

NATO Centre of Excellence for Military Medicine



# Military Medical Lessons Learned Workshop 2024 - Abstracts

ON NEAR-PEER CONFLICT  
AND LARGE-SCALE COMBAT OPERATIONS



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## Military Medical Lessons Learned Workshop 2024 - Abstracts

ON NEAR-PEER CONFLICT  
AND LARGE-SCALE COMBAT OPERATIONS



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# Foreword



The NATO Centre of Excellence for Military Medicine, in conjunction with the Committee of the Chiefs of Military Medical Services in NATO, hosted the Military Medical Lessons Learned from Near-Peer Conflicts and Large-Scale Combat Operations at NATO Headquarters in Brussels, Belgium from 21-24 May 2024. The Workshop aimed to consolidate and analyse observations, identify actionable lessons, and develop recommendations to improve the readiness and response of NATO and individual nations to increasing global and regional threats.

Recent regional conflicts and emerging threats have demonstrated the need to reevaluate medical support of military operations. Experiences from the Russian war against Ukraine highlighted the need to review and revise our doctrine, plans, and training, which for decades had been focused on medical support of asymmetric warfare and counter-terrorism operations. Workshop participants presented observations and lessons from current, recent, and historical conflicts that have applications to potential and future near-peer conflicts and large-scale combat operation scenarios.

More than 100 Subject matter experts representing XX Nations participated in both the plenary and syndicate discussions at the Workshop. The plenary session included a wide variety of topics, with both podium and poster presentations. Presenters shared historical lessons from World War I, World War II, the 1982 Falklands War, the 2008 Russo-Georgian War, Iraq, and Afghanistan, and observations from the ongoing Russian war against Ukraine. In addition, experts discussed current challenges related to medical logistics, evacuation, mental health, telemedicine, antimicrobial resistance, infection prevention, civil-military cooperation, and rehabilitation. Their contributions enriched our collective understanding of the realities of wartime medicine.

This publication presents the plenary session abstracts covering a broad range of topics and is a valuable reference for medical professionals and military leaders to advance medical support in modern warfare.

I want to thank all the presenters, participants, and support staff for their dedication and expertise.

February 2025

**CAPT (NAVY) Dr. Jeff Ricks, MD**  
Chief of Lessons Learned & Innovation Branch  
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# Russia-Georgia War 2008. The Medical care challenges during the LSCO

*Author/Affiliation:*  
**Colonel Zviad Burdzgla**

## **Keywords**

Medical and Pharmacy supply decentralization. Role1/Role2. Medical evacuation Challenges.

## **Abstract**

The issues discussed in the presentation reflect the problems, challenges and solutions faced by the Georgian military medical service during the Russia-Georgia war in 2008. The presentation discusses difficulties of medical evacuation, importance of civil-military cooperation, importance of decentralization medical and pharmacy supply, need for structural change of ROLE 1 and ROLE 2.

The process analysis identified problematic issues listed above, the resolution of which will improve and increase the quality and capabilities of medical care.

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# Polish perspective on strengthening medical support for NATO troops

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National Research Institute*

## **Keywords**

NATO, organization, Polish, dynamic planning of medical support, multinational, medical evacuation

## **Abstract**

Since the first Russo-Ukrainian conflict in 2014, Poland plays significant role in support of Ukrainian Armed Forces. After the attack in 2022, millions of Ukrainians have fled through and into Poland, seeking help and relieve. In the following years plenty of lessons regarding the medical support in Large Scale Combat Operation (LSCO) has been identified in Ukraine. Many of them are considered while working on models, organization and tactical solutions for NATO troops. Poland, with its rich historical experiences from the Cold War Era, is doing homework too. While NATO works on multinational medical evacuation channels, taking medical trains and “drug Schengen Zone”<sup>1</sup> as possible solution, Poland suggests the use of its hospital network located in West Poland<sup>2</sup>.

The presentation describes the actual and possible future solutions<sup>3</sup> of Polish support to NATO troops, both in Poland as well as in any other Area of Operation (AOO), based both on medical truths shared already by science<sup>4</sup> and real-life experience gained lately eg. at the border with Belarus.

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## **Historical Insights from World War II**

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### **Keywords**

Mass casualties; hospitalization; evacuation; return to duty

### **Abstract**

In WWII large militaries deployed large medical systems. As militaries have shrunk, those medical systems have shrunk, yet a future LSGCO could have similar casualty rates as in the past. It would be foolish to expect the medical miracles of the past 20 years that were possibly in COIN. Military medicine in a LSCO is going to diverge from civilian medicine, and leadership and civilian populations need to be prepared for that. Military medicine will likely need to refocus on supporting the fight rather than trying to save each life.

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# UK Armed Forces (UKAF) Female hygiene in the austere environment

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Defence Medical Services, Birmingham, UK*

## **Importance**

Women in the UKAF now have all roles and environments open to them however they may face unique challenges in these roles compared to their male counterparts.

UK Government target to increase the proportion of women joining the UKAF to 30% necessitates support to meet these challenges. The Servicewomen Health Improvement Focus Team 2022 introduced several measures including a urinary support device (USD) and menstrual waste pouches (MWP). This work reviews the knowledge of, and opinions around, these female hygiene products and austere environment female hygiene generally with a service evaluation across two settings.

## **Observations**

The evaluation was distributed following a short extreme heat humanitarian deployment (11 respondents) and a longer cold weather exercise (19 respondents). It questioned knowledge of, and attitudes around: hormonal methods of menstrual delay and control, disposable and re-useable sanitary products, USD and MWP; free text responses gave context. Women preferred to use different methods in the austere environment to at home (64% hot, 72% cold), most would opt for hormonal methods (82% hot, 79% cold). Although many were aware of the USD (63%) few had been issued (0% hot, 6% cold) but would have liked one (73% hot 32% cold). There were concerns in the cold group about urine spillage and subsequent freezing of clothes.

## **Conclusions**

Women need to be educated on available methods, supported to access these options and be able to choose the right option for them relative to the environment they will be working in. This is even more relevant as their proportion in frontline roles increase under Near Peer and LSCO.

## **Recommendation**

Pre-deployment education and planning on female hygiene options and policies including the servicewoman, chain of command and logistics support to maximise human performance on both small- and large-scale operations.

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# UK Medical Lessons From The 1982 Falklands War: Past and Distant Lessons for A Near Peer Future

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*Royal Army Medical Corps with Acknowledgments for the work of Surg Cdr Pen -Barwell, RNMS  
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## Importance

The Falkland's Conflict in 1982 was fought approximately 8,000 miles from the UK against a larger near peer force. The main mission of the combined Commando, Army and Naval medical services was to resuscitate and evacuate wounded to either damage control or definitive surgical care.

## Observations

With such a distance the problems of timely resuscitation and, contested and challenging casualty evacuation both tactical and strategic and limited clinical and logistical resources amplified this challenge. Both historical lessons help identify how even under these conditions almost 250 surgical cases and 777 wounded were able to receive and survive. There are several areas where the Chair COMEDs '12 LSCO lessons can be reviewed.

## Conclusions

The lack of dedicated and defined tactical medical evacuation platforms in the face of limited and contested rotary wing availability was one area in which lessons can still be learned. Other important lessons included the value of self aid and far-forward resuscitation in concert with effective but lightly scaled Forward Intensive Resuscitation and Surgical Teams helped reduce mortality once in the evacuation chain that exceeded 6 hours. long sea lines of communication (SLOC) to evacuate war wounded and limited capacity to treat them in local host nation (HN) facilities are reflective of the current LSCO scenarios.

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# Scrubbing the ‘Dirty Dozen’- UK Large Scale Combat Operations Lessons review and update of Key Operational and Strategic Challenges for the UK

*Author/Affiliation:*

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*Queen Alexandra's Royal Army Nursing Corps*

*HQ Defence Medical Services Organizational Learning, UK MOD*

## **Importance**

The seminal work produced by the UK SG/Ch COMEDs focused on 12 strategic lessons the Alliance should seek to address for future large scale combat operations is now approaching 2 years old. A review is now needed to ascertain what new observations or lessons have been learned from both the Russo/Ukraine War and the insights it stimulated in the UK's readiness for such operations.

## **Observations**

The author has reviewed the original dozen and made recommendations on where lessons are being actioned and developed and where new insights and areas for consideration have been identified.

## **Conclusions**

Training both collective and individual, protection and survivability of medical facilities, the need to address the impact of poor outcomes during MASCAL and C4IM are contain key new insights.

# Rehabilitation in Large Scale Combat Operations

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*Rehabilitation, LSCO, TBI*

## Abstract

Large Scale Ground Combat Operations (LSGCO) pose a unique threat to rehabilitation systems in terms of both casualty numbers and injury type, as seen in recent combat operations in the Russia-Ukraine war. Additionally, given the munitions present in this type of conflict, there remains a significant need for rehabilitation services that will persist for decades once hostilities have ended. The targeting of medical facilities also degrades the capability for rehabilitation, including targeting of locations far removed from battle zones. As such, LSGCO places a significant burden on rehabilitation capacities and capabilities during and after conflict, and these effects must be taken into account during any conflict planning.

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# Telemedicine Support in Military Psychiatry: Polish Experience

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## **Importance**

This abstract showcases the successful implementation of telemedicine systems to offer psychological and psychiatric assistance to Polish soldiers stationed in Afghanistan, as well as providing training and superintendent support to Ukrainian mental health professionals on war stress disorders and PTSD. It aims to shed light on the various possibilities of using telemedical systems i.a collaboration with psychologists in military units in Poland, providing consultations for Polish soldiers stationed on the Polish-Belarusian border, using telemedicine systems in daily clinical practice - providing online consultations.

## **Observations**

The Department of Psychiatry in Warsaw has extensive experience in conducting telemedicine support sessions for soldiers, organizing training programs for Ukrainian psychologists' doctors, and chaplains, and offering teleconsultations for healthcare professionals near the Ukrainian front line.

## **Conclusions**

Through our work, we have demonstrated the significant impact of telemedicine systems in military psychiatry, emphasizing the effectiveness of remote support, training, and consultations. This experience underscores the value of collaboration and the use of technology in enhancing clinical practice in the field of military psychiatry.

# Using the Global Trauma System Evaluation (G-TSET) Observational Tool to Assess the Compliance and Capability of the Current Trauma System in Ukraine through the perspectives of Returned Healthcare Volunteers and Ukrainian Healthcare Workers

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## **Abstract**

Disclaimer: The contents of this publication are the sole responsibility of the authors and do not necessarily reflect the views, assertions, opinions, or policies of the Uniformed Services University of the Health Sciences (USUHS), the Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. (HJF), the Department of Defense (DoD), or the Departments of the Army, Navy, or Air Force. Mention of trade names, commercial products, or organizations do not imply endorsement by the U.S. Government. The authors declare no conflict of interest.

## **Background**

Ukraine's health and trauma care system has been devastated by the Russian Federation's invasion in 2022. Understanding the observations volunteers and Ukrainian healthcare workers during their time in Ukraine is vital and helps illustrate the trauma system's current challenges.

## **Methods**

We conducted structured interviews with healthcare or healthcare adjacent returned volunteers and Ukrainian healthcare workers using the Global Trauma System Evaluation (G-TSET).

## **Results**

As of February 2024, we completed 9 assessments with an additional 10 planned. The overall score for the current trauma system was 1.55 of a possible 3.00. Leadership and Organization (Score=1.82): There is a lack of adequate funding to support trauma system operations and management, poor leadership at both military and civilian levels and at all levels of care, and an inability to monitor the trauma system. Respondents raised concern over the lack of a national development plan and vision for the trauma system and resources in regional hospitals. Communication (Score=1.97): Emergency medical systems have limited capability for coordinating medical direction of interfacility transfers. Access to Injury Care (Score =1.68): The trauma system's ability to evacuate casualties is hampered by the lack of air evacuation. Acute Injury Care (Score



=1.76): Prehospital guidelines are non-compliant. Acute Injury Care (Score =1.64): Triage and patient transfer of critically injured patients are impacted. Supply of blood products is adequate due to blood banking capability. Rehabilitation (Score =1.31): Inpatient and outpatient care rehabilitation services are not available promptly. Prevention (Score =1.43): Integration of injury data is lacking with other components of the trauma registry. Education/Research/Quality Improvement (Score=1.31): There is limited oversight of the trauma registry. Quality of the data is not monitored regularly.

### **Lessons Learned**

G-TSET component scoring from observations of volunteers and Ukrainian healthcare workers suggests the current trauma system has many opportunities for improvement.

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# **A model of dynamic planning of medical support for combat troops. A new look at the requirements and capabilities of the medical component**

*Authors, Affiliations:*

**LTG Grzegorz GIELERAK, MD, PhD, Prof COL (ret) Piotr MURAWSKI, PhD1 Michał MADEYSKI, MS1**  
*Military Institute of Medicine – National Research Institute, Poland*

### **Abstract**

The experience of the war in Ukraine shows that success in the field of medical protection of the population can only be ensured by a complete service, including one tailored to the nature of operational activities. The aim of the study was to develop a new method for dynamic planning of medical support for combat troops by modeling battlefield medical care processes, dedicated to improving the effectiveness and efficiency of resource management of the health care system and the operational capabilities of combat troops. The modeling of battlefield medical care processes was based on commonly recognized operational factors – force, time, area, expanding this group with an additional parameter, important from the point of view of organizing the work of medical field units – safety.

As a result, a proposal for a calculation model was developed, based on which an analytical tool was compiled that allows for flexible adjustment and combination of the goals and needs of medical care – regulated mainly by the scale and structure of sanitary losses, with progress during the military operation, in part depending on its dynamics and the ability to conduct a maneuver.

### **Conclusions**

The proposed model for estimating medical needs is a methodologically advanced and yet easy to use decision support tool. It integrates knowledge about the occurrence and distribution of the most important factors determining the conditions and possibilities of providing medical assistance as well as the needs and expectations resulting from tactical and operational intentions. It reduces the risk of errors and strengthens the health care system's resistance to hybrid and military operations by providing key information regarding the current needs for its organization and functioning in connection with tactical and operational plans and the state defense strategy.

# Historical Insights on Infection Prevention

*Authors, Affiliations:*

***Sanders Marble, PhD***

***U.S. Army Medical Department Center of History & Heritage***

## **Importance**

Large volumes of patients and delayed evacuation imply delayed surgical attention and increased rates of wound infection. This would both delay patient recovery and cause extra deaths, potentially undermining public support for military operations.

## **Observations**

In WWII, the U.S. Army tried to prevent wound infection through technological solutions (sulfa drugs) and prompt evacuation. Neither solution proved adequate, but it proved possible to move surgical support further forward. However, when battlefield conditions precluded prompt (<6h) evacuation, infection rates rose.

## **Conclusions**

There has not been a substitute for prompt surgery. However, battlefield conditions may preclude that, regardless of efforts to organize mobile surgical teams. Medical personnel should prepare their combat-arms colleagues, political leaders, and the public that medical conditions in a LSCO against an NPC will not approximate civilian medical standards.

---

# Historical Insights on Resuscitation

*Authors, Affiliations:*

***Sanders Marble, PhD***

***U.S. Army Medical Department Center of History & Heritage***

## **Importance**

Many wounded in a LSCO against an NPC will have significant wounds that require resuscitation, and evacuation delays will compound the problem.

## **Observations**

The U.S. Army started WWII believing it had solved the problem of resuscitation through use of plasma, which had apparently shown good clinical outcomes plus having operational advantages of being insensitive to temperature and long storage duration. That ignored plasma's clinical limitations. Fresh whole blood (FWB) could not be a systemic solution. In response, the Army built a specific supply chain for whole blood (WB) that had to operate at long distances and relatively high volumes. In addition, plasma continued to be used because it could be used in tactical situations where refrigeration for WB was not available.

## **Conclusion**

Clinical procedures standard in civilian settings may not be possible in military situations. While WB and FWB are the best outcomes for patients from point of injury to surgery; storage media are far improved from 1945; and drones provide possible tactical distribution routes for WB, we may need to go back to the past for alternatives and explain the situation to civilians not expecting a “drop” in standards of care.

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# **Historical Insights on Bulk Evacuation**

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*U.S. Army Medical Department Center of History & Heritage*

## **Importance**

The large quantities of wounded in a LSCO against an NPC will likely exceed capacity of existing evacuation platforms. In the past, a wide variety of austere platforms were used for evacuation to medical care, and to clear Role 3 hospitals by moving patients to Role 4 hospitals. With modest medical augmentation to those austere platforms, the U.S. Army improved outcomes and maintained capability and capacity in forward hospitals.

## **Observations**

In the past, when ground evacuation had to be used more than in recent operations, it was common to use tactical vehicles for evacuation of wounded to Role 1 care. Sending an ambulance to point of injury, under enemy fire, had multiple unnecessary risks. Even movement from Role 1 to Role 2 or Role 3 might be in CASEVAC vehicles. Moving large quantities of patients from Role 3 and Role 4 hospitals further back was also often by aircraft or transport ship, without dedicated medical personnel. There were not dedicated MEDEVAC aircraft, and hospital ships were scarce. The U.S. Army designed units to accompany patients, providing higher levels of en-route care.

## **Conclusion**

Plans should be made on how to provide some medical personnel and equipment to provide en-route care to non-standard platforms both to medical care (e.g. to Role 2 or Role 3) and from Role 3 to the rear.

# Historical Insights on Medical Footprint for a LSCO

*Authors, Affiliations:*

***Sanders Marble, PhD***

*U.S. Army Medical Department Center of History & Heritage*

## **Importance**

Large casualty numbers during a LSCO against a NPC would challenge the medical resources deployed to recent operations. Examining historical quantities of medical units deployed could help build adequate plans. Observations: in 1990 an international coalition deployed to fight the world's fourth-largest military, which was known to have chemical weapons and a nuclear weapons program. Drawing on Cold War doctrine and force structure, a substantial medical force was deployed. The U.S. Army alone deployed around 40,000 medical personnel, plus those from other U.S. services, and personnel mobilized but not deployed to the operational theater. Coalition casualties in Operation Desert Storm were very light, but the force structure deployed and the reasons for it, can shed light on what would be needed for a NPC LSCO.

Conclusion: Medical doctrine of 1989 was intended for a LSCO, and looking at a real-world employment of that doctrine, and working in a coalition, would stimulate discussion about what would be required in a next LSCO without air superiority.

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# Historical Insights on the Patient Evacuation Process

*Authors, Affiliations:*

***Sanders Marble, PhD***

*U.S. Army Medical Department Center of History & Heritage*

## **Importance**

In recent operations, patient evacuation has generally been prompt, with limited enemy interference, and with high levels of en-route care. Those conditions are unlikely to be true in a LSCO against an NPC, and historical methods can provide help in planning.

## **Observations**

In recent operations, patient evacuation to surgical care has generally been prompt, and has often had high levels of care on board. Patient evacuation from surgical care (Role 2+ or Role 3) to home country has been uncontested, and again had high levels of en-route care. Historically, these conditions are the exception. Examining ways that were used to mitigate problems from delayed evacuation and evacuation with lower levels of en-route care could inform future plans.



## Conclusion

Examining past efforts to deal with delays in patient evacuation and to provide en route care on non-standard evacuation platforms could be useful in planning for the future.

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# Historical Insights on the Importance of Forward Behavioral Health Care

*Authors, Affiliations:*

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## Importance

In the past, LSCO against NPC have caused large numbers and high rates of behavioral health casualties. In at least one case, the number of psychiatric patients evacuated from a combat theater exceeded the number of replacements arriving in theater. Providing forward care has proved valuable in returning patients to duty but has dependencies.

Observations: Forward psychiatric care (PIE, proximity, immediacy, expectancy) has been understood since WWI. It can also be performed with a modest number of medical personnel and return a high percentage of patients to duty promptly. However, hopes to avoid even that modest number of personnel have failed, resulting in large numbers of evacuations of psychiatric patients. However, psychiatric care relies on other medical units, and simply including the small number of behavioral health personnel will not yield full results in terms of returning patients to duty. Moreover, the number of psychiatric casualties has been higher for conflicts with substantial fear of Weapons of Mass Destruction, specifically chemical weapons.

Conclusion: Medical planners need to deploy not just behavioral health personnel to treat patients but provide other medical units at which they can work. Moreover, while rates of psychiatric reaction to combat vary, they increase in situations where WMD are a plausible threat.

# Historical Insights on Speeding Return to Duty

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## **Importance**

In the past, mass armies supported by conscription had deep manpower reserves. Today, smaller militaries that require higher training levels will need to speed return to duty to support combat power rather than expecting a modestly trained conscript to perform adequately.

## **Observations**

Even with large forces and readily available replacements, returning trained and experienced personnel to duty quickly and proximate to combat had significant value. The U.S. Army has used a variety of designed and improvised organizations to both reduce patient load at hospitals and speed return to duty. These organizations could be forward (less than 100km from the front lines) or in theater rear areas. The staff of convalescent units had limited skills, generally not optimized for rehabilitation, and still returned very high percentages of patients to duty within 21 days.

## **Conclusion**

For modest investment in medical personnel and equipment, some form of convalescent unit reduces load on Role 3 hospitals and evacuation assets. By allowing troops to recuperate in the combat theater they reduce the number of replacements that have to be sent forward and sustain combat power.

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# Historical Insights from WWII

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## **Importance**

While 80 years ago, WWII was the most recent LSCO against peer competitors. The U.S. Army had over 800,000 troops wounded in WWII.

## **Observations**

From forward care to rear hospitals, clinical and operational lessons were learned that could be useful for another LSCO.

## **Conclusion**

An overview of medical care in WWII, especially how it was restructured to meet challenges of patient

volume, evacuation volume, and speeding return to duty (and amid improving the quality of clinical care), could provide insights useful in reorienting medical systems that have focused on low volumes of patients.

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# Managing the UK's first reported outbreak of Human Adenovirus Type B7

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## Importance

OP INTERFLEX delivers a training package to Ukrainian trainees across multiple sites. They arrive at a central location and then disperse throughout the country.

In October 2023 there were initial reports of significant number of respiratory tract infections (RTI) presenting at one site. Over 2 weeks 7 patients were admitted to hospital, with 5 testing positive for Adenovirus B7. In November a patient at a separate location was admitted to hospital and ITU within 48 hours of arriving with a severe RTI, found to be Adenovirus. In January 2024 another location saw a marked increase in RTIs over a 2-week period, with 5 cases being admitted with 2 being admitted to ITU simultaneously, both Adenovirus positive.

The 2023 experience, severity of illness, and including knowledge of other nations experience of adenovirus outbreaks in military settings, acted as a trigger point for investigation of an Adenovirus outbreak. A case definition was created (and refined) with isolation and testing criteria, confirming the UK's first reported outbreak of Human Adenovirus Subtype B7. Case definition directed isolation was implemented with the outbreak being declared over 4 weeks later.

## Observations

Identifying adenovirus outbreaks and particular subtypes, such as B7 and E4, early in a military (closed) setting is important. They are associated with more severe disease, increased risk of hospitalization, and a direct threat to mission delivery, despite this we were able to maintain training throughout.

## Conclusions

- Clear communication between dislocated medical teams in October/November allowed early identification of significant RTI burden and Adenovirus cases.
- Early development of a case definition and directed testing allowed confirmation of the outbreak and an understanding of the scale of spread.

-Case definition defined isolation allowed the mission to continue but stop the outbreak, providing clear chain of command guidance. Thereby allowing more people to train unaffected.

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# Need for Antibiotic Stewardship Programs

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## Abstract

In recent and actual conflicts wounded soldiers and civilians evacuated to Germany present a wide spectrum of multidrug-resistant pathogens, to a large extent also with carbapenem resistance/carbapenemases – either as wound infections or colonization with multi-resistant pathogens (1.). As a result, extended hygiene measures are required, antibiotic treatment options are reduced or even no longer available, leading to avoidable deaths or more severe/longer courses of disease with the need for amputations.

In addition, even in a setting with generally available resources, transmissions to civilian hospital patients as outbreaks are already detectable and relevant increases in the detection of corresponding pathogens in the national civilian surveillance systems are already noticed (3.). In addition to a lack of opportunities to implement basic hygiene or a lack of awareness of the relevance of these measures, possible causes can be seen primarily in inadequate treatment with broad-spectrum antibiotics. Among other things, the TCCC guidelines suggest the administration of a carbapenem as a prophylaxis after combat-related trauma (4.), whereas the scientific literature clearly recommends the administration of a 1st or 2nd generation cephalosporin, possibly in combination with metronidazole (5., 6.), as a shift of the detected pathogens into the gram-negative range only occurs in 5-7 days as a nosocomial infection (7.-10.). In accordance to the scientific evidence our recommendations suggest the administration of cefuroxime and metronidazole from Combat First Responder Bravo. The aim should therefore be to adapt the respective national recommendations, the TCCC guidelines and to promote knowledge on the essential basic hygiene measures in the interests of the prevention of nosocomial infections and of a rational antibiotic use to reduce the development and spread especially of carbapenem-resistant bacteria.

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## Screening for tuberculosis for UKR soldiers participating in EUMAM-trainings

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### Abstract

The Ukraine is one of the countries in the European WHO regions with the highest rates of tuberculosis including MDR and XDR tuberculosis (1.). Incidence reported with 73 cases per 100.000 inhabitants – more than five-fold higher than in Germany, that reports 5 cases per 100.000 inhabitants. In particular affected are males aging from 25-64 which exactly meets majority of soldiers in the Ukraine. In the assumption that the health system due to war is at its performance limit tuberculosis might not be in the focus so that rates might even be higher than before war and therapies may not be continued. German civil surveillance systems already show that the incidence for tuberculosis is rising according to high numbers of refugees from the Ukraine (2.). Nevertheless are these rates are still lower than the rates we detected as refugees mainly are women and children.

In Germany we decided to perform a 100% screening on all Ukrainian service members, who participate in any military training program, directly on entry to Germany in one of our military hospitals. Screening was performed as chest-x-ray to exclude open tuberculosis as fast as possible. If required screening was supplemented by CT-scans and microbiological diagnostics among other things. Our findings show a much higher incidence in this special cohort with a high percentage of MDR tuberculosis. Each case detected before getting in contact with our German training personnel prevents at least contact persons with the necessity of further testing and supervision as well as possible conversion into latent tuberculosis and in consequence long lasting antibiotic prophylaxis or therapies.

In conclusion and even in view of the high organizational effort we strongly recommend this kind of screening before starting any training process aiming to prevent the transmission of tuberculosis in a low incidence country like Germany.

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# **Organizational structure of the civil-military medicine cooperation in the near-peer warfare: Experience of Ukraine**

(Zaporizhzhia Military Medical Hospital regional area of responsibility)

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## **Introduction**

The organization of medical support in modern warfare requires radical changes, rapid response to an unstable situation, constant control, and interaction with the civilian component at all levels. An effective evacuation and treatment system is only possible with interaction and support from the civil sector, which is achieved by working in a unified medical space.

## **Goal**

Present and discuss the order of organization of medical support in the area of operational responsibility of the military hospital to understand the system's functioning, coordination, evacuation procedure, and adaptation of the Role system to the war conditions in Ukraine; provide insights into the organization of work in the direction of medical provision in cooperation and with the involvement of the civil sector at various levels of state administration.

## **Justification**

Medical support in cooperation with regional authorities allows for a detailed study of the medical infrastructure of the area of responsibility to determine the objects that are used or reserved for military medical units. Implementation of full control over all healthcare facilities in the area of operational responsibility and online control of bed occupancy by categories (surgical, therapeutic, and resuscitation profile) is necessary to deploy and maintain the rapid and effective evacuation and treatment system. Implementation of the damage control program (incl. trauma registry) according to the order of patient flow of service members from the moment of their admission to the stage of the stabilization point (Role 1) until the moment of their return to the military unit or discharge. All this can be achieved by interaction at different levels of regional civil and military authorities, namely at the regional level with: city health department, regional health department, regional military administration; at the State level: through the system of coordinators and established connections from the Command of the Medical Forces and the Ministry of Defense of Ukraine, Ministry of Health coordinators, Minister of Health deputies.

A separate and no less important direction is interaction with volunteer organizations at the local and international level, based on the example of established connections and achieved results:

- **Support with medicines and expensive consumables;**
- **Conducting mass cultural events, film screenings, and concerts to maintain a high moral and psychological state of military personnel;**
- **Transportation of patients with the involvement of international humanitarian organizations.**

An example of interaction with business representatives allows you to attract additional internal financial resources to improve the quality of medical services, such as purchasing modern and expensive equipment. The development and implementation of radically different approaches to the medical provision of troops in the event of ineffective use of tent or container Role models in conditions of enemy dominance. For example, developing a new underground-type modular system for the functioning of medical support at the Role 1 and Role 2 stages.

### **Conclusion**

The proper functioning of the medical support of the Armed Forces of Ukraine in the conditions of a full-scale war is impossible without civil-military cooperation, which is represented by a single medical space and requires the involvement of all possible and available components to achieve the single goal of the victory of Ukraine.

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# **The place and role of volunteer organizations in the evacuation of the wounded in Ukraine and their influence on strategic medical evacuation**

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### **Introduction**

The interaction between the military and the civilian sector in the provision of medical services became closely related during the war in Ukraine. Let us consider the example of tactical and strategic evacuation (hereinafter referred to as evacuation) involving certain volunteer organizations in the ranks of which Ukrainian civilian medical workers work. This interaction between the military and civilians has both positive and negative aspects.

### **Strengths**

- Reducing the burden on the military unit (namely, medical personnel and logistical resources) that ensures the evacuation of service members.
- Allows a civilian doctor to participate in the provision of assistance to service members without joining the

ranks of the Armed Forces of Ukraine and to gain some experience to decide on further military service in the ranks of the Armed Forces.

- They provide a particular opportunity to rest military medics, performing work for them.

### **Weaknesses**

- Creating the illusion of sufficient provision in the direction of evacuation in the troops (and insufficient attention is paid to strengthening this link, both from the point of view of material support and human capital) if all volunteers leave the front at the same time, it can negatively affect the evacuation of the wounded.
- Doctors who work as volunteers do not join the ranks of the Armed Forces to use their capabilities at 100%. This factor creates an even more significant shortage of medics in the ranks of the armed forces.
- There is no control over the quality of assistance provided by volunteer organizations.
- There is a shortage of medical personnel in both civilian and military medicine, as these medical workers are not fully engaged in either civilian or military healthcare facilities.
- In most cases, the system of strategic evacuation can be covered by the capabilities of emergency medical aid and disaster medicine centers. Still, the involvement of volunteer organizations does not allow the capabilities of these centers to be fully utilized.

### **Conclusions**

Volunteer organizations positively contribute to evacuating service members between healthcare facilities but, in turn, weaken civilian healthcare facilities and the Armed Forces of Ukraine strategically and physically (slowing down the development of their capacities and capabilities). It is necessary to completely revise the concept of using volunteer organizations in the provision and develop the corresponding service in the Armed Forces of Ukraine, develop a clear strategy for using volunteer organizations at the tactical and strategic evacuation level, and rationalize the use of relevant volunteer organizations after building up their capabilities. The changes mentioned above should have improved the situation with personnel support in both military and civilian medicine.

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## **Ukraine's experience in the use of unmanned vehicles (ground drones) for the forward evacuation**

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Introduction: Delayed evacuations of the severely injured are a major issue along the Ukrainian frontlines. The following factors contribute to the problem:

- High intensity of combat;
- Wide range of weaponry utilized (combat drones, artillery and mines);

- Advanced surveillance strategies;
- Full visual and fire control (by the enemy) of the combat space extending any 3-5 km back from the frontline.

## **Rationale**

Attempts at evacuation often lead to loss of both human and materiel assets.

To ensure effective evacuation and casualty care system, battlefield evacuation must be reorganized and technically re-conceptualized. Utilization of unmanned ground platforms is one of the potential solutions. 1st International Legion Medical Service (MSIL) is currently working on the implementation of such platforms for the evacuation purposes. Multitude of manufacturers exist in Ukraine and globally. We have reviewed technical characteristics of more than 20 drones. Seven models, from most competent manufacturers were field-tested and refined to meet our specifications and realistic requirements.

General expectations for ground drone developers that require attention:

- Reliability of undercarriage;
- Maneuverability;
- Battery capacity;
- Reliability of drone communication and steering system;
- Drone and casualty safety.

Aside from the technical aspects, MSIL is also developing standard operating procedures (SOPs) for the utilization of ground evacuation drones. The goal is to support and expand casualty evacuation capabilities:

- Operating model for a ground drone evacuation group/unit, their staffing roster and potential locations of deployment;
- Drone request procedure, determination of necessity based on the severity of injuries, and coordination with the medical evacuation efforts;
- Casualty preparation algorithm, list of basic medical interventions necessary for a casualty evacuation by means of a ground drone;
- Determination of drone evacuation routes, and transfer points;
- Adverse event management algorithm, etc.

## **Conclusion**

Ground evacuation drone development and serial production, matching technical tasking and operational environment of the Defense Forces must be prioritized. It will improve timeliness of evacuation and increase access to qualified casualty care, with better long-term outcomes and more lives saved.

# Laparoscopic and thoracoscopic interventions in combat wounds of abdominal and thoracic organs: Experience of surgeons of the Armed Forces of Ukraine

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## **Introduction**

The war in Ukraine is a war of a new type and has features that significantly affect the structure of sanitary losses and the provision of assistance at all levels of medical support for combat injuries of the abdomen and chest. Features of this war: the unprecedented length of the front line, the greater frequency of the use of missile weapons, the use of unmanned aerial vehicles, the disruption of logistics routes, and the limitation of resources with a large number of missile strikes on civilian and military infrastructure objects that are at a great distance from the zone active hostilities, inability to timely remove the wounded from the battlefield. All this leads to a higher frequency of complications and high mortality among the injured. Approaching high-tech equipment using laparoscopy and thoracoscopy in wounded with combat trauma is essential and a priority.

## **Purpose**

Analysis of the experience of implementing modern endovideosurgical operations, laparoscopy, and thoracoscopy in the wounded at the II levels of care in the Role 2 military mobile hospital.

## **Rationale**

511 endovideosurgical interventions were analyzed in the wounded who were operated on in a military mobile hospital at the Role 2 level. There were 490 (96%) laparoscopies, 21 (4%) thoracoscopy. Indications and contraindications for these methods were clearly defined. During diagnostic laparoscopy and thoracoscopy, the nature of gunshot injuries was assessed with a thorough revision, and the possibility of operating laparoscopically and thoracoscopically was assessed. There were 69 (14) conversions at laparoscopy and no conversions at thoracoscopy. Electrocoagulation, vessel clipping, stapler resections, and manual intracorporeal sutures were used during these operations. Foreign bodies, bullets, and debris were removed using special magnets. There were no deaths after the operations. The wounded were evacuated to a higher level of medical care.

## **Conclusion**

To perform modern endovideosurgical surgical interventions at the II level in Role 2 conditions, a professionally trained team and appropriate equipment are required. A clear definition of the indications and contraindications for these modern operations is mandatory, as is consideration of the duration of the operations and the flow of the injured.



# Threats to medical operations, command and control in the modern warfare: Experience from the Ukrainian battlefield

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## **Introduction**

Despite the understanding of the necessary volume of medical support, the conduct of military operations aimed at resisting the full-scale invasion of the Russian Federation on the territory of Ukraine is carried out in conditions of a constant shortage of resources - both human and material. This requires a rational redistribution of available resources and correct management in conducting offensive and defensive operations.

## **Rationale**

Wartime medical care is not just about combat medicine per se. It is about the dignity that we must secure for every service member. Dignity is also about self- and mutual education, the training of those who provide help, medical supplies, the treatment of diseases, and access to social guarantees. All these things must be provided at the brigade level.

When we talk about the management of medical supply at the brigade level, we must understand three main principles:

1. Maintain process control at all levels of medical service management and provide medical care to those who need it. It is about understanding the needs, controlling the processes within the brigade's medical service, and providing care in a continuous mode.
2. Rapid response to challenges associated with dynamic changes in the operational situation at the front. This principle highlights the need for swift restructuring of work during sudden increases in the flow of wounded and sick service members.
3. Effective interaction with the civilian health care system and practical implementation of a unified medical space model. This principle underscores the importance of injured, wounded, and sick soldiers being evacuated to civilian healthcare facilities for comprehensive medical care.

## **Conclusion**

Given the limited resources and the numerical superiority of the enemy, the management of the medical service of the brigade in the conditions of active hostilities is carried out by rational redistribution of available resources and flexibility in the use of medics at various stages of assistance. Including the level of training of specialists should ensure the possibility of interchange of medical personnel to prevent mental burn-out and create healthy competition among doctors.

# Advantages of early use of O-negative whole blood experience gained from working in forward surgical teams (FST) during the Russo-Ukrainian war

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## **Introduction**

The dynamics of the increase of number of the wounded during the modern Russo-Ukrainian war approach the dynamics of the WW II. In conditions of active hemorrhage, the combination of bleeding at the site of the injury, rapid evacuation, and pre-hospital resuscitation of blood saves life. Whole blood transfusion was a critical aspect of medical care in the army, especially in emergencies where rapid resuscitation is vital for saving a life.

## **Materials and methods**

A six-month period of retrospective research was conducted; medical cards of 87 wounded soldiers of the Armed Forces of Ukraine who were treated in the Zaporizhzhia military hospital were analyzed. Patients were divided into two groups, depending on blood preparations for hemotransfusion. After the injury, the soldiers evacuated to a stabilization point. Patients of the first group (OWB) used only whole-negative blood for hemotransfusion. Patients of the second group (component therapy for CT) use o-negative canned erythrocytes, one-group lyophilized plasma, and cryo-lines in a ratio of 1:1:1. Indication to cryo-prolongation coagulation time (by the Burker method). Preserved platelets were not used in connection with the specifics of the national policy of procurement of blood components and the absence of laboratory confirmation of thrombocytopenia. An important characteristic of FST is the simultaneous appearance of many wounded, the limitation of the patient's stay, a limited supply of medicines, and a constant number of doctors.

## **Results**

Laboratory data for hemoglobin, pH, and platelet count showed statistical differences in the OWB cohort. There was a difference in median blood products between the CT group and the OWB group, and the CT group had a higher total volume transfused. The mean volume in the CT group was 1554 120 ml of conservation, while in the OWB group it was 1150 ml of real blood with additional solutions of 30 ml. Thus, while the CT cohort received about 85% of the extra solutions, the OWB cohort received almost 95% of the actual blood. There was no statistically significant difference in 24-hour mortality between both groups. In the CT cohort, two cases of acute respiratory failure and one case of complications from the cardiovascular system (TACO syndrome) were registered.

## **Conclusions**

Using OWB independently is associated with improved 24-hour survival without increasing 24-hour assessment of organ dysfunction. The use of OWB has most affected the survival of patients with reduced clot resistance. Using the unique properties of o-negative blood and the benefits of transfusion of whole blood, military health workers can improve patient treatment results and save lives on the battlefield.

# TCCC curricula and training of combat medics and lifesavers: adaptation and strategic changes in the medical military force preparedness through the experience of Ukrainian Armed Forces

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## **Introduction**

The need for fundamental changes in the approach to tactical medical preparedness of the military personnel is now broadly understood and discussed, in Ukraine and among our international partners. At the beginning of 2024 the 1st International Legion Medical Service, published a position paper titled “War in Ukraine: TacMed Lessons Identified. Proposal of Changes”. In this publication we analyzed our 2022-2023 experiences regarding both casualty care and TacMed training for the warfighters and combat medics. Consequently, we proposed some critical updates.

## **Rationale**

We definitely recognize the TCCC guidelines as comprehensive and relevant, but we noted some significant issues with implementation in different combat settings. Therefore, having analyzed our casualty data, and the current frontline situation in Ukraine, we searched for viable solutions.

## **How does the war in Ukraine differ from other conflicts in which NATO militaries participated?**

- Not a large-scale combat operation, but a full-scale war;
- Modern weaponry and combat settings of unprecedented complexity;
- Distinct conditions, means and duration of evacuation;
- Need for rapid mobilization and training of many civilians.

## **What are the consequences?**

- Evacuation from POI to stabilization point may take hours, occasionally even days;
- Tourniquets save lives, but also cause complications leading to disability or death;
- TCCC guidelines cannot be fully implemented;
- Preventable deaths cannot be prevented;
- Scope of TacMed skills must be adapted to the stages and conditions of care delivery;
- Training programs and approach to organization of training require optimization.

## **What do we suggest?**

- Revise basic TacMed training of the warfighters, teaching them all the tourniquet utilization skills, and emphasizing hypothermia management;
- Add a junior combat medic (i.e. warfighter with more advanced TacMed skills, including IM injections) to each tactical group;
- Develop systemic approach to TacMed training, both at the training centers and within the units.

## Conclusion

In summary, we propose an update to the TCCC guidelines, accounting for the distinct combat settings in which casualty care is currently delivered. This will likely improve quality of said care, reduce incidence of complications, and increase chances of avoiding preventable death.

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# Railroad-based interfacility transport for prolonged medical evacuation in Ukraine: Role, capacity, and prospects

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## Introduction

Following the onset of the full-scale Russian invasion of Ukraine, the urgent need to evacuate the wounded in action en masse to the country's healthcare facilities intensified. The evacuation requires efficient use of available resources and prompt action, including the existing network of railways in Ukraine. National Railway Company "Ukrzaliznytsia" assumed responsibility for evacuating civilians and the military and became a crucial component of the Armed Forces of Ukraine's operation to evacuate injured soldiers.

## Purpose

The Armed Forces of Ukraine evacuation units faced missions that required effective and urgent solutions. The primary challenge involved transporting numerous casualties and strategically distributing them to medical facilities based on their treatment capabilities. At the same time, the highest amount of medical care had to be provided to the injured during transportation based on the severity of their state, keeping in mind that this evacuation must be safe. Consequently, the interaction between the railroad transportation company and AFU evacuation units came into existence with positive and negative aspects.

## Strengths

The rail transport infrastructure required minimal modifications to perform evacuation missions, primarily by repurposing carriages. The number of medical personnel on the evacuation train is considerably lower than that on motor vehicles for transporting the same number of casualties. Allocated timeslots for trains guarantee predictable evacuation times and reduce dependency on external factors.

## Weaknesses

Evacuation railway routes are limited and cannot originate from just any location. Usually, the path lies between a city that can accumulate a suitable number of injured and another that can admit those. The distribution of railway evacuation transport and Armed Forces of Ukraine evacuation units is uneven across the country. EMS transports the wounded from hospitals to the pickup point and vice versa. Considering this must be done promptly, it creates a heavy workload in specific hours. There are limited treatment capabilities onboard. If the wounded's condition critically worsens, the patient must be urgently transported to a medical facility.

## **Conclusions**

Railway transport is an effective method for evacuating the wounded in action, and it has proven to be so for the third consecutive year of active warfare in Ukraine. Although not perfect, efforts are constantly being made to modernize the technical aspects of evacuation, train the Armed Forces of Ukraine evacuation units to work with new equipment, and improve administrative mechanisms. Overall, the trend is positive, with units now able to evacuate more casualties under severe conditions than was previously possible