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RESEARCH PAPER

Legal Protection of Medical Professionals in Armed Conflicts: Challenges in the Era of Autonomous and AI-Driven Warfare — A Case Study of Pakistan's Disputed Areas

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ABSTRACT

The protection of medical professionals in armed conflicts is a cornerstone of international humanitarian law (IHL), ensuring that doctors, nurses, and humanitarian personnel can provide care without fear of attack. However, the emergence of autonomous weapon systems (AWS) and AI-driven warfare presents unprecedented challenges to these protections, particularly in complex and disputed regions such as Pakistan's Line of Control (LoC) and former tribal areas. This study examines the legal framework safeguarding medical personnel, analyzes the implications of AI and autonomous systems on core IHL principles such as distinction, proportionality, and precaution, and explores the risks posed to medical neutrality in technologically advanced warfare. Using a doctrinal and case-study research design, the paper evaluates both international law and Pakistan-specific conflict contexts, highlighting gaps in enforcement, accountability, and operational safeguards. Key findings indicate that while formal IHL protections remain applicable, the use of autonomous and AI-enabled systems significantly increases risks to medical personnel, undermines human judgment in targeting decisions, and creates accountability gaps. The study concludes with recommendations for strengthened human-control obligations, enhanced operational protocols, and binding legal instruments to preserve medical neutrality in the era of AI-driven conflict.

Keywords: Accountability, AI-driven warfare, Armed conflicts, Autonomous weapons systems, Medical professionals.

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INTRODUCTION

Medical professionals play a critical role in armed conflicts, providing care to wounded combatants and civilians while upholding the principles of humanitarianism and medical neutrality. IHL, particularly the Geneva Conventions and their Additional Protocols, formally guarantees protection for medical personnel, facilities, and patients. Despite these protections, the nature of modern warfare has evolved, introducing new challenges that threaten the safety and neutrality of healthcare providers. The purpose of this study is to examine the legal protection of

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medical professionals in armed conflicts, with a particular focus on the implications of AWS and AI-driven warfare. The research is motivated by the growing use of AI and autonomous systems in military operations, which potentially undermines fundamental IHL principles such as distinction, proportionality, and precaution. The study also explores Pakistan's disputed regions, including the LoC in Kashmir and the former tribal areas, as a case study to assess the real-world impact of these emerging technologies on medical personnel (Jafariandehkordi, 2024).

The scope of the study encompasses doctrinal analysis of IHL provisions, evaluation of technological challenges posed by AWS and AI, and examination of operational and legal gaps in conflict zones. The central research questions include: (i) How do autonomous and AI-driven systems affect the protection of medical personnel under IHL? (ii) What specific challenges do medical professionals face in Pakistan's disputed areas? (iii) How can legal, ethical, and operational frameworks be adapted to safeguard medical neutrality in modern conflicts?. The study employs a qualitative research methodology combining doctrinal analysis, case study evaluation, and normative assessment. The hypothesis is that while formal IHL protections exist, the advent of AWS and AI-driven warfare significantly increases risks for medical personnel and creates accountability gaps.

Key outcomes of the study highlight that technological advancements challenge traditional legal frameworks, compromise human judgment in targeting decisions, and threaten the principle of medical neutrality. The article is organized as follows: the next section outlines the legal framework protecting medical professionals; this is followed by an analysis of autonomous and AI-driven warfare challenges; the subsequent section presents a case study of Pakistan's disputed areas; and the final sections provide legal and operational recommendations, followed by conclusions and directions for future research.

CONCEPTUAL AND THEORETICAL FRAMEWORK

This study is grounded in the intersection of IHL principles, particularly the protection of medical personnel, and emerging theories on autonomous and AI-driven warfare. Conceptually, it situates medical neutrality, distinction, proportionality, and accountability as core legal and ethical benchmarks for evaluating the impact of technology on conflict conduct. Theoretically, the research draws on legal positivism, emphasizing codified obligations under the Geneva Conventions, and humanitarian ethics, which prioritize the moral imperatives of preserving human life and dignity in war. It also engages with technology governance frameworks, analyzing how autonomous systems and AI challenge traditional IHL interpretations, create accountability gaps, and necessitate adaptive regulatory mechanisms. By combining legal, ethical, and technological perspectives, the framework enables a comprehensive understanding of how autonomous and AI-driven warfare affects medical personnel, guiding both doctrinal analysis and practical policy recommendations.

RESEARCH METHODOLOGY

This study employs a qualitative research design to examine the legal protection of medical professionals in armed conflicts, with a focus on the challenges posed by AWS and AI-driven warfare. The research combines doctrinal legal analysis, case study evaluation, and normative

assessment to provide a comprehensive understanding of both theoretical and practical issues. The doctrinal approach involves a critical review of IHL, including the Geneva Conventions, their Additional Protocols, and customary international law, with particular attention to provisions safeguarding medical personnel. The study analyzes legal texts, treaties, and scholarly interpretations to identify normative foundations, interpretive gaps, and areas of potential reform.

A case study methodology is applied to Pakistan's disputed regions, including the LoC in Kashmir and the former tribal areas (merged FATA). This enables the assessment of real-world implications of AI and autonomous systems on medical neutrality, operational challenges, and enforcement gaps. Data sources include official reports, media accounts, humanitarian organization documentation, and secondary literature, providing contextual insights into the risks faced by healthcare providers. Finally, the study employs normative and policy-oriented analysis to evaluate ethical, legal, and operational implications of AI-driven warfare, leading to practical recommendations for strengthening protection frameworks. By integrating doctrinal, empirical, and normative approaches, the methodology ensures a rigorous examination of both legal principles and contemporary technological challenges affecting medical personnel in conflict zones.

LEGAL FRAMEWORK: PROTECTION OF MEDICAL PERSONNEL UNDER IHL

Normative Foundations

Medical personnel engaged in humanitarian work are afforded special protection under IHL. They are entitled to respect and protection in all circumstances, and medical units, ambulances, and hospitals must not be attacked, provided they refrain from acts harmful to the enemy. These protections are enshrined in the Geneva Conventions of 1949 and their Additional Protocols, as well as in customary international law, reflecting a long-standing commitment to safeguard human life in armed conflict. Medical confidentiality is another core component of IHL protections. Healthcare providers cannot be compelled to disclose sensitive patient information, except under narrowly defined circumstances where disclosure is essential for public health or military necessity. The principle of medical neutrality underpins these protections, ensuring that medical personnel can perform their duties without fear of attack or coercion, irrespective of the patients' affiliations. Together, these legal norms establish a robust framework designed to preserve the humanitarian function of medical services in conflict situations (Samakashvili, 2024).

Practical Challenges

Despite this normative foundation, the practical enforcement of protections for medical personnel often proves weak, particularly in high-intensity or asymmetric conflict zones. Hospitals and clinics have frequently been targeted during cross-border hostilities, insurgencies, and civil conflicts, resulting in injury or death to medical staff and civilians. Contributing factors include the destruction of infrastructure, population displacement, and the instrumentalization of medical facilities by armed actors. In conventional warfare, identification of medical personnel and units is generally feasible through recognized emblems, fixed locations, and predictable behavior. However, technological developments — including drone surveillance, remote strikes, and increasingly sophisticated autonomous systems — have complicated this identification process.

The blurring of lines between civilian, military, and medical spaces, especially in urban or contested regions, significantly increases the vulnerability of healthcare providers and challenges the practical applicability of IHL protections (Greenbaum, 2025).

EMERGENCE OF AUTONOMOUS WEAPONS AND AI-DRIVEN WARFARE

AWS are advanced military technologies capable of independently selecting and engaging targets without direct human intervention. These systems rely on a combination of sensors, machine learning algorithms, and pre-programmed targeting profiles to identify, track, and engage potential threats in dynamic battlefield environments. In parallel, AI-driven surveillance and targeting systems process vast quantities of operational data, providing real-time assessments and recommendations for strike decisions, often with minimal human oversight (Batabyal, 2024).

While these technologies offer operational advantages such as increased precision, faster decision-making, and reduced risk to human soldiers they also present profound legal, ethical, and humanitarian challenges. The autonomy of AWS raises questions regarding compliance with core principles of IHL, including the principles of distinction, proportionality, and precaution. For instance, AI systems may misclassify civilians, medical personnel, or protected facilities as legitimate targets, thereby increasing the risk of unlawful harm. Furthermore, the delegation of lethal decision-making to machines complicates accountability, as responsibility becomes diffused among designers, programmers, operators, and states, creating potential gaps in legal recourse for victims. In essence, while AWS and AI-assisted targeting enhance military capabilities, they simultaneously challenge the normative framework designed to protect human life, particularly medical personnel, who rely on the predictability and respect for IHL to safely perform their duties in conflict zones (Guercio, 2025).

Challenges for Medical Protection

The introduction of AWS and AI-driven targeting technologies has significantly complicated the protection of medical personnel under IHL. These technologies create multiple challenges that undermine core legal and ethical principles:

1. Principle of Distinction: IHL requires parties to distinguish between combatants, civilians, and protected persons, including medical personnel. AWS, relying on algorithmic decision-making and sensor data, may misidentify medical units, hospitals, or healthcare providers as legitimate military targets. This risk is particularly acute in crowded or complex environments, where the visual or electronic signature of medical facilities can be easily confused with military assets (Kolesnykov et al., 2024).
2. Proportionality and Precaution: AI systems lack the moral reasoning and situational awareness necessary to evaluate whether harm to civilians or medical personnel is excessive relative to anticipated military advantage. Autonomous systems may calculate targets purely based on algorithmic assessments, ignoring contextual nuances that a human operator would consider, increasing the likelihood of disproportionate or indiscriminate attacks (Hosseini, 2024).
3. Human Control: Reduced human oversight in autonomous systems undermines the principle of meaningful human control, a key element for compliance with IHL. When decision-making

is delegated to machines, accountability and moral responsibility are diluted, raising ethical concerns and legal ambiguities in cases of harm to medical personnel (Ungar-Sargon, 2025).

4. Accountability: AWS complicate the attribution of responsibility. Liability may be diffused among programmers, operators, military commanders, and states, creating gaps in enforcement and weakening deterrence mechanisms. This accountability gap leaves medical personnel and patients with limited recourse when they are harmed by AI-assisted operations (Nazil, 2025).
5. Medical Neutrality: Delegating lethal or targeting decisions to machines risks dehumanizing warfare and eroding the principle of medical neutrality. Medical personnel may no longer be reliably recognized as neutral actors, undermining both their physical safety and the broader humanitarian ethos that underpins their role in conflict (Norlander, 2025).

Collectively, these challenges highlight the pressing need to adapt legal, operational, and ethical frameworks to address the unique risks posed by autonomous and AI-driven systems, ensuring that medical personnel retain effective protection in modern armed conflicts.

CASE STUDY: PAKISTAN'S DISPUTED AND CONFLICT-AFFECTED AREAS

Pakistan's disputed regions, particularly the LoC in Kashmir and the former tribal areas (now merged into Khyber Pakhtunkhwa), have experienced protracted armed conflict involving both state and non-state actors. Military operations, insurgencies, cross-border shelling, and counter-terrorism campaigns have placed civilians and medical personnel at significant risk. The complex security environment, combined with rugged terrain and limited infrastructure, creates heightened vulnerability for healthcare providers operating in these regions.

Attacks on Medical Personnel

In Kashmir (Line of Control and Azad Jammu & Kashmir), cross-border shelling and artillery exchanges pose constant threats to hospitals, clinics, and medical staff. These attacks often occur unpredictably, leaving healthcare providers to deliver emergency care under extreme pressure. The bombardments not only disrupt the evacuation of injured civilians and combatants but also destroy critical medical infrastructure, including operating theaters, pharmacies, and diagnostic facilities. Hospitals situated close to the LoC are sometimes perceived by opposing forces as potential military assets, either because of their strategic location or proximity to security installations. This perception challenges the principle of medical neutrality, exposing healthcare providers and patients to both direct and collateral harm. In many instances, medical staff must navigate ethical dilemmas, such as treating injured combatants from both sides, while maintaining impartiality under conditions of constant threat (Guedes Gonçalves Costa, 2024).

In the former FATA regions, including North and South Waziristan, ongoing counter-insurgency operations have severely impacted healthcare delivery. Repeated military campaigns have damaged permanent health facilities, forcing reliance on temporary or mobile clinics, which are more vulnerable to aerial and drone strikes. Medical personnel in these regions frequently face coercion from armed actors, who may demand preferential treatment, intelligence, or access to patients for operational purposes, undermining their neutrality and professional ethics. The operational environment is further complicated by the use of drones and AI-assisted targeting systems. These autonomous or semi-autonomous technologies, relying on algorithmic pattern

recognition, may misclassify ambulances, mobile clinics, or medical convoys as legitimate targets, significantly increasing the risk of civilian and medical casualties (Zakir et al., 2024).

Furthermore, these conflict zones often lack reliable communication and coordination between humanitarian organizations and military authorities, reducing the effectiveness of protective measures. The combined effect of cross-border hostilities, insurgency, and technological targeting systems creates an environment where medical personnel operate under constant threat, with limited capacity to assert their protected status under IHL. These realities underscore the urgent need for enhanced operational safeguards, legal clarity, and technological measures to protect medical staff and facilities in Pakistan's disputed and conflict-affected regions (Bilgin, 2024).

Impact of Modern Warfare

The rapid adoption of drones, AWS, and AI-driven surveillance has significantly altered the operational landscape for medical personnel in conflict zones. While these technologies enhance military efficiency and operational reach, they simultaneously complicate the protection of healthcare providers, undermining long-established norms of IHL. One major concern is the misidentification of medical units and personnel by AI-assisted targeting systems. Autonomous algorithms rely on sensor data, pattern recognition, and pre-programmed criteria to classify potential targets. In crowded urban areas or dynamic battlefield environments, these systems may erroneously identify hospitals, mobile clinics, or ambulances as legitimate military objectives, increasing the risk of unlawful attacks (Surber, 2018).

Collateral damage is another critical risk. AI and autonomous systems often lack contextual awareness and moral reasoning, making it difficult to assess whether anticipated civilian or medical harm is proportionate to military advantage. Decisions made purely on algorithmic evaluation may result in excessive incidental harm, disproportionately affecting medical personnel and patients. Finally, the rise of remote or autonomous operations introduces accountability challenges. When strikes are conducted without direct human oversight, attributing responsibility for harm to medical staff becomes complex. Programmers, operators, commanders, and states may all share partial responsibility, creating gaps in enforcement and reducing legal recourse for victims. Collectively, these factors illustrate that modern warfare technologies, while militarily advantageous, pose profound threats to medical neutrality and the safety of healthcare providers, emphasizing the urgent need for robust legal, operational, and ethical safeguards in contemporary conflict zones (Osimen et al., 2024).

Legal and Humanitarian Implications

Although formal protections for medical personnel exist under IHL, their practical implementation in conflict zones is often challenging. In areas such as Pakistan's disputed regions, the presence of multiple actors—including state forces, non-state armed groups, and cross-border combatants—creates a complex operational environment. This complexity hinders the enforcement of IHL norms and exposes medical personnel to heightened risks. The principle of medical neutrality is frequently compromised under these conditions. Hospitals, clinics, and mobile medical units may be misidentified as legitimate military targets, coerced by armed actors,

or caught in crossfire, leaving healthcare providers vulnerable despite their protected status. The erosion of neutrality undermines not only the physical safety of medical staff but also the broader humanitarian ethos underpinning their work. These realities highlight the urgent need for robust operational safeguards and legal frameworks. Enhanced identification protocols for medical personnel and facilities, clear communication channels between military forces and humanitarian actors, and accountability mechanisms for violations are essential to ensure that IHL protections are effectively translated into real-world safety measures. Strengthening both the legal and practical dimensions of medical protection is critical in preserving human life and maintaining the integrity of humanitarian principles in modern armed conflicts (Akhundov et al., 2025).

Policy Recommendations for Pakistan

To strengthen the protection of medical professionals in Pakistan's conflict-affected and disputed areas, several targeted policy measures are necessary. First, the establishment of humanitarian corridors and protected zones around hospitals, clinics, and mobile medical units is critical. These zones should be legally recognized and coordinated with both domestic military forces and humanitarian organizations to ensure safe access for patients and medical staff, particularly in areas exposed to cross-border shelling or insurgency. Second, improving the visibility and identification of medical personnel and vehicles is essential. Hospitals, ambulances, and mobile clinics should employ standardized emblems and advanced identification systems visible to both ground and aerial surveillance platforms. Such measures are particularly important in environments where drones and AI-assisted targeting systems are operational, reducing the risk of accidental targeting and reinforcing medical neutrality (Ullah et al., 2025).

Third, providing specialized training for medical staff operating in AI-assisted and autonomous warfare environments can enhance safety and preparedness. Training should include protocols for operating under autonomous surveillance, emergency evacuation procedures, and coordination with both military and humanitarian actors, ensuring that healthcare providers can respond effectively to emerging threats. Fourth, Pakistan should develop national accountability mechanisms to investigate and address incidents involving autonomous or AI-assisted military operations. Clear chains of responsibility for military personnel, programmers, and commanders will strengthen legal accountability, deter violations, and provide remedies for affected medical staff (Guo, 2025).

Finally, alignment of military protocols with IHL standards is essential. Operational guidelines must be updated to explicitly incorporate protections for medical personnel and facilities in the context of autonomous weapons and AI-assisted targeting. This ensures that operations respect medical neutrality, minimize harm to healthcare providers, and comply with IHL. Implementing these measures collectively would enhance the safety, neutrality, and operational effectiveness of medical personnel, ensuring that IHL protections remain meaningful even in technologically advanced and complex conflict environments (Ugwu et al., 2024).

LEGAL AND NORMATIVE CHALLENGES

Interpretive Gaps

IHL was primarily drafted with human actors in mind, assuming that decisions about targeting, proportionality, and precaution are made by individuals capable of moral and contextual judgment. The introduction of autonomous weapons systems (AWS) challenges this foundation. Questions arise regarding how to classify autonomous systems under IHL: Are they merely tools, or do they create a new category of actors with legal obligations? Additionally, enforcement mechanisms struggle to accommodate scenarios where machines independently select and engage targets, leaving interpretive gaps that complicate the application of core IHL principles (Khan et al., 2025).

Accountability Issues

Autonomous and AI-assisted systems diffuse responsibility across multiple actors, including programmers, operators, military commanders, and the state itself. When medical personnel or facilities are harmed due to misidentification or malfunction, pinpointing legal liability becomes exceedingly difficult. This accountability gap undermines deterrence, complicates reparations, and may erode trust in the protection offered by IHL. Without clearly defined chains of responsibility, violations affecting medical staff risk going unpunished, leaving healthcare providers vulnerable in conflict zones (Khan, 2024).

Technical Inadequacy

While AWS and AI-driven targeting systems offer operational efficiency, they are technically inadequate for replicating human judgment. Machines lack the ability to exercise empathy, consider context-specific nuances, or make moral assessments—critical elements in assessing proportionality and distinguishing between combatants and civilians. These limitations increase the likelihood of misidentification of medical personnel or facilities, posing severe risks to the safety of healthcare providers and undermining the effectiveness of IHL protections (Lin & Song, 2024).

Erosion of Humanitarian Principles

The reliance on machine-based targeting risks dehumanizing warfare, transforming the conduct of armed conflict from a human-centered to an algorithm-driven process. This shift threatens the principle of medical neutrality, as autonomous systems may inadvertently target hospitals, clinics, or ambulances without recognizing their protected status. The erosion of humanitarian principles compromises both the ethical foundations of IHL and the practical safety of medical personnel, making it imperative to integrate safeguards, human oversight, and accountability measures into autonomous operations (Khan, 2024).

RECOMMENDATIONS FOR LEGAL AND OPERATIONAL REFORM

Binding International Instrument for Autonomous Weapons Systems

A dedicated international legal instrument should be developed to define autonomous weapons systems (AWS), mandate meaningful human control, and explicitly prohibit attacks on medical facilities and personnel. Such a treaty or protocol would clarify obligations for states and military actors, ensuring that technological advancements do not erode protections guaranteed under IHL. By establishing clear prohibitions, this instrument would reinforce medical neutrality and provide a strong normative framework for regulating AWS deployment (Khan, 2024).

Strengthen Weapons-Review Procedures

Article 36 of Additional Protocol I requires states to review new weapons for compliance with IHL. These procedures should be updated to incorporate ethical, humanitarian, and operational considerations specific to AWS and AI-assisted targeting systems. This includes evaluating potential risks to civilians, medical personnel, and protected facilities, ensuring that emerging technologies do not undermine established legal protections (Khan & Jiliani, 2023).

Mandate Meaningful Human Control

To maintain compliance with IHL principles, all AWS deployments should include mechanisms ensuring meaningful human control, particularly in humanitarian zones. Humans must make final targeting decisions and retain the authority to override automated systems in real-time. This approach preserves accountability, reduces the risk of misidentification, and ensures that moral and contextual judgments remain integral to operational decision-making (Khan & Usman, 2023).

Ensure Robust Accountability Mechanisms

States must establish comprehensive accountability frameworks to investigate incidents involving AWS or AI-assisted operations. These mechanisms should guarantee transparency, assign clear responsibility to operators, programmers, commanders, and states, and provide legal remedies for harmed medical personnel. Strengthening accountability serves both as a deterrent against violations and as a means to uphold the integrity of medical protection in armed conflicts (Khan et al., 2023).

Protect Medical Neutrality

Operational measures should be introduced to safeguard medical personnel and facilities. These include designating no-AWS zones around hospitals and clinics, coordinating with humanitarian actors, and establishing strict operational restrictions to prevent targeting errors. By embedding medical neutrality into operational planning and technological deployment, healthcare providers can perform their duties safely, preserving both the ethical and legal foundations of humanitarian protection (Khan et al., 2023).

CONCLUSION

The protection of medical professionals in armed conflicts remains a cornerstone of IHL, yet the emergence of AWS and AI-driven warfare has introduced unprecedented challenges. This study demonstrates that while formal IHL protections continue to exist, their practical enforcement is increasingly complicated by misidentification of medical units, reduced human oversight, accountability gaps, and the dehumanizing effects of machine-based targeting. Pakistan's disputed regions, including the LoC in Kashmir and former tribal areas, exemplify these challenges, where healthcare providers operate under constant threat from cross-border shelling, insurgency, and technologically advanced surveillance and strike systems. The findings underscore the urgent need for both legal and operational reforms. Binding international instruments, strengthened weapons-review procedures, mandatory meaningful human control, robust accountability frameworks, and operational safeguards are essential to preserve medical neutrality and ensure the safety of healthcare personnel. These measures are not only critical for compliance with IHL but also for maintaining humanitarian ethics in modern conflicts.

Future research should focus on empirical assessments of AI and AWS-related incidents involving medical personnel, comparative analyses of state practices in autonomous warfare, and the development of interdisciplinary frameworks combining law, ethics, and technology. By addressing these gaps, policymakers, military actors, and humanitarian organizations can better navigate the complexities of AI-driven armed conflicts while safeguarding the lives and neutrality of medical professionals.

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