical sections, and only when the class conducted a lone, late rehearsal would the lapse in synchronization be realized. A course priority became the provision and employment of high-quality analog products. Students are now provided a large canvas map of the PE area of operations and custom unit symbols. The minimum requirement for the senior leader brief is the use of these analog products, with the option to include digital products as a supplement. Coordination between sections improved immediately. Students can now visualize how each section plans in real time;

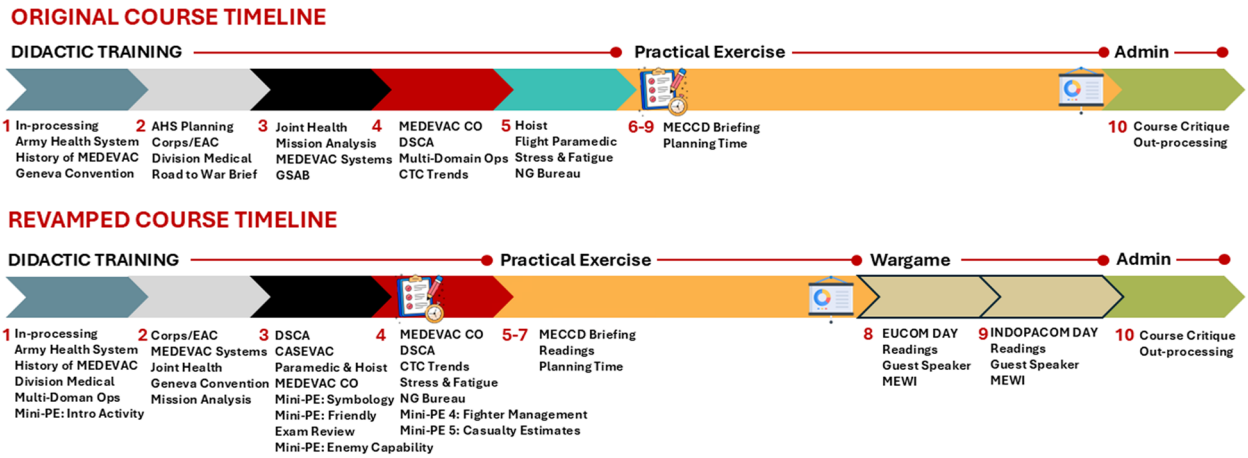

Figure 1. A comparison of timelines between the original and revamped Medical Evacuation Doctrine Course. Notable updates include covering additional course material in fewer days, increasing the difficulty of the practical exercise by including intelligence and operations staff sections, analog products, and a new, more challenging Indo-Pacific scenario in less time, introducing required readings and classroom discussions, and adding 2 wargame days dedicated to medical evacuation in specific operating environments. Course updates are facilitated through the unit Army Training and Education Development office with the support of the Medical Center of Excellence.

the map became a focal point for student discussion on the evolving medical plan by phase of the operation.

Many MEDC students arrive at the course with limited medical planning experience. 67J students attend MEDC after completing the U.S. Army Medical Department Basic Officer Leadership Course and are a few months removed from completing their undergraduate education. The warrant and noncommissioned officers who attend have more unit experience but typically lack a formal education in military planning. As a result, many MEDC classes spend the first few days of the PE primarily concerned with learning how to plan and identifying available resources to inform planning decisions. To better prepare students ahead of the PE, several worksheets, or "mini-PEs" were created. These worksheets, provided in the first 5 days, are designed to facilitate student familiarity with planning and reinforce lessons learned during the didactic portion of the class. Worksheets cover reading an operations order, conducting mission analysis, military symbology, friendly forces capabilities, enemy forces capabilities, casualty estimates, and fighter management/crew endurance. The worksheets consider the PE scenario, allowing the students to get familiar with the large sum of pertinent planning information available to them before officially beginning the PE. Overall, PE performance, to include the quality of briefings to senior leaders, has since improved substantially.

MEDC has been a "mobile capable" course since its inception. Mobile capable means that instructors can travel to an interested unit to facilitate the full course at their home station. Although the requesting unit must source the appropriate facilities, resources, and funding to cover instructor travel, this option still ends up being financially advantageous to the unit. This capability is frequently asked about by units across all components, but rarely acted upon. Before this year, the last MEDC mobile course was conducted in 2020. Under LOE 2, a stated objective was to execute a post-revamp MEDC mobile course with no degradation in training quality. 2-4 General Support Aviation Battalion "Archangel DUSTOFF" at Fort Carson, CO requested a MEDC mobile course and completed all pre-requisites to enable training. The revamped mobile capability was successfully validated, with no degradation in learning objectives and all lessons and activities executed. Student feedback from the class was overwhelmingly positive, with many recommending that additional units request this capability.

LOE 3: Rigor

LOE 3 ensures MEDC is more extensive and challenging in both content and application. MEDC has sometimes, unofficially, been referred to as a "check the block" course, that is, easy to pass with minimal effort. We introduced rigor to the course by assigning students challenging roles in the PE that forced careful consideration of the ground tactical plan and enemy threat considerations, and added required readings with subsequent classroom discussions.

The MEDC PE has historically assigned students to roles directly related to medical planning. Students served as medical planners for maneuver battalions, the brigade support medical company, ground ambulance company, and air ambulance platoons. S2 (intelligence) and S3 (operations) cells were added to the PE alongside medical sections to ensure medical planning did not occur without carefully considering the friendly tactical plan and enemy weapon systems. Interestingly, the addition of S2 and S3 helped unify the overall class plan, acting as a double filter through which all planning was scrutinized. Having S2 and S3 also significantly improved the depth of student planning and resulted in more substantial briefs to the senior leader.

The first 5 days of MEDC are dedicated to building foundational, doctrinal knowledge, and still culminates with a 75-question exam. The last 5 days of MEDC are tailored to application and critical thinking. Instructors maintain a rotating series of thought-provoking medical evacuation magazine articles, journal papers, and book excerpts. A selection of readings from the medical evacuation series is assigned daily to students, with an instructor-led discussion facilitated each subsequent morning. Topics include medical evacuation during the Central Pacific island-hopping campaigns of World War II,[3] the use of CH-47 Chinook helicopters as medical evacuation platforms,[4] employing trains for casualty evacuation in the European theater,[5] employing U.S. Army watercraft as maritime ambulance exchange points in the Pacific theater,[6] and medical and casualty evacuation lessons learned in Russia and Ukraine.[7] These readings and discussions introduce students to complex operational problems without obvious solutions, challenging them to engage critically with current doctrine. Given the renewed focus on both the European and Pacific theaters, training day 8 has been designated EUCOM day and training day 9 has been designated INDOPACOM day. During these days, all medical evacuation readings, discussions, guest speakers, and wargames are tailored to those respective operational environments.

LOE 4: Modernity

LOE 4 involves the development, deployment, and formal evaluation of the novel military Medical Evacuation Wargaming Initiative (MEWI), shown in **Figure 2**, specifically for MEDC. MEWI is an educational digital software that allows MEDC students to cooperate to plan and execute medical evacuation systems using a wide range of existing and emerging medical and casualty evacuation platforms. The program generates casualties stochastically at various collection points, with each casualty being assigned a unique patient identification number. The students are responsible for planning medical evacuation operations for a given European or Pacific scenario, allocating and dispatching their medical evacuation platforms, and regulating all patients from the collection points to the field hospital or joint equivalent medical treatment facility. Casualty mortality reflects trends documented in the literature; as time progresses, patients who have not received adequate medical care

Figure 2. Students participating in the digital medical evacuation wargames (right) often find patient regulating in mass casualty scenarios challenging and typically deploy multiple products, both analog and digital, to ensure patient documentation and status are updated as operations progress (left).

because of lapses in evacuation have a higher probability of death. After the wargame is completed, students are provided with patient statistical data to help identify medical system planning and execution failures. MEWI allows participating students to gauge real-time planning performance, identify the anticipated challenges of LSCO, receive actionable feedback from instructors, and form concrete evacuation experiences on which to facilitate future learning.

Students execute 2 MEWI scenarios during MEDC. The first is in Eastern Europe and involves a brigade (3,000-5,000 personnel) conducting an offensive across a sprawling road and river network. The brigade is separated into 3 unique maneuver battalions (30-1,000 personnel), of type light infantry, Stryker, and armored. Each battalion possesses their doctrinal, organic medical evacuation assets. The brigade is supplemented by 2 intra-theater aeromedical evacuation platoons (20-25 personnel). This more traditional scenario serves as an introduction to MEWI and cements student doctrinal knowledge of medical evacuation at the brigade-level. Students then progress to the second MEWI scenario, a more challenging joint dual-island amphibious assault of the Hawaiian Islands of Oahu and Kauai. A maneuver battalion is positioned on each island. Existing hospital ships (USNS Comfort) and emerging medical ships (USNS Bethesda) are located offshore to facilitate patient movement from the beachheads to the rear. Intra-theater aeromedical evacuation support includes a platoon of three HH-60M Black Hawks and a platoon of two V-280 Valors. Although there are fewer maneuver battalions producing casualties, this scenario challenges students to coordinate the use of sparse and unique multi-modal and joint platforms across long distances to evacuate casualties. A third MEWI scenario focused on air and ground medical evacuation integration in an urban area after a destructive hurricane (defense support of civil authorities) is planned for late 2025. The addition of interactive digital medical evacuation wargames into MEDC substantially enhances student educational outcomes by providing insight into prior planning and fostering critical thinking. MEDC students regularly remark in course critiques that the MEWI scenarios are the highlight of the course. MEWI is discussed in additional depth in our companion article.[8]

CONCLUSION

MEDC is dedicated to equipping the next generation of medical planners with the knowledge and skills necessary to sustain medical evacuation operations in a demanding LSCO environment. Having a foundational understanding of medical evacuation doctrine while also thinking critically about future challenges is imperative. The 4 LOEs presented arm students with the most relevant, useful, rigorous, and modern medical evacuation knowledge possible to enable ground force movement and maneuver, increase return-to-duty rates, and save lives on the battlefield.

ACKNOWLEDGMENTS

We thank John Venezia, Dana Franklin, Aaron Krupp, Bryan Jow, and Carl Piper at the Department of Aviation Medicine for their encouragement and support of recent Medical Evacuation Doctrine Course revisions, and Jeremy Fischer, Ram Krishnamoorthy, and Vishal Kumar at the University of California Berkeley for their sustained contributions to the Medical Evacuation Wargaming Initiative.

FUNDING

None declared.

CONFLICT OF INTEREST STATEMENT

None declared.

DATA AVAILABILITY

Not applicable.

INSTITUTIONAL REVIEW BOARD

Not applicable.

INSTITUTIONAL ANIMAL CARE AND USE COMMITTEE

Not applicable.

INDIVIDUAL AUTHOR CONTRIBUTION STATEMENT

All authors were directly involved with writing and approving the manuscript and revising and implementing the course curriculum.

INSTITUTIONAL CLEARANCE

Institutional approval pending by Medical Center of Excellence Public Affairs Office.

REFERENCES

1. ATP 4-02.13 *Casualty Evacuation*. United States Army; 2021.
2. Diamond DH, Dingle RS. *Army Medicine Strategy*. US Army Medical Command, United States Army; 2020.
3. Condon-Rall ME, Cowdrey AE. *The Medical Department: Medical Service in the War against Japan*. Vol 10. Center of Military History, United States Army; 1998.
4. Leone R, Remondelli MH, Smith SS, Moore BJ, Wuss SL, D'Angelo M. Adoption of the CH-47 to MEDEVAC special operations forces in USAFRICOM. *J Spec Oper Med*. 2024;24:86–90. https://doi.org/10.55460/42ix-2bix
5. Walravens S, Zharkova A, De Weggheleire A, Burton M, Cabrol JC, Lee JS. Characteristics of medical evacuation by train in Ukraine. *JAMA Netw Open*. 2023;6:e2319726. https://doi.org/10.1001/jamanetworkopen.2023.19726
6. Al-Husseini M, Wray KH, Kochenderfer MJ. Watercraft as overwater ambulance exchange points to enhance air medical evacuation. *Air Med J*. 2025;44:23–9. https://doi.org/10.1016/j.amj.2024.08.006
7. Epstein A, Lim R, Johannigman J, et al. Putting medical boots on the ground: lessons from the war in Ukraine and applications for future conflict with near-peer adversaries. *J Am Coll Surg*. 2023;237:364–73. https://doi.org/10.1097/XCS.0000000000000707
8. Fischer J, Krishnamoorthy R, Kumar V, Al-Husseini M. (2025). Digital wargames to enhance military medical evacuation decision-making. arXiv, preprint: not peer reviewed. https://doi.org/10.48550/arXiv.2507.06373