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Research and conflict: mapping research trends and gaps in Ukrainian Emergency Medical Services– a scoping review

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Abstract

Introduction Conflict´s impact on research has seldom been analyzed, while research activities may improve population health and health service provision in conflicts. Efficient functioning of Emergency Medical Services (EMS) is essential for providing regular emergency care and addressing the healthcare needs arising from the ongoing conflict in Ukraine. However, research on the development, challenges, and opportunities of EMS system are limited. The objective of this review was to document the research trends, identify how conflict has shaped research production, and knowledge gaps related to EMS in Ukraine from 2002 to 2024.

Methods A systematic literature search was conducted on January 26, 2025, on PubMed, Scopus, and Web of Science, following the PRISMA-ScR guidelines. The review included peer-reviewed studies, commentaries, case studies, reports, and policy documents focusing on EMS in Ukraine. Data extraction and analysis were performed using Microsoft Excel (Version 2501) and Jupyter Notebook(running on Jupyter Server 2.15.0) with visualization using Sankey plots and heatmaps.

Results Of the 1,010 initially identified articles, 62 met the inclusion criteria. Research topics have evolved significantly, with Disease-Specific Care in conflict emerging as an extensively studied area ($n=8$) post-2022. Quality of Care ($n=12$) and Hospital Care ($n=7$) were prominent focus areas. Profound impact on EMS research activity was noted in the 2022 invasion in comparison to the 2014 conflict, causing widespread service disruptions ($n=15$) and a positive impact on the evolution of EMS training ($n=11$). Key research gaps included lack of data, standardized protocols, and resource limitations within the emergency management system.

Conclusions This review highlights the evolving field of EMS research in Ukraine, emphasizing the growing focus on specialized care in conflict environments. The findings underscore both the resilience of Ukraine's EMS system and the need to establish standardized data collection systems, develop cost-effective resource management strategies, improve coordination among key stakeholders, and explore innovative technologies to enhance EMS operations in crisis situations.

Keywords Emergency Medical Services (EMS), Ukraine, Conflict, Healthcare, Research trends, Knowledge gaps

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Introduction

Conflicts have significant impact on various sectors including science and research, a discussion that extends beyond the objectives of our manuscript [12]. Specifically in Ukraine, the effect of Russian-Ukrainian war on research productivity has been analyzed. The authors documented a substantial decline in both quantity and quality of research produced by authors based in the Donetsk/Luhansk occupied regions with active hostilities. In contrast, the authors observed a rise in quantity of papers published by scholars based in annexed Crimea, which highlights the uneven impacts of war on research productivity [3]. Conflict can hinder research through disruption and resource limitations, while research can play a vital role in improving conflict response by guiding policy, practice and humanitarian actions [1, 3]. The relation between conflicts and research has different related components that are summarized in Fig. 1.

During conflicts, some health care sectors play a crucial role, among them is Emergency Medical Services (EMS) which provides emergency care to patients with acute illnesses or injuries while bridging the gap between community and hospital-based services [4, 6]. Research in prehospital care is a concern for the scientific community as it faces many practical difficulties, [7] including lack of standardized data and ethical issues [8] and these difficulties are severe in conflict situations.

In Ukraine, prehospital care has been described as highly variable in terms of quality, [9] although the EMS operates under a well-established legal framework, ensuring around the clock and free emergency care for citizens [10]. However, the system has encountered significant challenges due to economic constraints, political changes, [11] and ongoing healthcare reforms [12]. Similarly, outdated infrastructure, shortages of medical supplies, and limited funding continue to hinder EMS operations [10]. A comprehensive evaluation by the World Health Organization (WHO) highlighted the presence of fundamental elements in Ukraine's prehospital care system but emphasized the need for substantial improvements [4, 10, 13].

Various studies have highlighted the unique challenges in Ukraine that has been exacerbated by the ongoing armed conflict. These studies found significant gaps in standardized procedures, [14] limited data [15] resources, and training for workers [16]. Publications further highlight innovative training programs on the delivery of trauma care, [14] advanced trauma life support, [17] and Vita Rescue System (VRS) have enhanced prehospital care delivery [18] and medical evacuation during wartime [19]. The skills gained from conflict medicine training are valuable not only in conflict scenarios, but also in managing day-to-day medical emergencies [20]. Research on trauma care reveals serious problems with medical evacuation, a shortage of supplies, and poor coordination [9]. Field assessments point out challenges of standardizing emergency medical teams and the pressure on local resources [16]. There are also concerns about the EMS

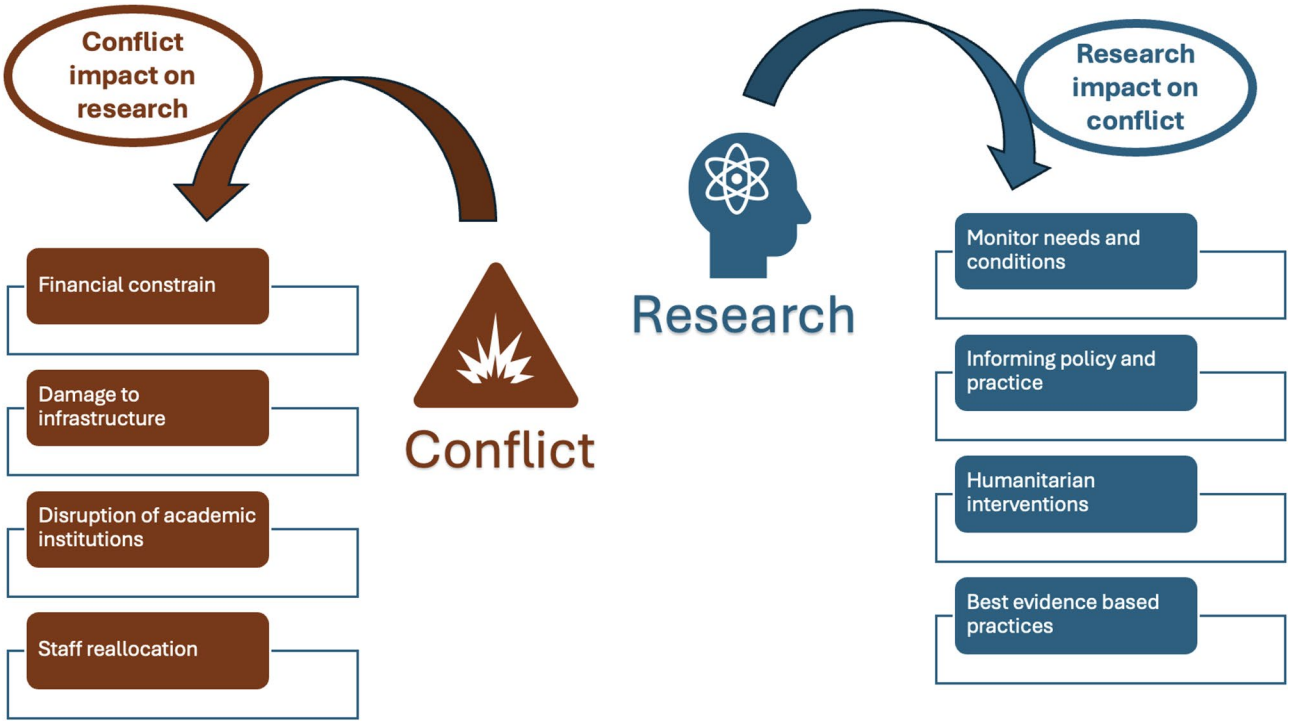

Fig. 1 Components of relation between the impact of conflict and research

Table 1 PCC framework for the systematic scoping review

Population	Actors relevant to Emergency Medical Services (EMS) in Ukraine
Concept	Types of research conducted, impact of 2014 conflict and full-scale invasion, knowledge gaps, research needs and opportunities
Context	Historical and geopolitical influences shaping EMS in Ukraine across three key time periods (Pre conflict in 2014, 2014–2022, full scale invasion in 2022 and post full-scale invasion. Studies conducted over the past 20 years from 2004 to 2024)

response to respiratory distress, especially regarding slow response times and deaths [6]. The situation in Ukraine is unique due to ongoing armed conflict and healthcare reforms. This requires a deeper understanding of the issues. The war has increased the need for emergency care, [21] disrupted supply chains, and damaged healthcare infrastructure. Despite the critical role of the EMS in Ukraine, there has been limited research on its development, challenges, and adaptations over time.

Given the major obstacles faced and limited documentation of EMS research production affected by conflict in Ukraine, a scoping review was selected as the most appropriate method to map the existing research areas and identify the gaps to prioritize future research. This approach provides a broad overview of literature and helps to explore emerging areas of research in Ukraine. Additionally, the review assesses the studies conducted across a 20-year period to capture long-term trends before and after major conflicts.

This scoping review seeks to explore research related to Emergency Medical Services (EMS) in Ukraine from 2004 to 2024 as an example on how research activity is affected by and can contribute to conflicts. It aims to identify key research trends, impacts, knowledge gaps, and opportunities for future studies (Table 1). The primary objectives of this review were to (1) Identify the types of research that have been conducted related to Emergency Medical Services (EMS) in Ukraine over a 20-year period. (2) Analyse the impact of 2014 conflict and full-scale invasion in 2022 on EMS research activity. (3) Identify knowledge gaps, research needs and opportunities to contribute development of EMS and adaptation to new threats in Ukraine.

Methods

Study design

This scoping review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) [22] Review protocol guidelines were developed according to Peters et al. [23] and Jonna Briggs Institute (JBI) scoping review methodology [24].

Table 2 Electronic search strategy

Database	Search terms	Records
PubMed	1. ((Emergency Medical Services OR EMS OR Emergency Care OR prehospital care) AND (before 2014 conflict or historical)) AND (Ukraine OR Ukrainian)–27 results 2. (((Emergency Medical Services OR EMS OR Emergency care OR prehospital care) AND (evolution OR development OR Changes OR Adaptations)) AND (Conflict OR Russian Invasion)) AND (Ukraine OR Ukrainians)–63 results 3. ((Emergency Medical Services or EMS or Emergency Care OR Prehospital care) AND (Russian Invasion or post-2022 or Current Conflict)) AND (Ukraine or Ukrainian)–41results 4. (((Out of hospital care or Emergency Medical Care) AND (Structure or Process or Results)) AND (Conflict)) AND (Ukraine)–116 results	**247**
Web of Science	1. ((TS=Emergency Medical Services or EMS or Prehospital Care)) AND TS= (Conflict or Russian Invasion or Donbas Conflict or Euromaidan)) AND TS= (Ukraine or Ukrainian)- 30 results 2. ((TS= (Out of Hospital care or Emergency Medical Care)) AND TS= (Conflict 2014 or Russian Invasion)) AND TS=(Ukraine)–14 results	**44**
Scopus	1. ((Emergency Medical Services or EMS or Prehospital Care)) AND TS= (Conflict or Russian Invasion or Donbas Conflict or Euromaidan)) AND TS= (Ukraine or Ukrainian)- 203 results 2. Emergency AND medical AND care OR out AND of AND hospital AND care AND conflict 2024 OR Russian AND invasion AND Ukraine – 126 results	**329**
Google scholar	1. (¨Emergency Medical Services¨ or EMS or Prehospital care) AND Ukraine AND (¨Conflict 2014 or 2022 full scale invasion)- 390 results	**390**

Search strategy

The database search was conducted on January 26, 2025, on PubMed, Scopus, Web of Science, and Google Scholar (Table 2). The search, guided by application of key words as "Emergency Medical Services", "Ukraine", "Prehospital care ", "Conflict", "Emergency Preparedness and Response", and "International Adaptations" using AND, OR as Boolean operators. A time filter of 20 years (2004–2024) was applied to the search to capture relevant studies and assess research trends over two decades. The open-source reference management software Mendeley Web Importer was used to save database search results.

All identified articles were uploaded into the Rayyan Intelligent Systematic Review tool, and duplicates were automatically removed [25]. Title and abstract screenings were independently conducted by two researchers

in accordance with predefined inclusion criteria. After abstract screening, full-text screening of the articles was performed. For paywalled articles, communication with the corresponding authors was established. Mutual consensus was established among all reviewers at each phase of the process.

Inclusion and exclusion criteria

This scoping review focused on Emergency Medical Services (EMS) providers and patients as the population of interest. It examined various types of research, the effects of conflict in 2014 and 2022, knowledge gaps, and potential opportunities in the field of EMS. This review addresses three time periods: prior to the conflict in 2014, the interval between 2014 and 2022, and the post-invasion period following the full-scale Russian invasion. The review includes a range of studies, such as peer-reviewed quantitative, qualitative, and mixed-methods research. It also considers commentaries, case studies, reports, grey literature, expert opinions, and policy documents.

The review excluded studies that did not concentrate specifically on EMS, those conducted outside Ukraine, and any studies published in languages other than English.

Data extraction and analysis

A standardized data extraction template was prepared in a Microsoft Excel spreadsheet (Version 2501) by Microsoft Corporation, based in Redmond, Washington, U.S. Two reviewers (R.S.A and M.P.B) independently collected specific information based on the following categories: title, authors, published year, sample/Scope, primary study focus, secondary focus areas, target population, key findings, major gaps, and study period. After the data extraction, a third reviewer (R.C.D.) verified and resolved any disagreements. The data extraction template is presented in Supplementary Table 1. The extracted data were analysed and synthesized following the JBI scoping review methodology. The data were categorized by study type, sample size, research method, focus area, target population, and system level to allow for consistent comparisons. The systematic coding of key findings and gaps across all studies resulted in major thematic categories that captured essential patterns in the literature. Additionally, research evolution was examined across three distinct periods: pre-2014, 2014–2022, and post-2022, to identify changes in focus, recurring gaps, and analyse patterns while mapping future research opportunities. For data analysis and visualization as part of this scoping review, reviewers utilized Jupyter Notebook (running on Jupyter Server 2.15.0). Furthermore, a Sankey Plot was used to visualize the connection between the topics of study and the target populations.

Methodological quality appraisal

Since this is a scoping review aimed at mapping available evidence, risk of bias assessment or quality appraisal of the included articles was not conducted.

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Results

A total of 1,010 articles were identified through database searches, including PubMed ($n = 247$), Web of Science ($n = 44$), Scopus ($n = 329$), and Google Scholar ($n = 390$). After removing 503 duplicates, 654 records were screened based on titles and abstracts. Of these, 554 were excluded at the screening stage, leaving 100 reports sought for retrieval. Four reports could not be retrieved($n = 4$), resulting in 96 full-text articles assessed for eligibility. Following full-text review, 31 articles were excluded due to full text not being available ($n = 31$) or not being relevant to the study objective ($n = 30$). Ultimately, 62 studies met the inclusion criteria and were included in this review. Detailed information on the article selection process is illustrated in the PRISMA diagram (Fig. 2).

Based on the analysis of the 62 included studies, a wide range of research topics and target groups were identified. The data revealed several key focus areas in research related to conflict.

Characteristics of included articles

The dataset included a collection of 62 publications (Supplementary Table 2). The temporal distribution of the publications ranged from 2004 to 2024, with studies published between 2012 and 2020 ($n = 3$), in 2022 ($n = 10$), in 2023 ($n = 20$) and in 2024 ($n = 29$). Regarding the types of studies, the dataset included cohort studies ($n = 8$), case studies ($n = 8$), cross-sectional studies ($n = 7$), secondary data analysis ($n = 6$), commentaries ($n = 7$), field reports($n = 3$), qualitative studies ($n = 3$), meta-analysis ($n = 3$), case-control studies ($n = 2$). Additionally, there was one publication each for descriptive study, scoping review, implementation study, documentation, review article, viewpoint article, report, observational study, project description, seminar report, editorial letter, and systematic review.

Evolution of EMS research topics in Ukraine (2012–2024)

Analysis of the 62 studies revealed diverse research topics related to Emergency Medical Services (EMS) in Ukraine from 2012 to 2024. The research landscape demonstrated significant evolution over this period, with distinct patterns of focus emerging across different timeframes.

The 2012–2020 period had limited research activity, with only sporadic publications focusing on Ambulance

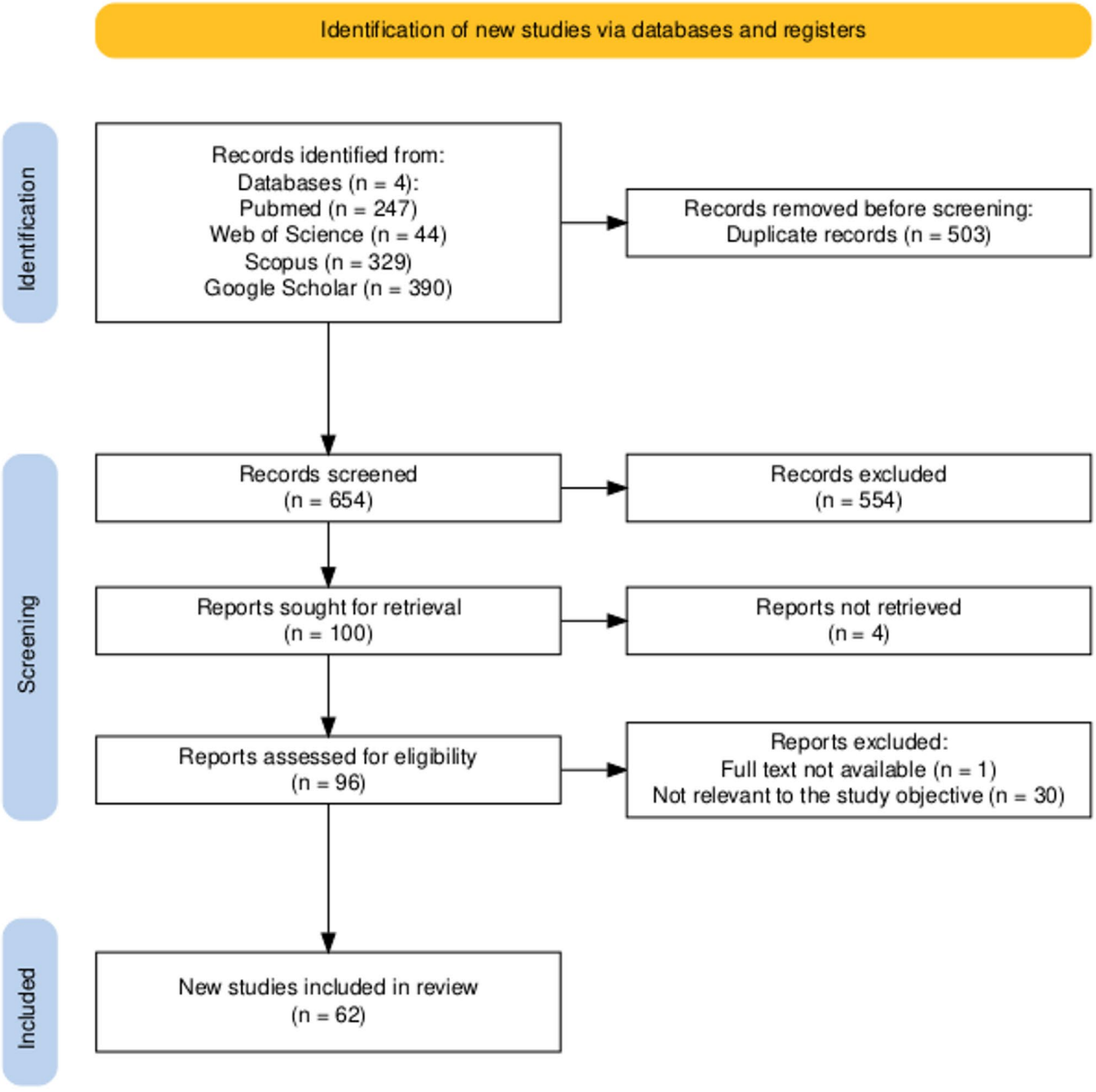

Fig. 2 The PRISMA flow diagram [22]

Services & Operations and isolated work on Disease-Specific Care in Conflict. This early research laid a foundational understanding but remained minimal in scope and quantity, with only 3 studies published during this eight-year period.

A substantial shift occurred from 2022 onward, with research topics expanding dramatically across multiple domains. Disease specific care in conflict emerged as the most extensively studied area ($n=8$), followed by Medical Evacuation Systems ($n=5$), Security & Attacks on Healthcare ($n=5$), and Emergency Training & Education ($n=4$).

The 2023–2024 period demonstrated further specialization with a notable focus on Chemical, Biological, Radiological, Nuclear, and high yield Explosives (CBRNE) emergencies, trauma systems, and innovations in emergency care. The most recent publications (2024) emphasized operational aspects including medical evacuation, military medical support, and mental health considerations for healthcare workers, reflecting the evolving priorities within the conflict setting (Fig. 3)

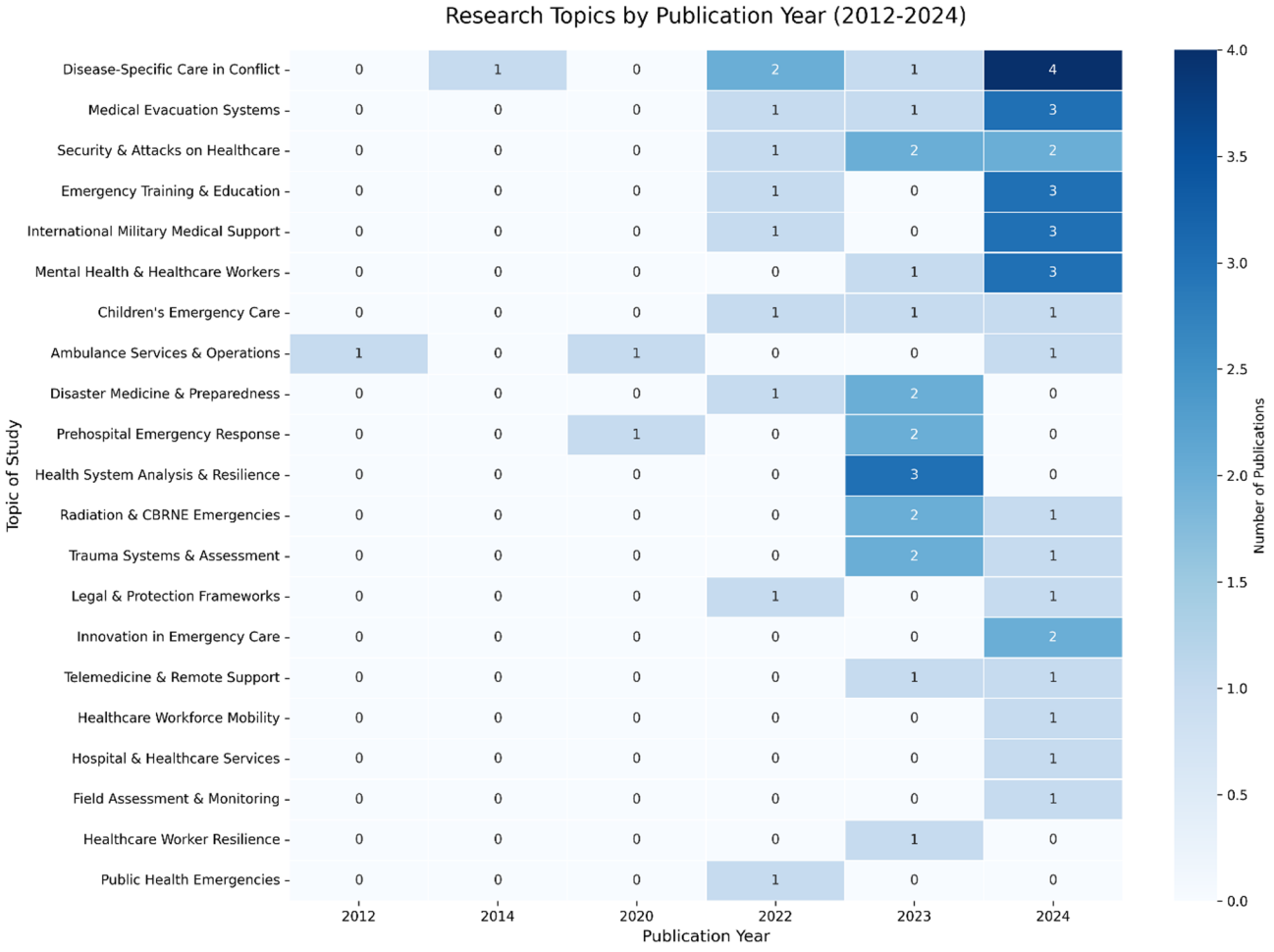

Fig. 3 Temporal distribution of research topics related to Emergency Medical Services in Ukraine (2012–2024). The heatmap illustrates the relationship between research topics (on the left axis) and publication years (on the bottom axis). The colour intensity corresponds to the number of publications for each topic per year, with darker blue indicating higher publication frequency and lighter blue representing fewer publications

Research topics and target populations in healthcare studies in Ukraine

Research topics were categorized into several main themes, with Quality of Care ($n = 12$) being the most common focus area, followed by Hospital Care ($n = 7$), Health Workforce ($n = 6$), and Medical Products & Technologies ($n = 6$). Other significant research areas included Trauma Care System ($n = 3$), Service Delivery ($n = 3$), and Health Information Systems ($n = 3$). Less frequent but notable topics included Patient-cantered Care ($n = 2$), Training and Education ($n = 2$), Emergency Preparedness ($n = 2$), as well as several topics represented by single studies such as Primary Health Care, CBRNE Training, Psychological Resilience in Mental Health Workers, Disease Management, Non-communicable Diseases, Vita Rescue System, Aeromedical Retrieval Medical Evacuation, Access to Care, EMS Response, War-related Disruption, Food Crisis, National Security, Healthcare Facility Attack, Infectious Diseases, and Health System Performance.

The target groups of these studies were predominantly Patients ($n = 19$), followed by Healthcare Providers ($n = 12$), Health Managers/Administrators ($n = 6$), and Healthcare Facilities ($n = 5$). Other target populations included Ukrainians ($n = 3$), Physicians ($n = 3$), Victims of War ($n = 3$), Multiple Stakeholders ($n = 2$), Wounded Combatants and Civilians ($n = 2$), and single instances of studies targeting Specific Disease Groups, Medical Students, EMS Staff, Children/Adolescents, and People with Disability.

The relationships between the research topics and target groups are shown in a Sankey diagram (Fig. 4), which illustrates the flow and distribution of the research focus areas across different populations.

Impact of 2012 conflict and full-scale invasion 2022 on emergency medical services research activity in Ukraine

Of the 62 included studies, 55 reported on the impact of the 2014 conflict and full-scale invasion in 2022 on EMS research activity in Ukraine. (Fig. 5)The Key research

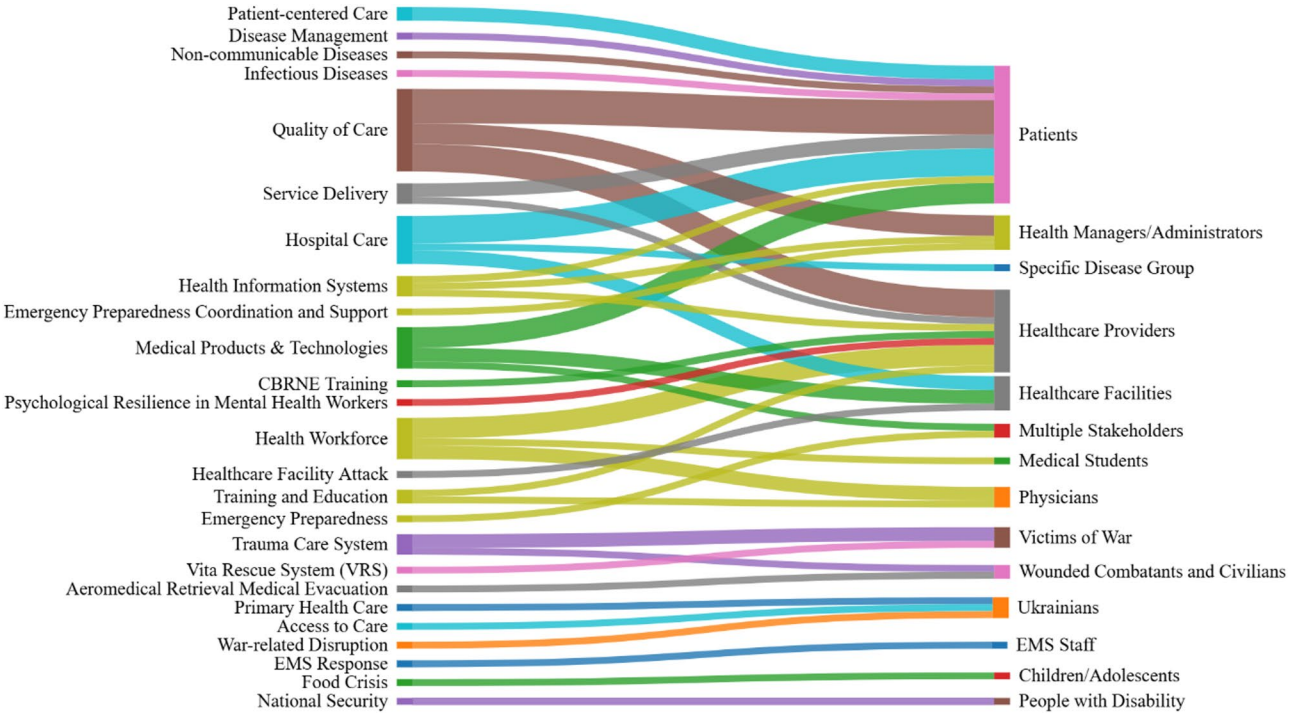

Fig. 4 Research topic distribution by target groups in the included studies. On the left side are the research topics identified across the 62 included studies, whereas on the right side are the target populations addressed by these studies. The width of each flow shows how many studies connect a specific research topic to a certain target group. Wider flows mean there are more studies involved

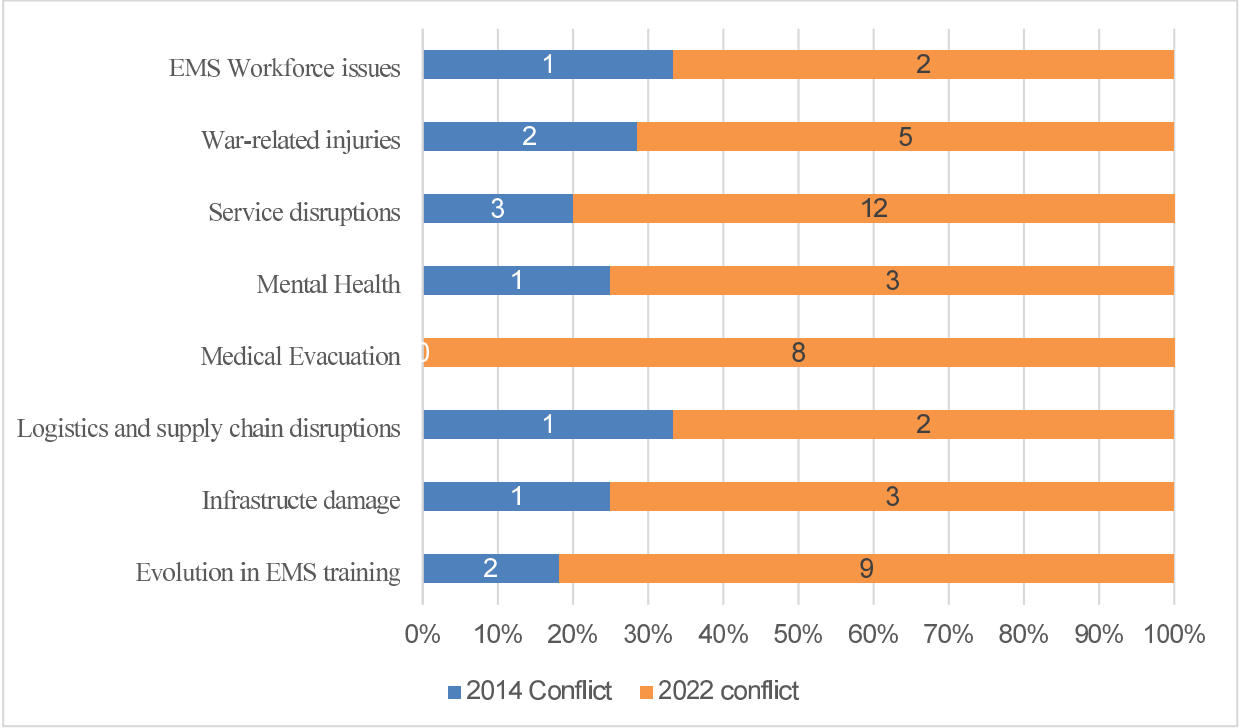

Fig. 5 Impact of 2014 and 2022 conflicts on Emergency Medical Services research activity in Ukraine, as identified in the 55 studies included in the scoping review. The horizontal bar chart represents the number of studies addressing specific themes related to key areas of impact. The 2014 conflict is represented in blue while the 2022 conflict in orange, the longer orange bars indicate greater strain on EMS due to 2022 full-scale invasion

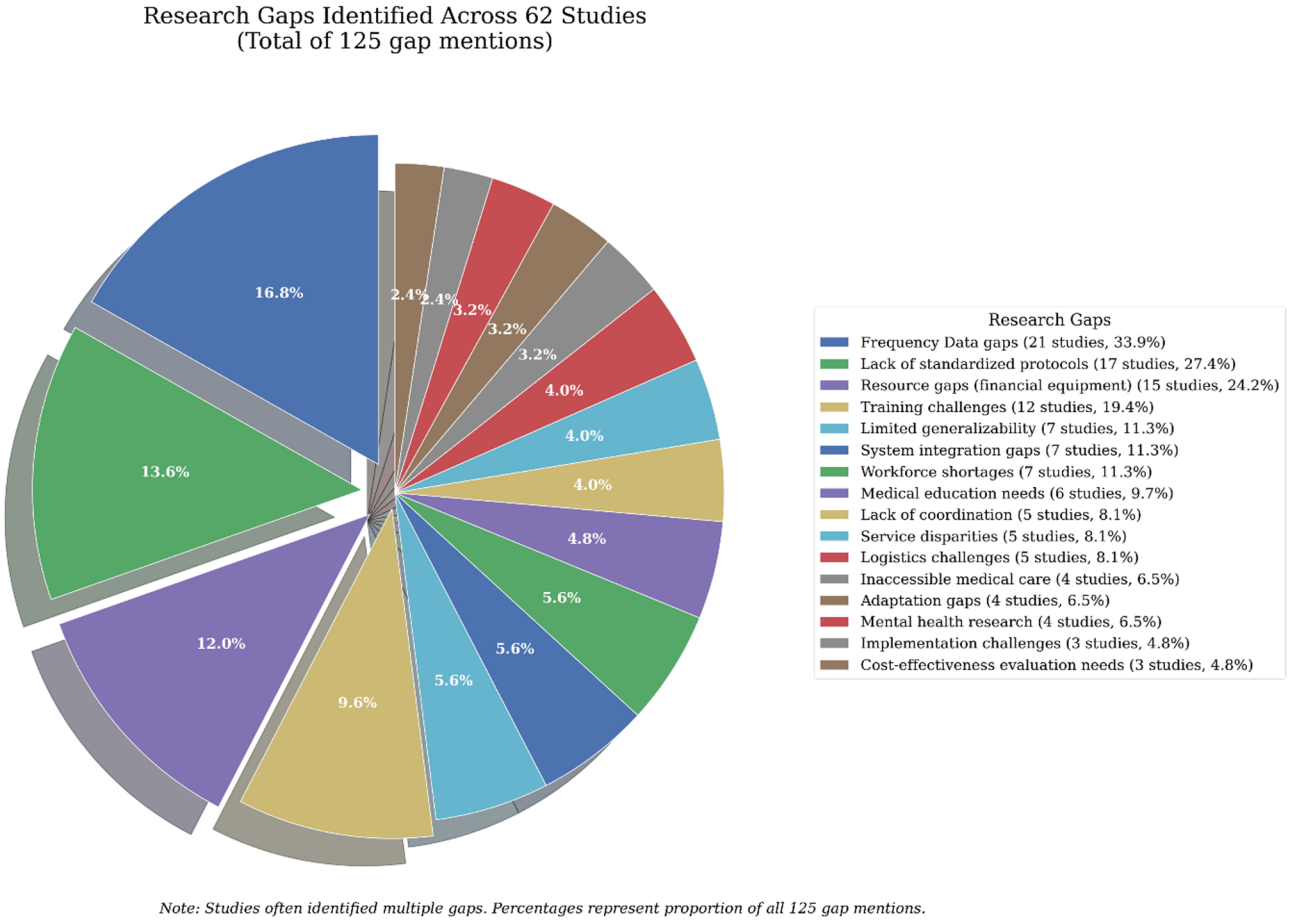

Fig. 6 Distribution of research gaps identified across 62 analyzed studies related to Emergency Medical Services in Ukraine. The pie chart segments represent the proportion of each gap category among the total 125 gap mentions, with percentages indicating relative frequency

activities conducted were categorized into specific themes, with Service disruptions ($n = 15$) being the most frequently mentioned, followed by evolution of training ($n = 11$), Infrastructure damage ($n = 4$), Logistics and supply chain disruptions ($n = 3$), Medical Evacuation ($n = 8$), Mental Health ($n = 4$), War-related injuries ($n = 7$), and Workforce Issues ($n = 3$). The data revealed a significantly higher number of studies documenting the impact of the 2022 conflict compared to 2014, particularly in the areas such as service disruptions, war related injuries, and medical evacuations. Notably, only 20% of the studies mentioned the impact of 2014, which indicates extensive research activities were carried out following 2022 invasion. Medical Evacuation ($n = 8$) highlighted studies were only conducted after the 2022. There was a positive evolution in the publication of manuscripts (highlighted in 11 studies) related to EMS training aimed at equipping medical personnel with combat-related trauma care and emergency response strategies, enhancing their capacity to provide emergency care in conflict settings.

Research gaps and limitations identified in EMS studies in Ukraine

As illustrated in (Fig. 6), the most common limitation was the lack of available data, which accounted 16.8% of all mentions and appeared in 33.9% of the studies ($n = 21$). The second most common issue was the lack of standardized protocols, accounting for 13.6% of mentions ($n = 17$), indicating inconsistencies in the methods used across the studies. Resource-related problems were also significant, with financial and equipment shortages making up 12.0% of mentions ($n = 15$). Training challenges were noted in 9.6% of mentions ($n = 12$), which further complicated resource limitations. Operational barriers appeared in several related gaps. These included issues with system integration and workforce shortages. Each of these was mentioned in 11.3% of studies ($n = 7$) and together accounted for 16.8% of all mentions. This suggests that staffing issues and coordination difficulties remain as ongoing challenges in delivering emergency care. Less frequently mentioned gaps included medical education needs ($n = 6$), coordination issues ($n = 5$), service disparities ($n = 5$), and logistics challenges ($n = 5$).

These highlight the complex and multifaceted nature of developing EMS systems in conflict zones. Although implementation challenges and the need for cost-effectiveness evaluations were less common ($n = 3$ each), they remain important areas for future research.

Discussion

This review examined 62 studies on Emergency Medical Services (EMS) in Ukraine from 2004 to 2024 and identified key trends in research topics, methodologies, the impact of 2014 and 2022 invasion on EMS research production, and existing gaps in the literature.

Prior to 2022, there were very few publications related to Emergency Medical Services (EMS), but afterward, a diverse area of studies emerged. Many studies identified gaps in research, with the lack of standard protocols being the second most common issue, observed in 27.4% of the studies. The most extensively studied topic was Disease-Specific Care in conflict settings ($n = 8$), emphasizing the immediate challenges of providing specialized care during humanitarian crises. Inesa et al. [26] pointed out that managing cancer care during conflicts and highlighted the successful evacuations of cancer patients, demonstrating their ability to overcome significant operational challenges. Similarly, these studies indicates that the Non Communicable Diseases (NCD) management remains a challenge in Ukraine, which included difficulty in diabetic care due to disruptions in health care, [27] disparity in healthcare access, relying on international support and logistics challenges in fighting with Cancer, [26] and as Shkoruta et al. [15] documented a concerning 22.4% increase in stroke incidence in 2023 and has identified a positive association of stress and stroke in their research. While there are various research mainly focusing trauma care and emergency management during a crisis situation, areas like NCD management may get less attention as was evident during the COVID-19 pandemic [28].

The WHO Country Office in Ukraine has identified HIV testing and treatment, TB prevention and treatment, mental health care, including low coverage rates, high levels of stigmatization, and limited training in mental health care for PHC staff [13]. Several studies have proposed improvements to clinical practice. For example, Butler et al. [29] provided important recommendations on the use of tourniquets in conflict situations. They emphasized that while tourniquets are vital for controlling severe extremity bleeding, unnecessary use can lead to amputations and serious complications. This highlights the need for proper training and regular reassessment.

There is a growing emphasis on addressing (Chemical, Biological, Radiological, Nuclear, and Explosive) CBRNE emergencies, [30] enhancing trauma system, [9] and exploring innovations [31] in emergency care. This shift reflects changing priorities in conflict zones and supports the findings of Timothy et al. [30] which highlight the need for specialized training to meet the unique challenges in these areas. One concerning trend is the targeting of healthcare facilities during conflicts. Verda Tunalıgil [32] raised alarms about the increasing attacks on hospitals and medical personnel. Our analysis of research on security and attacks on healthcare [32, 36] also documented systematic threats to medical infrastructure.

There are significant challenges faced by Emergency Medical Teams (EMTs) in Ukraine, as mentioned in the study conducted by Kobi et al. [16]. These challenges include the need for improved coordination, standardized certification processes, and enhanced training programs. Volunteers need to be prepared to address language barriers, emotional difficulties, and remain adaptable in rapidly changing situations [9]. Despite extensive research on Quality of Care ($n = 12$) and Hospital Care ($n = 7$), our analysis uncovered notable gaps in research methodology and focus areas. Approximately 33.9% of the studies ($n = 21$) lacked data, which poses a barrier to evidence-based healthcare initiatives in Ukraine. Additionally, resource constraints were observed in 24.2% of studies ($n = 15$).

The 2022 full-scale invasion had a more profound and extensively studied impact on EMS research activities 80% ($n = 44$) compared to the 2014 conflict, causing widespread service disruptions, extensive infrastructure damage, and severe logistical challenges. Barten et all [34, 37] indicate health care facilities and ambulances are targeted for attacks with increased documented attacks on healthcare facilities and ambulances creating huge strains on service delivery. Furthermore, the Ukrainian Health care system was severely impacted by the mass emigration of medical personnel [38] creating workforce shortage at medical facilities. This was further exacerbated by disruptions in supply chain for essential equipment and pharmaceuticals, problems around medication storage due to power outages [21, 39, 40]. As of October 2023, the main barriers impeding service delivery were lack of staff (49%), medical equipment (28%), medical supplies (39%) [41]. The review identifies war-related injuries reported ($n = 7$) in both conflicts, with a significant rise in polytrauma cases due to the use of NPA-level weaponry [42] increased deaths and injuries. [33, 43] Derrick et al. points increased war-related deaths and injuries reaching a peak in 2014, [33] with children and elderly being highly affected [44]. Evolution in EMS training was noticed as positive impact, which improved significantly in response to conflicts, demonstrating the ability of these systems to innovate under extreme pressure. This includes trauma care training in wartime setting, [14, 45]

VRS training to Ukrainian forces [19] (20) and integration of telemedicine for remote consultations [46].

The analysis of the target population reveals that most of the studies are focused on studying about the patient's group ($n = 19$). However, significant attention has been given to healthcare providers ($n = 12$), acknowledging their dual role as both caregivers and individuals affected by conflict. This is particularly important, as documented by Patryk et al. [47] which showed that many Ukrainian civilian doctors and paramedics suffer from PTSD, anxiety, and depression. Additionally, the ongoing migration of Ukrainian health workers to Poland, noted by Liudmyla et al., [38] even more complicates and worsens the workforce planning during for the healthcare delivery systems.

This review outlines several priorities for future research based on the identified gaps in EMS operations. First, research should focus on developing standardized data collection methods and protocols for EMS operations in conflict settings [14, 26, 36, 42]. Secondly, cost-effective solutions for equipment and financial resource allocation should be investigated to optimize resource use [21]. Given the geographical barriers in conflict-affected areas, developing remote learning and simulation-based training for EMS personnel is essential. Research should explore effective models for integrating EMS systems with existing healthcare infrastructure in conflict-affected areas [20, 21, 48]. Another critical area is investigating strategies to improve coordination among key stakeholders, including local authorities, NGOs, and the military to strengthen emergency response. In parallel, studying recruitment and retention strategies for EMS personnel in high-risk environment is vital, along with exploring local capacity-building initiatives to address workforce shortages. Conducting multi-site studies across different conflict zones will also improve the external validity of research findings. Additionally, research should focus on innovative solutions for supply chain management and equipment distribution in unstable environments to ensure the uninterrupted delivery of essential medical supplies. Conducting implementation research to identify the barriers and facilitators to EMS system development in conflict zones is equally important. Moreover, developing and testing implementation strategies tailored to the unique challenges can provide actionable solutions [16]. Lastly, assessing the potential of emerging technologies in improving EMS operations and decision-making will contribute to improve EMS service delivery in conflict zones [49]. Future research should take a balanced approach. It should focus on the urgent needs of emergency medical services (EMS) during conflicts while also paying attention to longer-term public health issues which includes managing chronic diseases, mental health, and rehabilitation after conflicts [28].

Limitation of the study

This study includes publications from 2012 to 2024, which limits the ability to capture research trends over the past two decades. Consequently, it does not provide a complete picture of how EMS in Ukraine has evolved over time. The review aimed to examine the impact of conflict on EMS research activity. However, many of the included articles addressed broader war-related issues rather than the specific impacts on EMS activities. This suggests that further research should be on the effects of conflicts on EMS and to non-war-related conditions. Additionally, studies published in Ukrainian or Russian may contain valuable insights, and their exclusion could lead to in incomplete representation of research trends, impacts and gaps. Since none of the authors are based in Ukraine, consultation was done with Ukraine based individuals to better understand the context and connect with local experts.

Conclusion

The findings of this review revealed a distinct shift in EMS-related research in Ukraine following the full-scale invasion, with a strong focus on operational challenges and adaptations in conflict settings. Key research areas included specific disease management in conflict zones, evolution of medical evacuation systems, and the security challenges faced by healthcare facilities. This review identified the critical impacts of conflicts on EMS research activities, such as service disruptions, infrastructure damage, and logistical challenges. However, positive developments were also noted, particularly the evolution of EMS training to address wartime medical needs. Despite these findings, important research gaps remain such as a lack of frequency data and standardized protocols. Overall, this review underscores the resilience of Ukraine´s EMS system while emphasizing the need for continued research to enhance emergency medical care in conflict-affected regions.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13031-025-00711-y.

Supplementary Material 1

Supplementary Material 2

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Author contributions

Conceptualization: RCD; Data curation: RCD, MPB, RSA; Formal Analysis: RCD, MPB, RSA; Funding acquisition: RCD; Investigation: RCD, MPB, RSA; Methodology: RCD, MPB, RSA; Project administration: RCD; Resources: RCD; Software:; Supervision: RCD; Validation: RCD, MPB, RSA; Visualization: RCD, MPB, RSA; Writing – original draft: MPB, RSA; Writing – review & editing: RCD.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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