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Literature Study of The Implementation and Policy of Military Telemedicine In Support Of Troop Mobilization In Conflict Areas

Desi Tirtawati*[1]; Sutanto[2]; Guntur Eko Saputro[3] .

Indonesia Defense University, Bogor, Indonesia
E-mail: (dstirtawati@gmail.com, pakarkeshan12853@gmail.com, Guntur.saputro@idu.ac.id)
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Abstract

The advancement of information technology has revolutionized military healthcare through telemedicine, particularly in supporting troop mobilization in conflict zones. However, the urgency of remote medical services in high-risk areas often conflicts with legality and information security challenges. This study aims to analyze the legal framework and regulatory challenges in implementing telemedicine within military operations. Using a literature review method, this research systematically reviews 25 national and international journal articles. The analysis focuses on legal voids, infrastructure policies, and legal protection of medical data security in cyber transmission. The findings indicate that while military telemedicine effectively enhances operational readiness and specialist access, its implementation is hindered by the lack of specific legal frameworks and vulnerabilities in protecting soldiers' personal data in the field. Therefore, harmonization of defense and health policies, along with the establishment of adaptive regulations, is required to ensure legal certainty and cyber security in military telemedicine administration.

Keywords: Military Telemedicine, Health Regulation, Data Protection, Cyber Law, Conflict Zone.

A. Introduction

Various conflicts of interest, whether political, economic, or socio-cultural, are an inevitable part of social life. In such conflict situations, special autonomy is usually granted to regions with high potential and vulnerability to differences and inequality, or with potential for conflict [1]. Both national and international conflicts involve the use of armed forces between two or more parties to resolve disputes. The chaos of conflict causes various problems, including health services, due to infrastructure damage and medical supplies shortages[2].

In times of conflict, troop mobilization is often a policy response to maintain the integrity and sovereignty of a region, with the aim of controlling and assisting post-conflict recovery. In this era of increasingly advanced information technology, troop control has

[1] E. I. Rohmah, "Otonomi Khusus Sebagai Bentuk Desentralisasi Politik Pada Daerah Rentan Konflik," *Legacy: Jurnal Hukum Dan Perundang-Undangan* 3, no. 2 (2023): 181–98, https://doi.org/10.21274/legacy.2023.3.2.181-198.
[2] M. S. Sever et al., "Armed Conflicts and Kidney Patients: A Consensus Statement from the Renal Disaster Relief Task Force of the ERA," *Nephrology Dialysis Transplantation* 38, no. 1 (2023): 56–65, https://doi.org/10.1093/ndt/gfac247.

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undergone a significant revolution, including the use of high-precision weapons and the integration of information systems, including the use of telemedicine in troop mobilization in conflict areas[3].

In conflict situations, access to health workers, facilities, and logistics is often disrupted. Telemedicine can be one solution that bridges this gap, enabling consultations, providing mental support, and monitoring from a distance. As seen in the Russia-Ukraine conflict, it was reported that through telemedicine programs, tens of thousands of consultations (around 62,000) were conducted in a war situation, with most of them being text-based communications. Telemedicine can expand specialist care, reduce the burden of evacuation, and maintain combat readiness[4].

Military telemedicine has been used in the US Military Health System (MHS) since the early 1990s. Telemedicine can improve access, quality, reduce costs, and increase military readiness. This is in line with the objectives of the MHS as outlined in the MHS "Quadruple Aim" (cost, quality, access, readiness)[5]. In its implementation, telemedicine varies across regions, including the types of telemedicine platforms used and their adoption rates[6]. Telemedicine has great potential, but there are still gaps, especially in evaluating the effectiveness of telemedicine interventions in conflict zones and ensuring equitable access for the most affected populations.

Although telemedicine helps with treatment options and outcomes, its implementation is very limited due to the context of operations under attack, logistical crises, staff and equipment shortages, and extremely urgent medical conditions. This study aims to explore how telemedicine models can strengthen the capabilities of local medical teams amid conflict and extremely limited conditions, even though such models cannot replace the need for a functional health care system[7].

B. Research Method

This study adopts a qualitative approach with a Systematic Literature Review (SLR) design to elaborate on the legal framework and operational implications of military technology application. This method is carried out through a series of systematic protocols that include inventory, critical evaluation, and synthesis of secondary data from various authoritative literature. Data collection was carried out by searching globally and nationally reputable academic databases, namely Scopus, Google Scholar, and SINTA, to ensure the validity and credibility of the reference sources. The literature search strategy focused on recent publications within the last five years (2021–2025) to capture the current dynamics of developments in defense technology and geopolitics. The search process used Boolean

[3] V. M. Yakymets et al., "Prospects for Using Unmanned Aerial Vehicles for Medical and Biological Protection of the Civilians and the Military in the Safe Zone and the Joint Forces Operation (Jfo) Area," *Science and Innovation* 18, no. 5 (2022): 49–60, https://doi.org/10.15407/scine18.05.049.

[4] M. Haimi, "Telemedicine in War Zones: Prospects, Barriers, and Meeting the Needs of Special Populations," *Frontiers in Medicine* 11 (2024), https://doi.org/10.3389/fmed.2024.1417025.

[5] C. Madsen et al., "Telehealth in the Military Health System: Impact, Obstacles, and Opportunities," *Military Medicine* 188 (2023): 15–23, https://doi.org/10.1093/milmed/usac207.

[6] G. J. Riew et al., "Telemedicine in Spine Surgery: Global Perspectives and Practices," *Global Spine Journal* 13, no. 5 (2023): 1200–1211, https://doi.org/10.1177/21925682211022311.

[7] K. Alser et al., "Trauma Care Supported through a Global Telemedicine Initiative during the 2023–24 Military Assault on the Gaza Strip, Occupied Palestinian Territory: A Case Series," *The Lancet* 404, no. 10455 (2024): 874–86, https://doi.org/10.1016/S0140-6736(24)01170-X.

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operators with a combination of specific keywords covering "telemedicine," "military," "armed conflict," and "troop mobilization," which were then juxtaposed with legal terminology such as 'regulation' and "policy" to ensure relevance to the subject of legal study.

From the results of this search, a multi-level screening process was conducted based on strict inclusion and exclusion criteria, whereby only literature discussing the description of technological architecture, logistical integration, and the legal aspects of troop deployment was retained. This process resulted in a final data corpus of 25 scientific journal articles that were deemed to be substantially relevant to the research question. Data analysis was performed using prescriptive and interpretive content analysis techniques. These techniques were used to identify regulatory patterns, evaluate legal gaps, and synthesize findings from various sources into a comprehensive argument regarding the governance of telemedicine in military operations. Through this synthesis, the study not only describes the phenomenon but also formulates theoretical and practical implications for the development of defense and military health law.

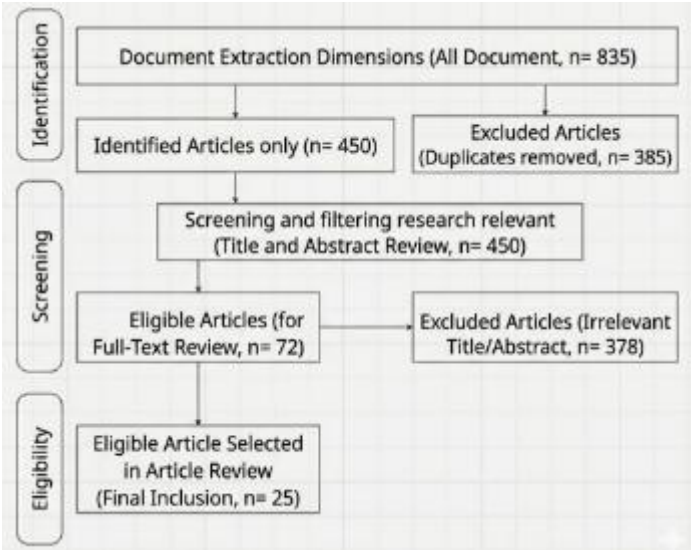

Figure. 1 Research PRISMA Diagram

C. Results and Discussion

Table 1. Synthesis of Selected Articles

No.	Category	Number of Studies	Findings	Implication
1	Clinical and Operational Benefits of Telemedicine in Conflict Areas	8	Telemedicine improves access to specialist services, consultation efficiency, and medical personnel training in war zones. Models such as TeleHelp Ukraine and CERTAIN Ukraine have proven effective in supporting trauma care and critical education.	Telemedicine should be made a key component of healthcare systems in conflict areas to expand service coverage.

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2	Technical Risks and Limitations (Security, Infrastructure, Privacy)	5	Key risks include cybersecurity, lack of connectivity, and challenges with interoperability between systems. Patient privacy and potential malpractice are major concerns for practitioners.	The development of cybersecurity protocols and low-bandwidth system designs should be prioritized for implementation in war zones.
3	Implementation of Telemedicine in War Zones and Humanitarian Crises	6	The implementation of telemedicine in six conflict-affected countries (Afghanistan, Gaza, Iraq, Libya, Syria, Yemen) shows great potential, but faces cultural, cost, and infrastructure barriers.	Cross-border collaboration and international organizations are needed to support local infrastructure and training.
4	The Role of Supporting Technologies (AI, UAV, IoMT)	3	Supporting technologies such as UAVs and AI improve the efficiency of medical logistics, evacuation, and clinical decision-making. IoMT supports real-time patient monitoring but adds to digital security risks.	The integration of AI and UAVs can strengthen rapid medical response in high-risk zones.
5	Policy, Ethics, and Health System Resilience	3	Cross-jurisdictional policies and telehealth ethics are still not uniform. Strengthened regulations, training of local personnel, and digital resilience strategies are needed to ensure sustainability.	Adaptive policies and human resource training are essential to ensure the sustainability and accountability of telemedicine systems.

A systematic synthesis of the literature produced a comprehensive mapping that converged on three main thematic clusters in the discourse on law and health defense. The majority of studies focused on the Clinical and Operational Benefits of Telemedicine in Conflict Areas (8 articles), indicating that the current global discourse emphasizes proving the effectiveness of technology as a strategic instrument for countries in guaranteeing the health rights of soldiers and the continuity of medical support. Furthermore, the second cluster highlights the dimension of Telemedicine Implementation in War Zones and Humanitarian Crises (6 articles), which provides an empirical description of the adaptability of medical protocols amid force majeure conditions and its function as a bridge to health access when conventional infrastructure is paralyzed. However, the urgency of utilizing this technology is balanced by critical findings in the third cluster related to Risks and Technical Limitations (5 articles), which specifically outlines unresolved issues including cybersecurity vulnerabilities, infrastructure deficiencies, and the crucial issue of medical

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data privacy protection that demands more rigid regulatory resolutions.

The health sector is currently undergoing a significant digital transformation, becoming increasingly dependent on digital technology and integrated infrastructure, as well as increasingly open access to information[8]. The health resilience system states that one of the indicators of resilience is an integrated information system that not only provides services but is also resilient in the face of shocks such as conflict or war[9].

One of the alternatives developed in the health resilience system is the use of telemedicine, especially in conflict situations. Although not new, the concept of telemedicine has evolved over time. The use of telehealth in the US Military Health System (MHS), particularly in deployment/conflict areas, has been in place since the early 1990s, including the use of remote consultations, tele-behavioral health, teleradiology, etc[10]. In certain conditions, such as during conflict, the delivery of health services is often hampered by distance, logistics, long evacuation times, or even impossibility. Therefore, the use of military telemedicine is one of the strategic solutions that can bridge the real needs that are most needed in the field at that time[11].

In the conflict in Gaza, where intense military attacks were carried out by Zionist Israel, causing tremendous pressure, especially on the health care system. In these conditions, with limited medical resources available, an initiative was launched to conduct peer-to-peer telemedicine, enabling remote consultations with international specialists for surgical teams in the conflict area. This was done to support clinical decision-making in low-resource, austere environments and to increase the capacity of local teams who were overwhelmed by the large number of victims[12].

However, the use of telemedicine is not without risks. Telemedicine cannot completely replace the need for a functional healthcare system. In some cases, direct intervention is still necessary due to the limitations of physical examinations via telemedicine[13]. Some concerns that may arise with telemedicine are the accuracy of remote diagnosis, reduced direct monitoring, and challenges in objective measurements (e.g., blood pressure, glucose) when patients are located far from the doctor treating them[14]. Not to mention that if there is an error in diagnosis, it is ethically unclear who is legally responsible for the treatment. However, in a crisis situation, it is possible for the national health system to change while still following global standards, as happened in Ukraine, one of the areas affected by conflict, where the use of telemedicine increased significantly as a substitute or complement to medical services disrupted by the war[15].

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[8] A. Garcia-Perez et al., "Resilience in Healthcare Systems: Cyber Security and Digital Transformation," *Technovation* 121 (2023): 102583, https://doi.org/10.1016/j.technovation.2022.102583.

[9] W. Sulistiadi, "Health Policy Reform through Strengthening Indonesia's Health Resilience System," *Journal of Indonesian Health Policy and Administration* 8, no. 3 (2023): 106, https://doi.org/10.7454/ihpa.v8i3.7321.

[10] Madsen et al., "Telehealth in the Military Health System: Impact, Obstacles, and Opportunities."

[11] J. C. Pamplin et al., "Military Telehealth: A Model for Delivering Expertise to the Point of Need in Austere and Operational Environments," *Health Affairs* 38, no. 8 (2019): 1386–92, https://doi.org/10.1377/hlthaff.2019.00273.

[12] Alser et al., "Trauma Care Supported through a Global Telemedicine Initiative during the 2023–24 Military Assault on the Gaza Strip, Occupied Palestinian Territory: A Case Series."

[13] E. Carter and A. El-sayed, *Emerging Trends in Medicine Telemedicine Beyond the Pandemic: Innovations, Challenges, and Policy Implications*, 2024, 24–31.

[14] Haimi, "Telemedicine in War Zones: Prospects, Barriers, and Meeting the Needs of Special Populations."

[15] K. S. Malakhov, "Insight into the Digital Health System of Ukraine (eHealth): Trends, Definitions, Standards, and Legislative Revisions," *International Journal of Telerehabilitation* 15, no. 2 (2023): 1–21, https://doi.org/10.5195/ijt.2023.6599.

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Based on the data in Table 1, a synthesis of 25 journal articles shows that telemedicine has clinical and operational benefits, especially in conflict areas where telemedicine can improve access to specialist services, consultation efficiency, and medical personnel training in war zones. This is in line with the World Health Organization (WHO) Health System Resilience theory, which states that Health System Resilience is the ability to cope with unexpected conditions or shocks while maintaining essential core services. How can the health system anticipate, prepare for, absorb, respond to, and recover from such unusual conditions (WHO, 2020)? This can be illustrated as follows.

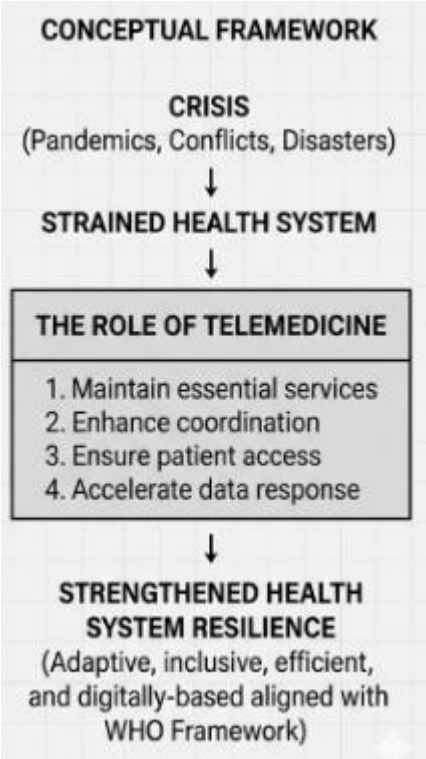

Figure 2. The Relationship Between Telemedicine and Health Resilience WHO

In general, the use of telemedicine, especially in conflict-affected areas, is a viable option considering that its benefits outweigh the potential risks. The benefits of telemedicine, as reported in 25 reviewed journals, are as follows:

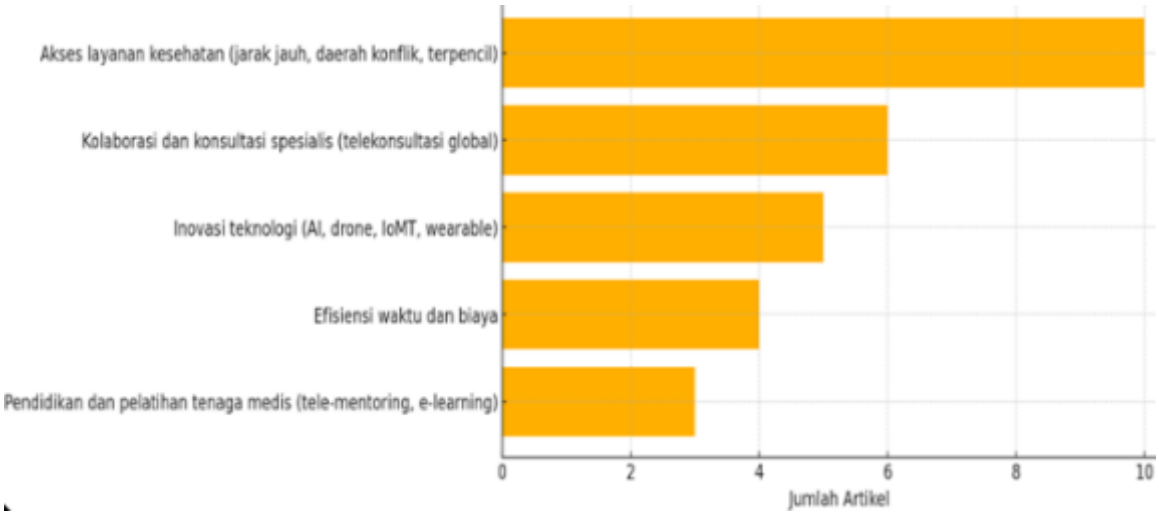

Figure 3. Distribution of Telemedicine Benefits Based on Literature Findings

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Based on the data visualization in graph 3, the literature findings are significantly centered on the aspect of Health Service Access discussed in (10 articles). The high frequency of this discussion indicates that current academic discourse places telemedicine as a vital instrument for breaking down geographical barriers in conflict and remote areas in order to fulfill the health rights of soldiers. The next dominant findings are Collaboration and Specialist Consultation (6 articles) and Technological Innovation (5 articles), which show a shift in the military health support model towards a globally integrated and artificial intelligence-based system. However, the high dependence on technological infrastructure to ensure access and collaboration inherently creates new vulnerabilities, which are further mapped in the following distribution of challenges, where data security issues and infrastructure limitations are the most crucial obstacles. Figure 4. Informing the challenges of telemedicine.

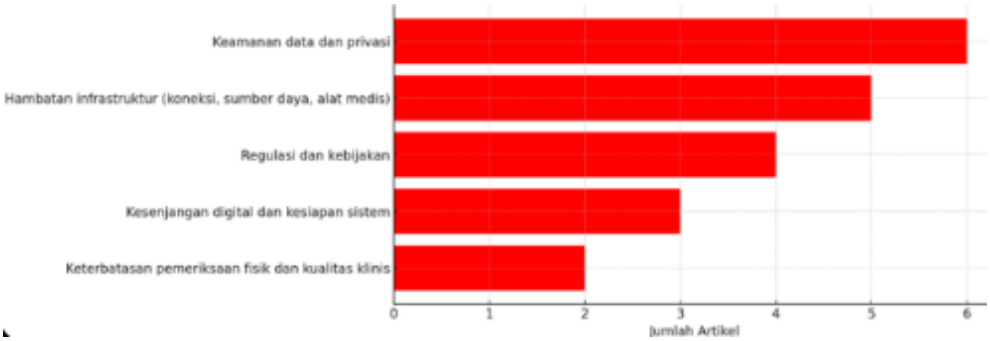

Figure 4. Distribution of Telemedicine Based on Literature Findings

On the other hand, the map of telemedicine implementation issues shows that Data Security and Privacy dominates academic discourse with the highest number of discussions (6 articles). This indicates that vulnerability to cyber attacks and the lack of guarantees for the protection of soldiers' medical data are the biggest legal threats in digital military operations. The next crucial challenges are Infrastructure Barriers (5 articles) and Regulatory and Policy Uncertainty (4 articles), which reflect the gap between the urgency of medical needs in the field and the readiness of physical facilities, as well as the absence of a legal umbrella covering them. Meanwhile, the issues of the digital divide and the limitations of physical examinations are secondary obstacles that also affect the quality of clinical services. Based on the complexity of the challenges faced in utilizing telemedicine in conflict conditions, a comprehensive risk analysis and mitigation strategy can be developed to overcome them, as shown in Table 2.

Table 2. Risk Analysis and Mitigation Strategies

No.	Key Challenges	Implications for the Healthcare System	Mitigation Strategy
1	Data security and privacy	Risk of medical data leaks and declining public trust	Implementation of end-to-end encryption and blockchain for data auditing, Establishment of national security standards (HIPAA-like) and

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			regulatory harmonization, Cyber security training for medical personnel.
2	Infrastructure barriers (internet, electricity, medical equipment)	Telemedicine services are unevenly distributed in remote areas	Utilization of medical satellites & IoT edge devices in remote areas, Broadband network subsidies and public-private partnerships, Training of local technicians for equipment maintenance.
3	Inconsistent regulations and policies	Legal inconsistencies hinder service expansion	Establishing a national telemedicine legal framework, Integrating digital licensing and verification systems for healthcare workers, Gradually disseminating new policies
4	Limitations in physical examinations and clinical quality	Remote diagnoses may be less accurate	Training in telemonitoring data interpretation and empathetic communication, Utilizing wearable devices, HD cameras, and biometric sensors, Establishing minimum service standards and clinical security protocols.
5	Digital divide and system readiness	Access gap between urban and rural facilities is widening	National contingency plan for digital health infrastructure, Multi-region server backup and automatic redundancy systems, Routine security & emergency preparedness simulations.

In certain conditions, such as in austere environments, locations with very limited resources: for example, war zones, natural disasters, remote areas/areas with minimal infrastructure, extreme weather, difficult transportation conditions, telemedicine becomes one of the alternatives that can be used for health services[16]. Moreover, in conflict environments where all conditions become increasingly complex (multi-domain operations, remote areas, advanced enemy technology), this can add to the burden and uncertainty, especially in medical evacuation[17]. The need for increased effectiveness, timeliness, and flexibility in medical evacuation is growing[18].

Telemedicine has now moved from being "optional" to an essential element in the healthcare system, especially for conditions such as routine visits, chronic condition management, and consultations that do not require in-depth physical examinations[19]. Telemedicine interventions have proven feasible in conflict situations such as those occurring in the Eastern Mediterranean Region (EMR), where telemedicine can bridge the

[16] M. Bixio et al., "Management of Critically Ill Patients in Austere Environments: Good Clinical Practice by the Italian Society of Anesthesia, Analgesia, Resuscitation and Intensive Care (SIAARTI)," *Journal of Anesthesia, Analgesia and Critical Care* 4, no. 1 (2024), https://doi.org/10.1186/s44158-024-00209-8.

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[19] Carter and El-sayed, *Emerging Trends in Medicine Telemedicine Beyond the Pandemic: Innovations, Challenges, and Policy Implications*.

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gap in access to specialists in conflict-affected areas [20].

Telemedicine in the form of teleconsultation has been tested in military/military environments for decades, and is now an operational necessity in combat conditions. Although technology continues to evolve, in situations where conflict occurs and troops are mobilized, there are generally conditions where communication networks are limited, medical resources are limited, and environmental conditions are less than ideal. In these conditions, teleconsultation can be effectively utilized as part of telemedicine[21]. In its development, IoMT (Internet of Medical Things) has great transformational potential for the future of the health sector, ranging from patient monitoring, telemedicine, to clinical data integration and analysis processes. However, many factors can influence the success of IoMT implementation, including data and cybersecurity challenges, system interoperability, data management, regulations, and technology adoption [22].

In addition, the development of digital health capacity must be accompanied by strengthening regulations/good governance, increasing digital literacy, and ensuring equitable access to digital infrastructure so that solutions are not merely reactive[23]. A study conducted on medical evacuations related to eye complaints in the U.S. Africa Command (AFRICOM) area between 2008 and 2018 showed that telemedicine was used when local care was inadequate[24]. Telemedicine is seen as a potential strategy to reach populations affected by conflict. As with the increased use of e-health in Ukraine during the conflict[25].

This model shows that telemedicine is not only for rapid services, but also as a link to follow-up services or local referrals, which are very important in the context of conflict[26]. Several innovations in medical care in conflict zones besides telemedicine also utilize drone technology. Although still experimental, the use of drones for mass transfusions at the point of injury on the battlefield has proven feasible and could be an important component of advanced trauma care in austere conditions[27]. In addition, the use of unmanned aerial vehicles (UAVs) offers the potential to overcome some access and speed barriers in difficult conditions[28].

Telemedicine platforms such as home-to-home telehealth services like VA Video Connect (VVC) enable direct video consultations from home or private locations, which can

[20] P. Parkes et al., "Telemedicine Interventions in Six Conflict-Affected Countries in the WHO Eastern Mediterranean Region: A Systematic Review," *Conflict and Health* 16, no. 1 (2022): 1–18, https://doi.org/10.1186/s13031-022-00493-7.
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[22] G. R. Pradyumna et al., "Empowering Healthcare with IoMT: Evolution, Machine Learning Integration, Security, and Interoperability Challenges," *IEEE Access* 12 (2024): 20603–23, https://doi.org/10.1109/ACCESS.2024.3362239.
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reduce barriers to access[29]. Telehealth requires the least amount of time commitment compared to patients traveling to healthcare facilities[30]. Telemedicine will increasingly become an integral part of everyday healthcare practices in the future. Moving forward, virtual care will become more mature and integrated, with technologies such as AI, wearables[31], and big data playing a role in strengthening preventive and personalized care models[32]

D. Conclusion and Recommendations

The use of telemedicine in supporting troop mobilization in conflict areas is one option that can overcome various difficulties, especially in conflict-affected areas with limited conditions and insufficient local healthcare. Accessibility to specialist services is the main reason for the use of telemedicine, especially in conflict areas. Meanwhile, data security and infrastructure development are absolute requirements, in addition to supportive regulations, so that telemedicine can be implemented optimally.

The limitation of this study is that it is a review or descriptive study, not an experimental or longitudinal study with strong controls, so the generalization of the results is limited. Future research needs to develop telemedicine models tailored to the local context (safe zones, military operation areas) using existing information technology and formulating uniform policies that can serve as a basis for the implementation of telemedicine and strengthening human resources in health to support the implementation of telemedicine, especially in conflict areas.

[29] J. A. Lindsay et al., "Getting Connected: A Retrospective Cohort Investigation of Video-to-Home Telehealth for Mental Health Care Utilization Among Women Veterans," *Journal of General Internal Medicine* 37 (2022): 778–85, https://doi.org/10.1007/s11606-022-07594-2.

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