



RESEARCHING THE IMPACT
OF ATTACKS ON HEALTHCARE



Methodologies for evaluating impacts of attacks on health in conflict

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Executive Summary

This working paper synthesises methodological insights from seven years of research by the RIAH Consortium on how attacks on healthcare in conflict settings disrupt health systems, harm health workers and patients, and undermine the right to health. Drawing on qualitative, quantitative, historical, and rapid-assessment methodologies across Afghanistan, Central African Republic (CAR), Colombia, Democratic Republic of Congo (DRC), Myanmar, Nepal, Syria, and World War II, the paper outlines how violence against healthcare, ranging from bombings and looting to intimidation, arrests, and obstruction, produces direct, indirect, cumulative, and long-term impacts that extend beyond the immediate incident.

Health workers described profound personal, professional, and psychological consequences across contexts. Attacks undermine and weaken the health system and worsen overall health and well-being of health workers and patients, illustrating how violence reverberates and affect staffing, supply chains, service delivery, and community trust. Quantitative analyses in CAR and Syria showed measurable drops in service utilisation, delayed vaccinations, and disruptions to maternal and trauma care following attacks, even after accounting for conflict intensity.

The working paper highlights major methodological challenges including data quality and scarcity, security constraints, recall bias, and difficulty isolating causal pathways, while demonstrating that mixed-methods approaches can yield credible, actionable insights. A rapid assessment in DRC illustrated how operational agencies can measure impacts in real time to guide response and adaptation measures.

Key recommendations include:

- strengthening global, systematic, and prospective data collection;
- expanding research on gendered and intersectional impacts;
- improving ethical and trauma-informed research practices; and
- investing in methodological innovation to better attribute impacts and support anticipatory action.

Ultimately, the authors argue that understanding the full spectrum of impacts is essential for accountability, the protection of healthcare, and effective humanitarian response.

1. Introduction

In conflicts across the globe, there are growing threats of violence against health. Physical attacks have taken many shapes, such as air strikes against hospitals, looting of ambulances and facilities, arrests of health workers, blocking patients from entering facilities and preventing health workers from accessing patients. Other attacks have included violating patient privacy norms, exploiting the medical emblem, blocking access to pharmaceuticals, and threats or intimidation of both health workers and patients. While diverse in their forms, these attacks have the cumulative and destructive result of undermining and weakening the health system and worsening overall health and well-being of health workers and patients.

These attacks, so clearly detrimental to health, are almost always a direct violation of International Humanitarian Law (IHL). From its earliest iterations, IHL has outlined protections for health and health workers.¹ The 1949 Geneva Conventions ensure protections for medical workers, facilities and patients and have positive obligations for combatants to guarantee care for the wounded and sick.² Under the 1977 Additional Protocols to the Geneva Conventions, parties to an armed conflict must distinguish between civilians (including health workers) and combatants, and ensure that any attacks are proportionate and directed only at legitimate military objectives.³ Medical units and personnel benefit from special protection: they must not be attacked under any circumstances unless they are used to commit acts harmful to the enemy, and even then, only after due warning and with all feasible precautions taken to protect the wounded, the sick, and those caring for them. Compliance with these laws has been low and recent global reporting suggests that attacks on health are rising sharply in recent years. Since the Safeguarding Health in Conflict Coalition (SHCC) began data collection in 2015, documented attacks on medical facilities have grown dramatically.^{4,5} In 2024, Insecurity Insight and the SHCC documented the highest number of attacks on record—over 3,600 incidents in which hospitals, clinics, ambulances, and even health workers and patients became military targets, and a 15% increase from 2023, and 62% more than 2022.^{4–8} Advocacy around this problem has centered around three dimensions: strengthening and communicating the law to combatants, enumerating the scope and scale of the issue, and most recently, exposing the devastating impact of these attacks.^{9–13}

This paper focuses on the third dimension - the impacts of such attacks - and specifically on the aims, methods, and limitations of measuring impacts of attacks on health. Measuring the wider and longer-term impacts of attacks on health can both help to ensure better protection through visibility and contribute to a better understanding of the dynamics of armed conflict and violations of international human rights law (IHRL) and IHL.¹⁴ This work permits evidence-based, targeted approaches to address weakened health systems and high morbidity and mortality as well as other indirect effects. Measuring the impacts of attacks on health is critical to gain a deeper understanding of how violence against health affects the population. It is a core part of the critical work of advocacy for prevention and accountability, and to improve operational understanding of how to support health programs that may require difficult choices on resource prioritization. It has required interdisciplinary work from legal, medical, historical, social science, and epidemiological perspectives and is complicated by the challenges of data collection in dynamic and insecure contexts typical of conflict. Impact assessment and attribution require rigorous methodologies that can effectively and credibly target interventions. Studies can contribute towards all these targets but often, the findings are communicated either toward an academic audience or policy/operational one. The Researching the Impact of Attacks on Healthcare (RIAH) project has aimed to do both by bridging the gap between academically rigorous methodologies and applicable findings.¹⁵

A central question is how specific acts of violence affect the ability to deliver healthcare, and what mitigation measures can limit the cascading consequences that such violence inflicts on complex health

systems. Addressing this question requires recognizing that different actors hold distinct roles and responsibilities in the protection of healthcare. Healthcare providers cannot stop violence—they are not policymakers, soldiers, or security forces—but they do bear a responsibility for protecting patients and their staff against dangerous circumstances and they may be able to mitigate the impact of violence on their ability to deliver healthcare in conflict. Legal experts likewise cannot prevent violence, though they aim for justice and deterrence by pursuing accountability after irreparable harm has occurred. Military actors are responsible for creating an environment in which care can be provided according to international law, based on need, and even to those labeled as adversaries. Conflict parties, in turn, are obligated to uphold the principles of distinction and proportionality, and to enable medical services and workers to function impartially through measures such as ceasefires, deconfliction/humanitarian notification processes, and the unimpeded flow of medical supplies—even to the opposing side. A comprehensive framing of the protection of healthcare must therefore make explicit that multiple stakeholders, each with different mandates and capacities, contribute to this shared goal in distinct ways. Impact studies play a crucial role across these domains, providing evidence that informs adaptation, accountability, security planning, and compliance with international norms.

The RIAH Consortium, headquartered at the University of Manchester in collaboration with Johns Hopkins University, University of Geneva, and the University of California, Berkeley has been leading impact work since 2019. Experience developing studies in Afghanistan¹⁶, Central African Republic¹⁷, Colombia^{18–20}, Democratic Republic of Congo²¹, Myanmar²², Nepal²³ and Syria^{24–26} have tested both qualitative and quantitative methodologies for measuring the impacts of attacks, while a case study from World War II²⁷ has highlighted the value of historical analysis. Insights and lessons from these case studies can contribute to approaches for understanding the conceptual issues, choosing methods and designing studies, appreciating limitations, and leveraging these health impact analyses for better accountability, protection, and programming. These analyses may be helpful not only for ongoing research and advocacy in protecting health in conflict settings, but in attribution and impact assessment for other dimensions of conflict. In this paper, we review the conceptual issues required to understand the impacts of attacks on health, describe qualitative and quantitative methods to measure impact as well as their strengths, limitations, and relevance. We conclude with an agenda for next steps in this field with the dual objectives of sharing these methodologies and analyzing lessons learned.

2. Operationalizing Definitions

There are numerous conceptual issues around measuring impact. An understanding of the policy aims of the research, the definitions of terminology such as ‘attacks’ and ‘impacts’, and local relevance of the research is required to guide the methodology. Before conducting field research, we conducted an extensive literature review and held meetings with experts in epidemiology, conflict, security, and advocacy to develop a consensus on these issues.^{28,29} The conclusions of this early work was critical to guide ongoing research. This section summarizes that initial work and expands the concept of ‘impacts of attacks on health’ and the need for local context and understanding.

The RIAH project specifically examined outcomes within public health systems, including impacts on healthcare workers, facilities and infrastructure, health policies, healthcare utilization patterns, patient and provider behaviors, and morbidity and mortality. In our case study research, we engaged primarily with healthcare workers on the ground, necessitating an emphasis on understanding the experiences of and impacts on health workers themselves. We chose to focus on these health dimensions because their often more direct causal pathways make them more measurable, and because public health methodologies - both qualitative and epidemiological - provide the rigorous framework needed for our initial studies. Methodologies must also consider a range of ecological-social levels of study: impacts on individuals, organizations/institutions, specific communities, or larger regional populations as well as temporality and the practical limitations of the study, which are supported by public health methods.

2.1. Attacks on Healthcare

Understanding the impacts of attacks on healthcare requires capturing data both on the incidents of attacks, and their attributable impacts in other domains. The WHO definition of an attack is widely accepted and describes an attack on health as “any act of verbal or physical violence or obstruction or threat of violence that interferes with the availability, access and delivery of curative and/or preventive health services during emergencies.”³⁰ Notably, the WHO definition does not imply that the attack was unlawful; rather it is used for capturing and categorizing incidents of attacks. For response and legal determinations, other factors are critical to document: the specificities of perpetrators, intent, indiscriminate versus discriminate violence, occurrence of physical attacks versus interference, whether a facility has lost its protection, threats and non-physical violence, and attacks affecting vs directly targeting health. For example, a legal analysis may need to understand whether violence against civilians was proportionate to military necessity, while an organization’s programmatic impact analysis may need to understand the measures required to mitigate the consequences of violence suffered. Facility or organizational level security risk managers need to understand the level of anticipated risks and the possibilities for engaging with potential threat actors to negotiate safe passage or continued functioning of a facility.³¹

We found that for every context, it was critical to understand how research participants themselves described and characterized attacks on health. Distinctions on the nature of attacks on facilities (bombing, looting, threats) and of individual health workers (including arrests, violence and intimidation, individual experiences, viewpoints, and exposure to conflict) influenced their experiences of impact. This is particularly important because, in many contexts, public reporting on incidents of attacks on health was limited. Beginning impact discussions by describing incidents both helped generate needed data and supported participants in recalling their experiences, while also allowing reflection on their individual roles within the health system and personal backgrounds. This approach fostered trust and enabled greater nuance than public reporting alone can provide.

The operational definition of ‘healthcare’ tends to be consistent across different organizations, with general consensus on four domains (Figure 1):

1. Healthcare workers: medical and support personnel;
2. Patients: the ‘wounded and the sick’ - whether civilian or combatant, the latter so long as they are hors de combat or out of combat;
3. Healthcare facilities: fixed and mobile facilities, including hospitals as well as community-level primary health centers, including equipment, supplies, and medications present therein;
4. Transports: including transportation vehicles for patients, medications, and equipment as well as supply chain processes.

However, the inclusion criteria of these four dimensions vary by context and the formality or informality of the functioning health system. For example, ‘healthcare workers’ include clinical staff such as doctors and nurses but sometimes also include non-clinical staff who are critical to the functioning of a medical system: administrators, clerical workers, technicians, cleaners, porters, security personnel, students, volunteers, community health workers, and many others. Many organizations classify all staff from a facility or clinic as health workers but others do not. The same complexity applies to the other health system components. Hospitals are only one type of facility; mobile clinics, doctor’s offices, medical schools, specialized facilities like IVF clinics, laboratories, and other facilities are critical to a functioning health system. Transports include all components of the supply chain. A more comprehensive discussion of these issues can be found in our prior analyses.²⁸ In documenting incidents, it is important to make these underlying assumptions as visible and explicit as possible; there needs to be systematic thinking and standardized approaches that take this diversity into account and reflect reality. [†]

2.2. Overall Impacts Analysis Framework

Our exploration in this field began with conceptualizing impact as “a positive or negative, direct or indirect, intended or unintended change produced by an intervention. An impact evaluation is a systematic and empirical investigation of the effects of an intervention; it assesses to what extent the outcomes experienced by affected individuals were caused by the intervention in question, and what can be attributed and cannot be attributed to other factors such as other interventions, socioeconomic trends, and political or environmental conditions.”³²

The measurement of impacts can be analyzed across multiple dimensions including temporal scale, geographic reach, and subject domains, and there is significant overlap between the categories. Impact occurs at various levels: for an individual, and then for their family and colleagues; at a specific health facility or for a particular health provider; at a health system level; and for the population served. We categorized the dimensions of impact as follows for our research:

- Direct, Short-term Impacts: Effects that manifest through clear, immediate causal pathways, typically easier to measure and attributable to specific incidents

e.g. deaths of health workers as a result of bombing a health facility

- Longer-term Impact: Effects that emerge gradually over extended time periods and may demonstrate sustained influence or persistence.

e.g. a chilling effect on willingness to seek care for health conditions, reticence of health workers to remain in the profession, or long-term deterioration of health system infrastructure due to repeated targeting.

- **Indirect Impact:** Effects that occur through complex or obscured causal pathways, often involve multiple intermediary factors or feedback loops.

e.g. after armed groups repeatedly raid clinics, midwives relocate and the remaining functional facilities reduce maternal services, leading to more home births and unmonitored deliveries.

- **Cumulative Impacts:** Effects that build up or compound over time through multiple pathways. These may result from the interaction of various smaller impacts.

e.g. repeated small-scale disruptions to health facilities leading to chronic shortages of staff, supplies, and training opportunities, ultimately degrading the quality of care.

- **Heterogeneous Impacts:** Effects that vary across different population segments or geographic areas or vary over time. This term highlights equity considerations and differential outcomes among sub-populations, services, or facilities.

e.g. women health workers face distinct and complex burdens (as compared to male health workers) because of their roles as health workers, breadwinners, and primary caretakers in their families.

- **Adaptive Impacts:** Effects that lead to changes in behavior or practice that can prevent future attacks or mitigate their impacts or, on the contrary, be maladaptive.

e.g., health facilities moving services underground or to mobile clinics to reduce exposure.

- **Reverberating Impacts:** A term prominent in law, political science, and conflict analysis, describing the cascading effects that ripple through systems over time and space as a result of destruction of infrastructure or harm to civilians. This concept helps understand how initial impacts can trigger subsequent waves of consequences across different domains. The term emphasizes that impacts are not only linear or one-dimensional, but rather create complex patterns of cause and effect that can continue to influence systems long after the initial event.²

e.g. the bombing of a major hospital leads to regional shortages of critical care capacity, pushing patients to travel long distances, which strains neighboring facilities and destabilizes health systems across multiple provinces; or the destruction of electricity grids or water systems affects the availability of electricity and water to health facilities, with consequent negative implications for sanitation or the provision of healthcare.

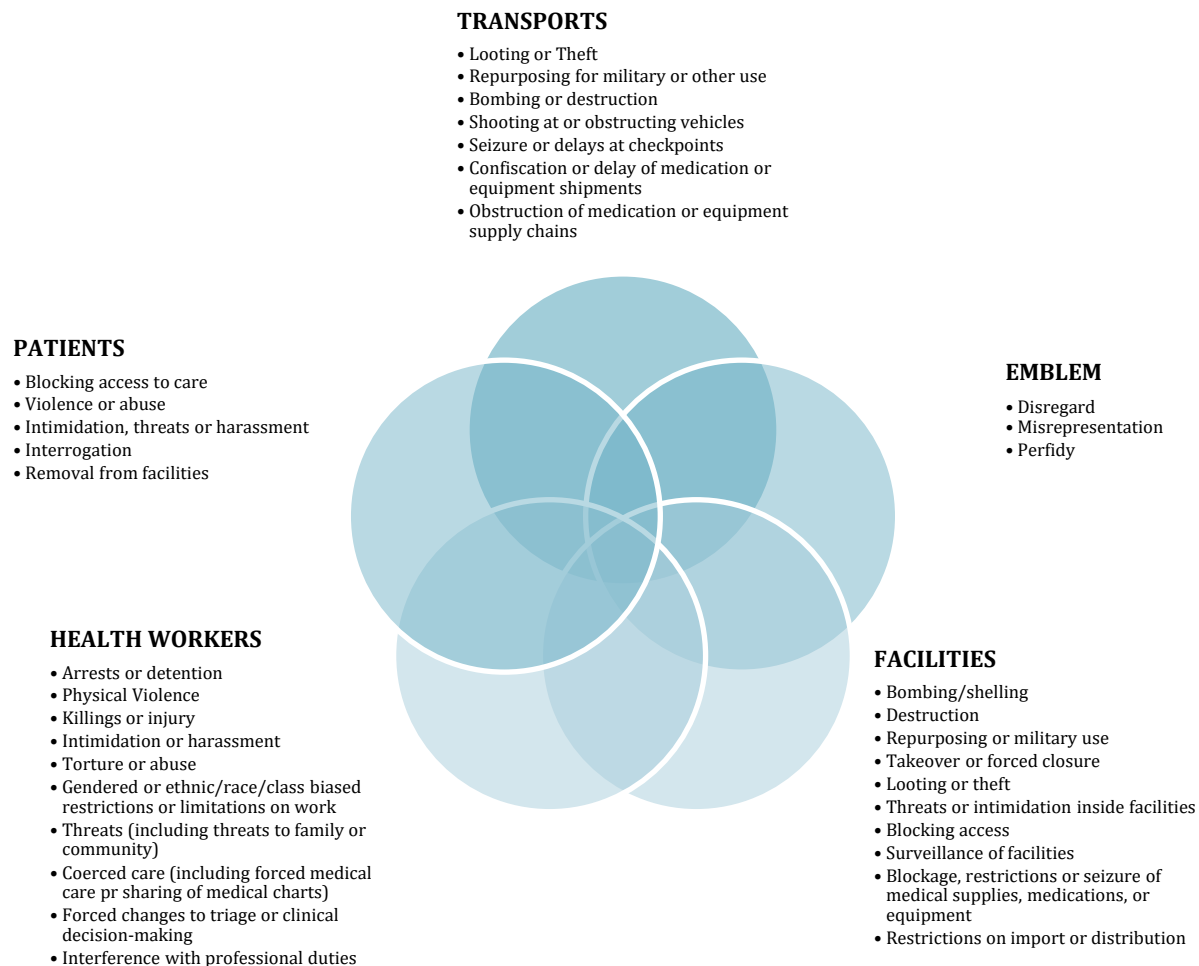
- **Broader Impacts:** Effects that extend beyond the health sector into other domains, and may include social, economic, or environmental consequences. Impacts can also span domains more directly related to health and well-being: public health outcomes, humanitarian operations, medico-legal and health economic consequences, and broader implications for medical ethics.

e.g. economic decline in surrounding communities that depended on the health facility for jobs and local economies.

Our studies have shown that incidents typically involve multiple overlapping dimensions of impacts. As these impacts compound and interact, the effect over time can look very different from the sequelae of a single incident. Recognizing these diverse facets helps explain why this work demands innovative, multi-layered approaches to fully understand its complexity. One major conceptual and operational challenge has been isolating the impacts of specific incidents within the broader context of conflict dynamics. The complex interplay of known and unknown factors, cascading impacts, human decisions, and missing or poor-quality data that obscure clear causal pathways in conflict settings can complicate efforts to

document and distinguish the impacts of a specific event. When analyzing attacks on healthcare specifically, a key challenge lies in distinguishing their impacts from other factors affecting civilian health. For example, general insecurity can inhibit a sick person's willingness or ability to travel to a health facility. This may be captured in an impact analysis as a civilian attack that affects health but should not be interpreted as an attack on health. Through both qualitative and quantitative approaches, we have worked to disentangle these interconnected effects, though significant analytical challenges remain.

Figure 1: Framework of Attacks on Health developed for our studies



3. Country Case Studies

In 2019, the RIAH consortium convened to identify potential case studies. We sought geographical diversity and aimed to examine various conflicts while avoiding duplication of existing research, particularly work by locally based colleagues. Before finalizing our plans, we conducted extensive preliminary scoping work to thoroughly understand the multifaceted dimensions of the study environments. This preparatory phase, including both literature review and site visits, was essential for identifying the specific needs, constraints, opportunities, and contextual nuances across our diverse research settings. After conducting scoping research and field visits, we selected Afghanistan¹⁶, Central African Republic¹⁷, Colombia^{18–20}, and Nepal²³ for our initial case studies. As the project progressed, we added an historical analysis of World War II²⁷ and then Myanmar²², following the 2021 coup and the subsequent surge in attacks on healthcare. In 2024, we collaborated with the International Rescue Committee to produce a report focused on the impact of attacks on selected hospitals in eastern Democratic Republic of Congo²¹.

This paper also incorporates complementary research from Syria^{24–26}; although this work was not formally part of the RIAH research program, the overlap in team members (RH and LR), research aims, and overall conceptualization were complementary. Our research team was intentionally multidisciplinary, ensuring we examined attacks on healthcare through a broad interdisciplinary lens. The team comprised physicians, epidemiologists, political scientists, historians, lawyers, and social scientists. Given this perspective, our methodology encompassed historical analyses based on literature review and archival work, rapid surveys, interview-based research, and quantitative methods, and also prioritized opportunities for advocacy and operational relevance.

Equally important to our research approach was to establish collaborative partnerships with national research institutes and local healthcare professionals embedded within their respective organizations and communities. These partnerships proved invaluable in several ways:

1. They contributed to the analysis.
2. They facilitated access to insider perspectives that would have been otherwise inaccessible to external researchers.
3. They enriched our understanding with culturally informed interpretations of observed phenomena.
4. They provided historical, political, social, and cultural context for current practices and challenges.
5. They helped navigate complex institutional relationships and social and cultural dynamics.
6. They supported access to complex local networks of health workers, facilitated initial contacts, and helped establish credibility and trust in our research endeavors.

Through these collaborative relationships, we gained a deeply contextualized and nuanced understanding of the healthcare landscapes we were studying. Local health workers served not merely as data collection assistants but as research partners and co-authors, contributing their expertise to shape research questions, interpret findings, and identify meaningful patterns that might have been overlooked by researchers without their embedded knowledge. In one case, CAR, the Minister of Health provided unique insights to the study.

4. Principles and Legal Framework Grounding the Research

In protracted conflicts, humanitarian support to health systems encompasses both formal service delivery under the auspices of Ministries of Health and improvised community-led structures that sustain access to care. RIAH research is positioned along a continuum focused on managing and mitigating security risks for healthcare providers and accountability efforts for violations. Accordingly, we identified three legal frameworks within which to analyze the impact of attacks on healthcare. First, International Humanitarian Law draws a clear line on protecting health workers in conflict settings.² In RIAH's WWII historical analysis, we note that while the protection of medical units has changed shape over the past decades and has been interpreted differently across contexts, the core principles of ensuring that health providers in conflict are not targets and should be allowed to safely care for the wounded and sick has stood firm over time.^{27,33} Despite being widely adopted in the rhetoric, these principles for the protection of healthcare providers continue to be poorly enforced. The RIAH consortium, in its initial meetings, used the standards of IHL in focusing on attacks that occur in contexts where IHL applies, where armed or organized groups rather than individuals perpetrate attacks, as the general boundary of inquiry.^{34,35} However, the studies illustrate that demands to uphold IHL are simply not enough: the laws are well established even if not sufficient to uphold the norm to protect healthcare in conflict.

To add to this legal framework, our research led us to two additional potential frameworks to understand the impacts of attacks on health, namely a public health framework and a human rights framework. A public health framework evaluates if and how attacks on health affect the health system and health seeking behavior. In our research, we found that the health system building blocks, as defined by the WHO, provided a foundation to organize and categorize the myriad impacts and complex pathways of impact on the public health system.^{36,37} The building blocks, including governance, financing, health workforce, equipment/medicines/infrastructure, information, and health delivery, are each affected both directly and indirectly by attacks on health. Demonstrating how these impacts occur, particularly through interviews with health workers, community members and other experts, opens a window into how attacks on health result in a public health catastrophe. Public health advocacy, in turn, may be a strong tool when legal framing by itself is not enough. It brings to light the enormous economic and social burdens that result from attacks on health, and illustrates how problematic, costly, and challenging rebuilding a health system may be.

Finally, a human rights framework falls under the 'right to health' norm. The United Nations Convention on Economic, Social, and Cultural Rights (ICESCR) explicitly recognizes the right to the "highest attainable standard of physical and mental health" in Article 14, effectively enshrining every individual's right to health within international law and the UN system.^{38,39} Countries that have signed the ICESCR are, among other requirements, obligated to take steps to ensure access to healthcare services, prevent diseases, improve environmental hygiene, and reduce infant mortality to realize this right. In its most direct form, the right to health requires that healthcare services fulfill what is known as the 'AAAQ threshold': they are available, acceptable, affordable, accessible, and of high quality.⁴⁰ Healthcare that fulfills these criteria is usually framed as adequate access to care. To test that the third of these – access to care – is achieved, our research uses quantitative data on the utilization of health services as a proxy indicator. In theory, if the services meet the AAAQ criteria, utilization would be stable and match the population needs. If utilization drops, whether discretely or trends down while a conflict surges and health needs go up, we argue that at least one of these criteria may not be met, thus hindering fulfillment of the right to health.

5. Methodologies: Descriptions, Advantages, Limitations, and Lessons

5.1. Qualitative Research Methods

Each of the country case studies utilized methods that engaged with participants within the health system, including administrators, policymakers, health workers (in a range of professions), technicians, students, and community members (not all studies included all these categories). Studies focusing on the perspectives and experiences of health workers were foundational.

5.1.1. Qualitative Research Questions

The research question drives the process from study design through to analysis. While each case required contextual nuance, all focused broadly on the public health and social and personal impacts of attacks on health. Specific research questions included:

1. How do health workers perceive and articulate the multi-dimensional impacts of attacks on healthcare infrastructure, their professional practice, personal wellbeing, and the patients and communities they serve? (All country case studies)
2. What strategies do health systems and individual health workers employ to respond to or mitigate the impacts of attacks? (All country case studies)
3. Additional research questions were context specific and addressed gaps we identified in earlier rounds of research or scoping. For example,
 - a. In Colombia, we explored how intersectional identities, particularly gender, shape vulnerabilities and experiences of violence against healthcare workers in specific contexts.
 - b. In Myanmar, we investigated how healthcare workers navigate ethical and professional tensions when choosing between continuing to work within compromised health systems versus engaging in forms of resistance such as the Civil Disobedience Movement (CDM).
 - c. In Nepal, we examined the paradox that, during the armed conflict in that country, health indicators appeared to improve.

Many research questions aimed to capture a holistic picture of how attacks on health impacted various parts of the health sector, including such issues as supply chains and patient access. Other research questions captured different facets of impact, from participant perspectives to the changes in how people used or accessed healthcare, and their various responses to these attacks. Each study required slightly different phrasing to capture a full picture.

Disaggregated data on particular groups of health workers (e.g. women in Nepal and Colombia) opened a new window into understanding the intersectional identities that shape impact. For example, the women we interviewed in Colombia were not just female, they were also predominantly Afro-Colombian, living in rural areas, and experiencing poverty. Identifying and understanding their multiple identities and their impacts on the health workers themselves and the health system helped identify recommendations to holistically support them. In our studies, we primarily focused on health worker and key informant interviews. Where possible, we also conducted interviews with patients and community members (as in the Colombia study) to capture more diverse perspectives.

5.1.2. Qualitative Study Design

In each case, we designed our studies keeping in mind the research context, available data, and research aims. For the qualitative studies, we employed a hybrid approach drawing from both phenomenological and grounded theory methodologies for both the design and analysis.^{41,42} The phenomenological elements allowed us to capture the lived experiences of diverse health workers who witnessed or survived attacks, providing contextual insights into the psychological, professional, and social dimensions. This approach illuminated what it means to deliver healthcare under threat but was limited in its ability to generate broader insights. Complementing this, we incorporated grounded theory techniques for data analysis, which enabled us to systematically identify patterns across narratives and develop conceptual models explaining how healthcare delivery adapts following violent incidents. While grounded theory alone might have overlooked the depth of individual trauma experiences, the combined methodology created a more comprehensive understanding.

5.1.3. Qualitative Sampling Frames

In all our country case studies, we implemented purposive and snowball sampling strategies to recruit participants, in coordination with in-country partners.⁴³ Purposive sampling enabled us to strategically select health workers from the affected regions and facilities, ensuring representation across professional roles and exposure levels. We complemented this with snowball sampling, wherein initial participants referred colleagues within their networks, helping us to reach less accessible health workers. Inclusion criteria primarily focused on adults working within the healthcare system, in conflict settings. In most studies, we also included health workers without direct experience of violence; as witnesses and colleagues, they felt the ripple impacts as well.

In one Colombia study, we included only women health workers while in other contexts, we included only health workers aligned with a specific political ideology (e.g. in Myanmar we focused on health workers within the CDM movement) or healthcare organization (e.g. Syria with the Syrian American Medical Society). This approach was practical because it allowed us to reach participants through trusted networks, and it also helped fill a gap by capturing perspectives – often critical of government – that are typically missing from existing research.

The selection of participants and regions of study within countries varied by contexts. The team that led the oral history project in Nepal, for example, selected three contrasting zones of the central belt of the country in order to recruit participants from regions where the insurgency had obtained full control and reshaped access to care according to its agenda, areas contested by State and insurgency, and areas where control remained in the hands of the State. The comparative perspective of these three areas illustrated the common experience of war violence but also how attacks on health reflected political and ideological aims.

5.1.4. Qualitative Data Collection

Data collection primarily relied on in-depth interviews, complemented by life-histories and surveys in some study sites (e.g. in Colombia). As the RIAH project began, we developed a semi-structured interview guide template based on the core research questions.⁴⁴ This template was then adapted and translated for the specific contexts to capture relevant information. The template introduced participants to the project and sought consent for participation. Questions examined the following topics:

1. Participant demographics/professional identity
 - Identity characteristics: gender, age, political or other identity

- Professional background including occupation, experience level, duties, and organizational affiliation
- 2. Conflict Context
 - Exploration of the broader conflict landscape
 - Participant's professional and personal experiences within the conflict, participation in conflict etc.
- 3. Type, Patterns and Intensity of Attacks on Health
 - Personal experiences or witnessing of attacks on health
 - Knowledge of attacks on patients, facilities, transports or health workers (themselves, colleagues, the wider network)
 - Temporal and geographical patterns, immediate impact, and perpetrator identification
- 4. Multi-dimensional Impacts of Attacks on Health
 - Effects on health system functioning (programs, facilities, services, operations, staffing, financing)
 - Individual impacts (personal and professional well-being, mental health, professional duties, ability to provide care, ethical tensions)
- 5. Responses
 - Institutional, community or individual responses, mitigation strategies, coping mechanisms, and adaptations
 - Assessment of effectiveness, challenges encountered, and lessons learned
- 6. Conclusion
 - Post-interview re-consent to ensure continued participation agreement
 - Snowball sampling referral requests
 - Debriefing and additional space for questions or supplementary discussions

This structured yet flexible approach allowed us to develop a rich, if still exploratory, understanding of the impacts while maintaining methodological and substantive consistency across diverse contexts. This approach also supported our goal of fostering cross-context learning and solidarity among health workers operating under threat. However, it is important to note that while the questions were organized in similar patterns, the specific questions, participants, research design, and other components differed across the studies, emphasizing the need for a context-specific approach.

In our studies in Syria and Myanmar, we conducted one-on-one in-depth interviews about the individual experiences of health workers, using qualitative interview techniques of open-ended questions to capture the diversity of views and follow up prompts to focus interviews on our research questions. For the CAR and Afghanistan study, we conducted key informant interviews to identify incidents for the quantitative analysis and focus on the ability to provide support and resources rather than on specific experiences of

attacks. In Nepal, we used group interviews as well as individual ones, which allowed discussants to engage with each other and deepen their responses.

For our initial study in Colombia,¹⁹ as well as our research in Afghanistan, we adapted our approach by implementing our template questions in a survey format with more structured categorical responses. The survey instrument was particularly useful when interviewing a larger sample of participants, and where one-on-one interviews were not feasible because of time or security constraints. For example, in Colombia, travel to rural towns to conduct interviews was only possible in the daytime, so we conducted surveys to enable interaction with more participants in a single location. Because our research team did not live in these areas, a survey also allowed for anonymized responses where we did not have the opportunity to build the trust and rapport required for one-on-one in-person interviews. Following the surveys, we utilized a life-history approach for a second study in Colombia. This methodology arose from the earlier research that identified a set of complex factors affecting the impacts of attacks on healthcare, particularly for women health workers. The life-history approach enabled exploration of participants' intersectional identities and cumulative experiences of violence throughout their lifetimes, and how it shaped their experiences of and responses to attacks on health.

Many of our studies collected data remotely due to multiple contextual constraints (especially in Syria, Myanmar, CAR and Afghanistan). The COVID-19 pandemic coincided with our research timeline, quickly eliminating possibilities for in-person data collection and necessitating adaptation to virtual methodologies. This challenge was compounded by the fact that many of our research sites were located in active conflict zones or areas with significant security concerns that would have posed unacceptable risks to both researchers and participants even under non-pandemic circumstances. We conducted individual interviews via encrypted video conferencing platforms where internet connectivity permitted, or through secure phone calls when digital infrastructure was poor or compromised. Though remote methodologies presented challenges related to building rapport and capturing non-verbal cues, they ultimately enabled participation from otherwise inaccessible locations and offered participants greater control over their environment during sensitive discussions. This approach allowed flexibility in scheduling around unpredictable security situations and clinical demands, potentially enhancing participation rates despite the challenging research context.

5.1.5. Qualitative Data Analysis

Data analysis varied across the contexts. A distinctive facet of our process was the concurrent implementation of the RIAH case study research across multiple contexts. This timing enabled us to conduct regular in-person and virtual cross-team meetings throughout the analysis period, creating valuable opportunities for researchers to share emerging themes, methodological insights, and preliminary findings. This cross-pollination of ideas enhanced analytical depth and facilitated the identification of both consistent patterns and context-specific nuances in how healthcare systems and workers experience and respond to attacks. Our findings reflect how important it was to understand the context, as well as some cross-study findings.⁴⁵

5.1.6. Qualitative Challenges and Limitations

There were significant challenges, both practically and within interview-based research methods. On the practical dimension, working with healthcare workers in insecure circumstances - many of whom were actively working within conflict settings, and facing threats, intimidation, and attacks - shaped both the data collection and analyses.

Conceptually, and for logistical and ethical reasons, our focus on the health workers and the health system necessarily meant that we could not include the service user's perspective. Patients, other health sector stakeholders and informal workers would likely have very different views and experiences. In some cases, our sampling was limited to health workers aligned with a specific perspective (e.g. CDM workers in Myanmar), within a specific organization, or of a specific targeted group (e.g. rural women health workers in Colombia), potentially missing alternative viewpoints. One key question is how well the health workers understood the health system as a whole and whether they could describe impacts beyond their personal experiences of attacks on healthcare. Recognizing that health workers would likely give different answers, we aimed for a diversity of perspectives (CAR, Colombia, Afghanistan).

Interview data provide valuable insight into the individual perspectives of health workers but are limited by recall bias (memory may be inaccurate) and confirmation bias (people may interpret events to fit their expectations). Recall bias is an inherent limitation in interviews about past violence. Willingness to report, fear of reprisals, stigma around certain types of attacks, and the normalization of violence may all shape what is remembered, recounted, or silenced. Our research sits within the broader terrain of retrospective interviews—where memory, interpretation, and identity intertwine. Narratives of past attacks are not static records, but are instead reconstructions shaped by time, trauma, and collective memory. Confirmation bias, where researchers may interpret or emphasize information in ways that fit what they already believe or expect, is another risk in qualitative research. Researchers' reflexivity and learning to be aware of their position and biases can help to mitigate confirmation bias. Recognizing this dimension is essential: while oral accounts may be partial or subjective, they also reveal how individuals and communities make sense of violence and its aftermath, offering insight into the lived realities that formal records often miss.

Despite precautions, these studies posed both psychological and security risks for interviewees and researchers. Data collectors received a briefing on psychological first aid in case it was required but discussing attacks on healthcare carried potential security implications and emotional strain. Future research should build in stronger psychosocial and protection measures to ensure continued ethical and safe participation. For these studies, ethical review was sought both at the RIAH affiliated universities as well as at the national or local level with relevant authorities. It is important to recognize that interviews about traumatic events may contribute to re-traumatization, and researchers are not always equipped to respond to participant distress. At the same time, some participants experience empowerment through sharing their experiences, particularly where violence has silenced survivors. Ethical research must therefore balance these risks and benefits, supported by clear protocols, referral pathways where possible, and ongoing debate within the humanitarian sector about the role of researchers as observers versus responders when distress occurs. In some settings, this led organizations to adapt how they communicated with staff about traumatic incidents to better support staff well-being while restoring services.

On the analytical side, our phenomenological and grounded theory approaches, while broad enough to capture a wide swath of perspectives and experiences in this exploratory research, required balancing rich experiences within a narrow topic area. Despite cross-team coordination, differences in researcher expertise and identities among our interdisciplinary and international team, analytical approaches (e.g. historical, epidemiological) may have influenced how similar phenomena were interpreted across different settings.

As a collective, the RIAH case studies offer valuable insights into the experiences of health workers in conflict settings and their perspectives on the impacts of violence against healthcare. The unique characteristics of each participant, their interview, and their context, however, limit broad

generalizability. The varying intensity, characteristics, duration and nature of violence, combined with differences in baseline healthcare structures and cultural contexts necessitate caution when interpreting findings across different conflicts.

Despite these limitations, our research provides greater understanding of this little-studied issue and contributes to the growing body of knowledge on the multi-dimensional impacts of attacks on health. Taken as a whole, the studies paint a picture of substantial impacts of these attacks on health workers both personally and professionally, and how they mitigate and respond to them, as well as on their broader communities that last decades. Each of these cases is available on the RIAH website with additional synthetic findings to come.¹⁵

5.2. Quantitative Methodologies

RIAH's partner Insecurity Insight collected data on incidents globally, allowing deeper insights into these different data types. Impact analyses are intrinsically linked to incident documentation and should be grounded in systematic assessment of recorded attack patterns. In the DRC study, for example, incident datasets were first reviewed to identify the locations, frequency, and characteristics of attacks, and health facilities were then selected for study based on these patterns.²¹ Beginning research design with an incident-pattern assessment allows investigators to make informed sampling decisions, prioritize the most affected facilities or regions, and better align study objectives with the realities of violence on the ground. While practical considerations—such as access, security, and data availability—will inevitably shape final site selection, incorporating incident analysis at the outset provides a more transparent, analytically robust foundation for both qualitative and quantitative impact studies.

Of the RIAH and associated cases, two conducted quantitative analyses of retrospective data (CAR, Syria). The data available in these very different contexts demanded different methods of analysis. The findings may not be conclusive or generalizable to other contexts but give insight into the kind of research that is possible if data are available.

5.2.1. Quantitative Research Questions

Our quantitative work was aimed at providing rigorous, measurable evidence of how these attacks affect specific healthcare indicators—such as facility operations, consultation numbers, downstream vaccinations, or disease incidence. This data-driven approach may resonate with stakeholders influenced by measurable quantitative reproducible data, especially in addition to in-depth examples from the qualitative work. Additionally, our quantitative analysis aimed to identify specific vulnerabilities among regions, groups, levels of health facilities, and services, enabling more targeted resource allocation and support where it is most needed. Our overarching quantitative research question was:

1. What measurable changes occur before and after attacks on health facilities in healthcare delivery patterns, service utilization, and disease outcomes, and how can these changes be causally attributed to specific incidents?

In one case, Nepal, we used health data from the Nepal Living Standards Survey to examine correlation, in the form of general trends in health data during the conflict, instead of looking to identify causation. As a result, we were able to investigate an apparent paradox: that health indicators improved during the conflict, despite attacks on healthcare.

5.2.2. Quantitative Study Design and Data Availability

Quantitative studies in this field require available and quality data about both the independent variable (the attacks themselves) and the dependent variable (e.g. health indicators, including utilization and outcomes). The RIAH quantitative studies were limited to retrospective secondary data analysis, restricted by the data available in the context and the type of attacks that occurred. Additional information on the confounders (e.g. conflict intensity or major policy changes) is helpful and necessary for causal analysis.

Detailed information on the attacks (the independent or exposure variable) is the first step to any quantitative analysis on this topic. Sources for these data depend on the context and the researchers. For example, in CAR, where data about only the most notable violence was publicly available data, our researchers created their own dataset by triangulating data from key informant interviews, and secondary sources, including organizational security incident data, local radio, and news reports, and data collected by Insecurity Insight from public sources and partners in the aid sector.⁴⁶ These data yielded far more incidents than a single source but required careful and thorough matching and de-duplication before analysis. On the other hand, in the Syria study, documentation of attacks on health was more robust, and triangulation of data was conducted between datasets from two organizations: one who collected data from field reports from Syrian American Medical Society (SAMS) and the other using primarily media monitoring from Physicians for Human Rights (PHR).^{47,48} Both datasets required aligning the inclusion and exclusion criteria for attacks, and matching of facility names, locations and data/characteristics of attack. In CAR, we included data on different types of attacks (threats, obstruction, physical or verbal violence) while in Syria, we only included health facility attacks, specifically, aerial bombardments of hospitals. Because hospitals can move or change names and conflict data can be messy and incomplete, the matching and de-duplication process is time-consuming, requiring careful decisions and deep contextual knowledge from local partners. These choices reflected the overall patterns of attacks in the country, and the two approaches illustrate the importance of accounting for contextual differences in any analysis.

To conduct a proper analysis, there needs to be robust data for the outcome variable or dependent variables, namely, the health indicators to be measured. We received secondary data collected by local and international organizations (including ministries) as part of routine health monitoring. These resources made the studies significantly cheaper, as the data already existed, but came with its own limitations (how the data were collected, what was collected, and any gaps). In CAR, we used weekly health facility data from facilities supported by an international NGO, including reporting on outpatient consultations, postnatal care visits, measles vaccination, deliveries, number of hospitalizations, and number of measles cases. In Syria, we initially collected similar data from a non-governmental health organization on outpatient consultations, trauma consultations, and deliveries but had access to daily data which significantly improved the quality of our analysis.

One major issue in conducting this type of attribution analysis is distinguishing the causality of attacks on health versus the impacts of the armed conflict more generally on the outcome variable. For example, the number of hospital visits may decline precipitously because bombardment that makes the streets unsafe or destroys roads, both of which make reaching the hospital more difficult. This may harm health and be captured in our outcome data but would not be caused by discrete attacks on health facilities. Our team discussed this concern extensively and identified several ways to account for this confounder. In the CAR study, we used a controlled version of interrupted time series in the analysis, where we compared the changes in outcomes of interest in a facility following an attack with the changes in a nearby, similar facility that was not attacked but was expected to experience similar general trends due to its location and shared environment. In Syria, the availability of data on violence affecting civilians allowed us to create a novel conflict intensity indicator variable that we could include in the model to address this issue.

In the Syria study, we used data from xSub (Cross-National Data of Sub-National Violence) to capture conflict events including airstrikes, suicide bombings, shelling, mortars and other weapon use. We created a weighted score of the severity of ‘conflict intensity’ based on the number and types of these events per day. Because large-scale attacks are more likely to be captured by xSub, this indicator may have underestimated intensity based on smaller scale violence but did allow us to capture an estimate of conflict intensity. The methodology holds promise if data availability improves in conflict settings.

In contrast to the causation work in CAR and Syria, in Nepal we used secondary data to examine the trend in health indicators during the conflict, finding that they improved in the most affected conflict areas and deteriorated after the end of the conflict. To explain this somewhat counterintuitive finding, we adopted a mixed methods approach, complementing the analysis with qualitative interviews with belligerents on both sides of the conflict. Although attacks on healthcare were frequent, both sides saw healthcare as an important factor in gaining the support of the population. Thus, Nepal is an example where healthcare was mostly instrumentalized in service of conflict aims rather than targeted for destruction.

5.2.3. Quantitative Data Analysis

Descriptive data: In our studies, we presented a descriptive analysis of the data. This information can provide an assessment of the quality and characteristics of the data available. Simple visual analysis and comparisons can also illustrate the temporal and geographical trends in both the conflict and in attacks on health, variations between different health indicators, and potential relationships between attacks and these indicators. Descriptive statistics help establish baseline patterns, identify outliers, and inform the development of more sophisticated analytical approaches.

In the CAR study, the research team utilized an interrupted time series approach. The research team compared the difference in the observed trends in health service outcomes in the twelve months after an attack and the predicted trends if no attack had occurred. The model accounts for long-term trends in the indicators and seasonal changes. They calculated two measurements:

1. The numerical difference between the health indicators after the attack and the predicted values in the twelve months following attack.
2. The percentage difference of actual compared to the predicted values.

This approach allowed the team to estimate both immediate and long-term impacts on health indicators by comparing observed post-attack data with counterfactual predictions representing expected outcomes had no attack occurred. The researchers analyzed eight health facilities that experienced attacks, looking at data before each of the attacks and in the 12 months after. These facilities were located in different regions and included one larger referral-level facility and seven smaller primary-level facilities. The study identified varied impacts of attacks, where some facilities and indicators showed decreases in consultations after attacks while others actually showed an increase in vaccinations or deliveries after an attack.

To strengthen the analysis and account for trends in outcomes that were likely influenced by other events outside of attacks on healthcare, the researchers compared attacked facilities to similar facilities that were not attacked, using a controlled interrupted time series design. For larger hospitals the nearest similar hospital in the same area was used, and for smaller clinics, they used primary-level facilities along the same major road. Facilities that were also attacked during the study period were excluded, which limited the number of comparison options. Regardless, they saw declines in outpatient consultations and deliveries in the twelve months post-attack, declines not observed in control facilities.

The CAR team also used survival analysis to assess whether there was an association between a facility experiencing an attack and the reporting and timing of measles cases. Namely, the team explored the hypothesis that healthcare facilities with an attack were more likely to experience decreased coverage with measles vaccines, which would result in an increased number of children susceptible to measles, and earlier measles introduction events. Analyzing 20 healthcare facilities in a single prefecture (three experienced attacks in 2018 and 17 had not), they found that there was a significant difference in how quickly measles cases appeared in attacked versus non-attacked facilities. However, the sample size was very small, and the findings should be interpreted with caution.

In the Syria study, the availability of more granular daily level data at a greater number of facilities allowed for additional analysis. Daily attack data focused only on strikes against health facilities, enabling a consistent exposure variable. The outcome variables chosen were outpatient consultations (as the largest dataset in most facilities, demonstrating regular clinic utilization), trauma consultations (as critical to understand in conflict settings and expected to rise, despite hospital attacks) and obstetric deliveries (as a critical part of community services and because births cannot be postponed). The case-time series design, initially developed for environmental attribution studies, was flexible and adaptable enough to handle exposure at different times, allowed each facility to serve as its own control, and captured the delayed effects of attacks on healthcare. In this study, the case-time series design permitted detection of non-linear patterns of how the effects of attacks changed over time, looking at periods from 1 to 90 days after each attack and, in some cases, to 120 days to capture longer-lasting effects. The model accounted for the effects of seasonal patterns, daily conflict intensity in the area (as calculated above), and day of the week and major holidays, such as Ramadan which can affect healthcare seeking behavior. We also conducted sub-analysis based on verification (i.e. documentation by PHR's more rigorous two-source verification method), and by attack type. Testing this methodology in Syria demonstrates the potential of using novel models, many already used in other fields, in conflict settings. These analyses, however, require more granular data and could motivate humanitarian and human rights organizations, as well as UN groups such as WHO that already collect hospital surveillance data in many settings, to share data and collaborate. As both the CAR and Syria studies illustrate by their absence and presence, respectively, quality and granular data enable a more comprehensive and nuanced understanding of the impacts of attacks on healthcare systems and the populations they serve.

In Syria, we also collected data on measles and other vaccine-preventable diseases from another partner organization, Assistance Coordination Unit (ACU). The complexity of the conflict, migration and displacement patterns, missing data due to insecurity and unstable funding, temporal lag, and other factors limited our ability to directly link increases in attacks on health in one district to increased incidence of measles, polio, or other diseases. However, in corollary descriptive studies we were able to report on the rise of measles outbreaks and rates of acute flaccid paralysis in Syria, particularly as measles vaccinations dropped precipitously during the war.^{49,50} Using related ACU data on water sites, we were also able to use regression and dose-response models to demonstrate that cases of waterborne diseases rose with decreasing water station functionality and chlorination.⁵¹

In addition to our two formal impact studies, our team and collaborators have explored innovative data science approaches to understand civilian violence, including multiple correspondence analysis techniques. These emerging methodologies open promising avenues for more sophisticated quantitative analysis in conflict settings. Such approaches are particularly valuable where traditional epidemiological methods are constrained by inconsistent, messy, and unpredictable data patterns. These advanced analytical frameworks offer new possibilities for extracting meaningful insights about impact from complex humanitarian contexts where conventional methods may fall short.^{24,52}

5.2.4. Quantitative Challenges and Limitations

There are significant limitations to the quantitative methods described here. Both the CAR and Syria studies were fundamentally constrained by data quality and availability, necessitating compromises and methodological innovation. Access to limited health consultation data (in both cases to only one organization), the lack of consistent mortality data in both settings, and constraints in understanding the factors that led to reduced consultations are all major limitations in the data.

In CAR, the interrupted time series approach relied on counterfactual assumptions about trend continuation that may not fully capture unpredictable conflict or practical dynamics. Limited sample sizes, particularly in stratified analyses, restrict the power to detect meaningful differences. Finding appropriate control facilities presented significant challenges, as attacks were so pervasive that most candidate facilities were ineligible to serve as controls because inherent matching imperfections introduced unknown biases. Perhaps the biggest challenge in the CAR study was identifying and characterizing specific incidents of attacks with sufficient detail to compare their impacts. We attempted to mitigate this by supplementing with interview data, publicly available sources, and organizational records. However, the available information was often sparse or incomplete, making it impossible to disaggregate incidents beyond the monthly level.

In the Syria study, complete data for our analysis were available for two years of a 14-year conflict, limiting the analysis significantly. The de-linked disease data made attribution of infectious disease to specific health attacks impossible. For the case time series design, the model assumed some stability in the underlying patterns, which may not be certain in evolving conflict environments. While the self-matching design helps control for confounding factors that do not change over time, it cannot account for confounders beyond the specific elements we explicitly included in the model, namely seasonality, day of the week and holidays. The approach also required relatively dense time-series data, which are not always available and took years of diligent collection by the health organization. Additionally, despite innovative approaches to measuring conflict intensity, this indicator likely captures only a portion of relevant confounding variables.

The methodological approaches applied in these studies demonstrate the adaptability of established statistical techniques to challenging conflict settings. The interrupted time series design in CAR effectively enabled counterfactual analysis, allowing for estimation of attack impacts while accounting for pre-existing trends and seasonality. The introduction of a controlled design could strengthen causal inference by providing comparison facilities, particularly in settings with larger samples. Similarly, the case time series design applied in Syria represents an innovative adaptation of methodologies from environmental epidemiology to conflict settings. This approach's flexibility in handling time-variant exposures and facility-level analysis proved particularly valuable. The development of a conflict intensity indicator to control for background conflict represents a methodological advancement that begins to address the critical challenge of disentangling targeted healthcare attacks from broader conflict effects. Together, these approaches demonstrate that creative application of existing methodologies can yield meaningful insights in data-constrained environments.

We note that while we attempted quantitative analysis in our other country-case studies, this was often not feasible. For example, in the Nepal study, the interviews and accounts could not be correlated to incidents. A central finding there relates to the difficulty of retrospectively connecting events, accounts and detailed medical information. Oral accounts often misattributed acts of violence or dated them incorrectly but arguably sought to make sense of them in a broader narrative of attacks on healthcare.

The difficulty of combining aggregated statistical data and narratives which make sense of how health improvements were delivered reveals the need to gather data in real time rather than retrospectively.

6. Rapid Assessments and Operational Research Methodologies

In addition to the rigorous academic research methods outlined above, the RIAH Consortium partnered with operational organizations in order to test how these organizations can conduct impact studies as part of their humanitarian responses. In collaboration with the International Rescue Committee (IRC) and Insecurity Insight, the RIAH team tested a rapid assessment methodology to examine the impact of attacks on healthcare on specific health facilities. Rapid assessment methodologies in the aid sector are designed as time-bound data collection processes that can be conducted immediately after, or during, a crisis to generate essential information for initial operational and strategic decision-making. Their purpose is to prioritize actionable information over completeness, and relevance for an operational context over academic or methodological rigor; findings are therefore indicative rather than definitive.

In contrast to academic studies, rapid assessments are explicitly embedded in the realities of a specific health system. Rather than analyzing impacts at a macro level, they focus on how attacks affect individual facilities, service delivery, and health outcomes within a given context, taking into account prevailing health indicators and locally relevant attack patterns. Rapid assessments typically rely on standardized, quantifiable indicators related to access to health services and service outcomes, while situating these quantitative findings within descriptive analyses of how system functioning is disrupted or adapted.

For rapid assessments of attacks on healthcare, the selection of case studies is particularly important. Facilities are identified on the basis of documented attacks, allowing observed impacts to be directly linked to specific incidents. Impact, in this understanding, extends beyond immediate damage or service disruption to include the coping mechanisms adopted by health workers and communities, as well as the adaptive capacity of the health system in response to shocks.

Rapid assessments therefore seek to understand the overall response to an attack, recognizing the agency of affected communities and health professionals alongside harm and loss. This distinguishes them from more linear, victim- or tragedy-focused impact narratives that aim primarily to explain causes or origins. In this sense, rapid assessments are not defined solely by speed (usually 3 months), but by their granularity, contextual specificity, and focus on the interactions and adaptive practices that emerge in response to attacks on healthcare. Rapid assessments are also a cost-effective method that can be deployed alongside ongoing operational responses.

6.1. Rapid Assessment Study Design

Effective rapid assessments require close collaboration with researchers rooted in the context who have in-depth knowledge of the functioning of the health system and access to relevant health programs and indicators. The RIAH rapid assessment was conducted in health zones in eastern Democratic Republic of the Congo (DRC) with the support of a university research team from the École Régionale de Santé Publique de l'Université Catholique de Bukavu, in collaboration with the International Rescue Committee (IRC), Insecurity Insight, and the RIAH team.

The study adopted a mixed-methods approach, combining quantitative and qualitative data across three case studies. Case studies were selected based on documented attacks against health services in the study area, as recorded in the Insecurity Insight database and validated by the Provincial Health Divisions. The assessment focused on identifying the impacts of these attacks on maternal and child health services.

The study began with a desk review of reported attacks on healthcare, known structural challenges within the health sector, and existing patterns in health outcomes in eastern DRC, including where data were

available for the three selected health zones. Findings from the desk review informed the formulation of specific research questions aimed at addressing identified knowledge gaps.

The research design was guided by three key considerations:

1. the nature of the attack;
2. the role of the affected health facility within the wider health system; and
3. the availability of specific, measurable health indicators for selected services in the pre- and post-attack period.

The study included three primary health facilities to identify common and unique consequences.

Health facilities were selected for in-depth interviews in January and February 2024 if they had experienced a recorded attack in 2023. This timing allowed sufficient time for impacts to manifest, while remaining close enough to the events to ensure the availability of respondents with direct knowledge of conditions before and after the attack. The study focused on large attacks to ensure that respondents would be able to recall the specific impacts of a memorable event.

The assessment focused on attacks against primary healthcare facilities in order to analyze impacts on a defined level of service delivery within the broader health system. In the DRC context, primary healthcare is provided through health centers, where teams of nurses deliver a minimum package of activities, including preventive, curative, and promotional services, particularly for women and children under five. To assess patient-level impacts, the study examined the role of primary healthcare facilities in relation to other components of the system, including health posts (which offer a more limited emergency care package) and referral health centers, which serve as an intermediary between health centers and general hospitals. Situating facility-level findings within this wider system context was essential for interpreting observed impacts.

6.2. Rapid Assessment Analysis

To enable specific and nuanced analysis, the study focused on maternal and child health services, allowing for comparison of key indicators before and after attacks and for differentiation of impacts across patient groups (see Table 1).

Indicator category	Details to measure
Preventive maternal health activities	Prenatal consultations, Family planning acceptance, Malaria prophylaxis, Micronutrient supplementation
Maternal health and childbirth and neonatal health	Assisted deliveries, Live births
Preventive maternal and maternal and child health	Postnatal consultations, Preschool consultations, Vaccinations and micronutrient supplements for children under 5
General curative activities	Number of cases in the health facility

Table 1: Indicator categories and measures

Following attacks, affected health centers reduced services or closed for one to four weeks due to staffing shortages, loss of equipment and supplies, and widespread fear among health workers and communities, with services resuming gradually and often limited to daytime hours. These disruptions led to sharp declines in maternal and child health service utilization, particularly facility-based deliveries, as many women delivered at home or travelled long distances to alternative facilities, increasing risks of complications. While some daytime preventive maternal services continued, their quality declined because of shortages of essential inputs, and postnatal care, preschool consultations, vaccinations, and nutrition services dropped substantially, contributing to increased child health risks, including malnutrition and untreated acute illnesses. In response, communities adopted a range of coping strategies, including shifting care-seeking to other health facilities, relying on traditional healers, and increasing self-medication. While these strategies enabled some continuity of care, they also introduced additional risks and highlighted the longer-term consequences of attacks on health services.

6.3. Rapid Assessment Challenges and Limitations

The RIAH study focused on large-scale attacks against health centers and did not examine the impacts of lower-intensity incidents, such as threats, intimidation, or harassment of health staff. It also analyzed the effects of specific, discrete attacks and was not designed to capture the cumulative or compounding impacts of repeated attacks over time, a particular challenge in protracted crisis contexts.

Because the selected attacks were large in scale, they often extended beyond the health facilities themselves and included violence against surrounding communities, schools, markets, and other civilian infrastructure. As a result, it was not always possible to clearly disentangle impacts directly attributable to the attack on the health facility from those resulting from the broader attack on the community. Some observed changes in patient behavior may therefore reflect wider insecurity and displacement rather than the facility-level attack alone.

Recall of events is generally strongest when interviews are conducted close in time to the incident, whereas quantitative indicators of service provision and utilization benefit from data collected over a longer post-attack period to better capture recovery trajectories. The rapid assessment design, which relied on a single data-collection visit per site, necessarily limited the ability to optimize both qualitative recall and quantitative trend analysis.

Finally, the assessment did not include data from alternative health facilities to which patients may have shifted their care-seeking. As a result, it was not possible to assess the extent to which the wider health system absorbed the shock experienced by affected facilities or to analyze system-level substitution effects.

Building on the research summarized above, as part of the final phase of the RIAH project, we are collaborating with multiple operational agencies to develop a process and method for using existing routinely collected data (e.g. security incident data, health information data) to better understand the operational impact of attacks. Results from these collaborations will be published on the RIAH website.

7. Discussion

To summarize, this paper reviews the methodologies and critiques for our series of studies on the impacts of attacks on health in conflict. We conducted qualitative and quantitative analyses, and operational research. Before we began our work in 2019, studies that attributed cause, directly linking one exposure to a specific outcome in a sea of complex causality patterns and particularly in conflict, were limited. This is even more true for understanding the impact of attacks on health in conflict. We knew from our collective years of previous research to document attacks on health and in talking with stakeholders in myriad conflicts that the impacts of attacks on health were profound.

Our aim was to fill this gap with innovative exploratory research, testing different methods, establishing an evidence base, and identifying generalizable and context-dependent patterns. The resulting studies represent an important advance to understand not only the number and range of health workers, patients, and facilities that have been attacked, but also to approach a deeper understanding of what that actually means: lack of services, taking away the human right to health, and destroying lives of health workers and patients. Ideally, understanding these impacts will improve accountability, mitigate harm, and help target resources to the places, people, and health outcomes most in need. In exposing the longer-term impacts, we also hope to strengthen advocacy to better protect healthcare, principally, by demonstrating the massive cost.

While the individual studies describe the impacts we identified, our experiences across multiple conflict settings have yielded valuable methodological insights for future work in this field that we share below. We present overarching lessons from the work, followed by reflections on the quantitative, qualitative, and rapid assessment methods.

7.1. Overarching Lessons

First, research approaches must balance methodological rigor with contextual sensitivity and data availability. Our multiple methods strategy provided complementary strengths: qualitative methods captured the lived experiences and complex impact pathways that statistics alone cannot convey, while quantitative approaches offered measurable evidence of service disruption that resonates with policymakers. The rapid assessment highlighted the importance of considering community agency and coping mechanisms. This complementarity proved essential for comprehensive understanding, particularly as reporting on attacks was so poor in many of the contexts we studied. Because each method has inherent limitations, combining approaches allows triangulation of data and strengthens the credibility of findings. For example, qualitative interpretations of attack experiences evolved over time, with the strongest recall of personal experiences found among respondents interviewed closer to the time of the incident. In contrast, quantitative data require a longer post-attack period to be compiled and analyzed in order to allow for more nuanced interpretation of trends and recovery patterns. We also learned that there are limitations in establishing a linear relationship between a single attack and its discrete impact, particularly in any predictive model. There are differential impacts in services in a single facility which were different in a different attack, and recovery time depended on a variety of factors. Interviews with experts helped direct what impacts we could measure and how to understand the compounding impacts. This highlights the need for continued methodological development, grounded in careful interpretation and nuanced understanding of specific contexts and actors, as well as the use of complementary and overlapping methods that inform one another to ensure a more accurate and comprehensive account of impacts.

Across all studies, ethical considerations should remain paramount. Interviews with health workers who have experienced trauma require specialized approaches to prevent re-traumatization, and in conflict settings also require nuanced security considerations. As noted in our Colombia study, researchers must avoid "opening a wound" without providing adequate support. Including psychological expertise in research teams and establishing clear protocols for when to pause or end interviews is essential, areas where our work has made initial progress but where further development remains necessary. Research partnerships with in-country organizations and the government or ministry of health where relevant, significantly enhance both data quality and ethical practice and are fundamental to strengthening humanitarian research globally. Our collaborations improved access to difficult-to-reach populations, provided crucial local understanding, and helped ensure that findings would be relevant and actionable. However, these partnerships also require genuine reciprocity with the in-country research team. Our experience also highlighted the importance of considering how participants and communities can directly benefit from the research. While these data can be important for global advocacy, oftentimes, the findings are not shared with local providers who spent hours collating or providing the qualitative or quantitative data. To mitigate against this extractive practice, our research team coordinated myriad types of feedback meetings and reports for study participants, even while we acknowledge more could have been done. Contextually relevant feedback must be part of the design and implementation of research on this topic. While significant progress was made in our studies, our team would like to continue strengthening this approach by fostering greater ownership and deeper, more sustained engagement with research partners.

Third, methodological adaptability proved critical in dynamic conflict environments. Our flexibility in data collection methods—shifting to remote interviews during COVID-19, adapting survey instruments to security constraints, and developing novel analytical approaches for inconsistent data—allowed research to continue despite significant obstacles. This adaptability should be built into future research designs from the outset. Particularly in complex and dynamic environments such as conflict settings, funders and researchers alike must not only accept but embrace adaptation and real-time flexibility in research processes.

Another challenge that many in applied research face is translating research into policy change. While systemic, political and diplomatic issues play out in far larger planes than our work, there is room for growth in this area for researchers as well. It falls on the researchers in humanitarian and human rights spaces, for example, to underscore findings and develop thoughtful actionable recommendations, both for armed groups who must stop attacking health, and for other stakeholders that may be more relevant downstream to an attack. The challenge is to identify the points of entry where an intervention can change the causal pathway from attack to deleterious impact. In an *Insecurity Insight* recent paper on food insecurity, an "anticipatory mindset" can, rather than predicting conflict itself, focus on anticipating the humanitarian impacts of conflict events (such as looting, market violence, or supply disruptions) and enabling early interventions that mitigate their downstream effects before needs escalate.⁵³ From a research perspective, improved methodologies for identifying differential impacts—and the factors that drive them—could help guide prevention and mitigation planning by clarifying which populations, services, or system components are most vulnerable. But here too, complementary, adaptable, and ethically engaged processes must be followed: flexible risk analysis, contextual expertise, and expert contextual knowledge to identify windows for early action, while stressing that anticipatory interventions must be embedded within existing coordination, operational, and financing mechanisms.⁵⁴

In addition to these critical broader themes, our cross-study synthesis gleaned more practical insights from the research methods. Qualitative analyses across the case studies demonstrated that the impacts

of attacks on healthcare extend far beyond immediate physical damage to shaping health worker well-being, professional decision-making, and patterns of care-seeking over time, with highly varied impacts based on the context and health worker. Methodologically, semi-structured interviews grounded in participants' own descriptions of incidents helped reconstruct attack patterns in contexts where formal reporting was incomplete while strengthening participant trust and narrative depth. Purposive and snowball sampling, although not representative, proved essential for reaching high-risk or hard-to-access health worker populations, particularly when paired with strong local research partnerships that improved contextual interpretation and access. Integrating phenomenological and grounded theory approaches also enabled the studies to capture both lived experiences and cross-case conceptual patterns, which has expanded the evidence base. Future studies could build on this data with work with community members, and historical or longitudinal studies, as well as with interventional studies to direct better mitigation of these impacts.

Quantitative analyses across the country-studies demonstrated that attacks on healthcare are associated with measurable disruptions in service utilization, facility operations, and selected health outcomes, although effects varied across services, facilities, time, and contexts. From a methods perspective, the studies showed that attribution analysis is feasible only when sufficiently detailed incident and health service datasets are available, particularly through the creative adaptation of approaches such as interrupted time series and case-time series designs to conflict settings. Triangulation of multiple incident datasets and incorporation of proxy indicators—such as conflict-intensity measures or matched comparison facilities—proved essential for addressing confounders resulting from broader conflict dynamics. At the same time, the analyses highlighted persistent challenges, including limited data completeness, small sample sizes, and the difficulty of isolating the discrete effects of individual attacks, underscoring the need for improved prospective data systems and continued methodological innovation. Future work will require more systematic data collection and greater data sharing, alongside the development of predictive indicators and modeling approaches that can support anticipatory planning and mitigation of attack-related impacts.

Rapid assessments across the case studies demonstrated that attacks on healthcare can produce immediate, facility-level disruptions in service delivery that are often not captured in routine monitoring systems. The assessments showed the value of combining incident data with locally-available health service indicators to rapidly generate operationally-relevant findings, particularly when case selection is guided by documented attack patterns and conducted in partnership with in-country research institutions and operational agencies. Future work should test and refine these methods across different organizational settings and geographic contexts to ensure findings are operationally useful, alongside sustained collaboration with operational partners to evaluate which interventions are adopted, which prove effective, and how rapid assessment findings can best inform real-time decision-making.

8. Agenda for the Future

Our explorations into the impacts of attacks on healthcare have identified promising methodological approaches but also highlight substantial opportunities to expand and strengthen this field across research, operational, and policy domains. Drawing on our experiences across multiple conflict settings, we propose the following priorities for future work:

8.1. More systematic and prospective global data collection

- Harmonize data collection tools, definitions, and indicators across datasets and organizations to enable comparability, pooled analyses, and improved attribution studies, supported by sustained trust-building and long-term collaboration among partners.
- Support systematic, prospective data collection in affected countries, including real-time impact monitoring following attacks. Integration with existing health information systems (e.g., DHIS2) could reduce recall bias and allow more timely and consistent measurement of indicators over time.
- Strengthen collaboration and responsible data sharing among humanitarian, governmental, and research actors to build more robust and granular incident and health datasets while addressing operational concerns about data use and sharing.
- Develop actionable indicators of the right to health, including further operationalization of AAAQ-related utilization measures that can signal deterioration in access to care and guide early intervention.
- Link incident and impact monitoring more directly to operational decision-making through dashboards or analytical tools that inform protection planning and rapid resource allocation.
- Strengthen integration of rapid assessments with routine health information systems to support real-time operational decision-making.

8.2. Further topical research

- Expand economic analyses of attacks on health to quantify the financial burden on health systems, communities, and governments, strengthening the evidence base for advocacy and policy action.
- Advance focused analyses of gender dynamics and other intersecting vulnerabilities, recognizing that attacks affect health workers and populations differently across contexts.
- Investigate the drivers and motivations behind attacks on healthcare, using qualitative and quantitative approaches to better understand the strategic, political, and social dynamics shaping targeting decisions.
- Evaluate the pathways through which research and advocacy influence behavioral change among states and armed groups, identifying which forms of evidence, framing, and accountability processes are most effective in motivating protection of healthcare.
- Examine cumulative and reverberating system-level impacts of repeated attacks, including long-term degradation of infrastructure, workforce stability, and population health outcomes.

8.3. Strengthen inclusion and participation in research

- Broaden participant inclusion to incorporate perspectives of patients, community members, displaced populations, and informal health providers, complementing health worker–focused analyses.
- Promote meaningful participation and leadership of Ministries of Health and local research organizations, whose engagement provides critical contextual insight, strengthens data systems, and supports locally grounded ownership of research processes.
- Strengthen ethical and psychosocial research frameworks, including trauma-informed interviewing practices and locally appropriate referral pathways for participant support.
- Extend qualitative research to include patients, community members, and displaced populations to better capture system-wide and community-level impacts of attacks.
- Develop intervention-oriented qualitative research examining which mitigation and adaptation strategies that health systems and communities adopt are most effective.
- Establish sustained collaboration between researchers and operational agencies to track how rapid assessment findings are translated into interventions and to evaluate which response strategies prove most effective.

8.4. Methodological innovation

- Invest in representative surveys and field-based studies to better capture population-level impacts of attacks on health.
- Expand historical and archival documentation efforts to ensure systematic preservation of incident records for long-term historical, legal, and accountability research.
- Strengthen causal attribution methodologies, recognizing that isolating the discrete impacts of individual attacks remains challenging and requires innovation in causal inference designs, longitudinal data collection, and mixed-method attribution frameworks.
- Evaluate protection, mitigation, and community adaptation strategies, including facility-, system-, and community-level measures that reduce the impacts of attacks while preserving equitable access to care.
- Examine long-term health workforce consequences, including retention, migration, and training disruptions that shape long-term health system recovery.
- Strengthen the operational translation of impact data by developing tools that enable humanitarian actors and health authorities to adapt services rapidly following attacks.
- Enable cross-context comparative studies through greater harmonization of indicators and methodologies across conflicts.
- Develop predictive indicators and modeling approaches that can support anticipatory planning and targeted mitigation of attack-related impacts.
- Pilot and refine rapid assessment methodologies across diverse organizational contexts and geographic settings to expand operational research capabilities and opportunities.

Building on the growing body of work documenting and analyzing the impacts of attacks on healthcare, this expanded agenda aims to deepen and extend the evidence base to more directly inform protection strategies, resource allocation decisions, operational planning, and accountability mechanisms—ultimately strengthening efforts to safeguard healthcare in conflict settings.

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10.4. Contributions

RH drafted the manuscript, and led the editorial process. LF, KB, LR, SR, RR, CW, KC, BT, LL, and NK contributed to writing, critical review, and substantive editorial feedback. All authors read and approved the final manuscript.

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10.6. Ethics declarations

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10.7. Keywords

attacks on healthcare; violence against healthcare; health workers in conflict; health system impacts; protection of healthcare; international humanitarian law; researching the impact of attacks on health, qualitative methods, quantitative methods, rapid assessments, humanitarian health

11. ANNEX – SUMMARY OF CASE STUDIES

Location	Type of Study	Methods	Method Details/Sources	Publications
Afghanistan	Retrospective qualitative empirical study	Semi-structured key informant interviews	Key informant interviews and health utilization analysis	Interview guides available. Study publication pending
Central African Republic	Retrospective qualitative empirical study	Semi-structured key informant interviews	Purposive and snowball sampling; interviews with health authorities, frontline personnel, and NGO staff in three conflict-affected prefectures (2016–2020)	“It’s normal to be afraid”: attacks on healthcare in Ouaka, Haute-Kotto, and Vakaga prefectures of the Central African Republic, 2016–2020
Central African Republic	Quantitative analysis	Interrupted time series analysis	Statistical analysis quantifying impact of attacks on healthcare services, using attack data from primary and secondary sources, and health facility data on select indicators across primary and secondary curative services, sexual and reproductive health services, and vaccination	Healthcare under fire: quantifying the impact of violence on medical services in facilities supported by International Medical Corps in three prefectures of Central African Republic, 2016–2020
Colombia	Retrospective qualitative empirical study	Qualitative interview analysis	qualitative fieldwork (interviews and/or focus groups) with female health workers in three conflict-affected territories in Colombia, examining the impacts of attacks on them in the context of armed conflict	Impacts of attacks to female health care workers in three territories of Colombia
Colombia	Cross-sectional survey	Survey	Cross-sectional survey with closed and open-ended questions administered to health workers and community members across seven departments	“There is a fear that you will be attacked just for the act of working in health”: a survey of experiences of violence against healthcare in Colombia
Democratic Republic of Congo	Rapid assessment	Mixed-methods case study	Mixed quantitative and qualitative — interviews, focus groups, and health service utilization data analysis across three health zones in North and South Kivu; attack data sourced from the Insecurity Insight database and provincial health divisions	The impact of violence against health care on the health of children and mothers: A case study in three health zones in Eastern DRC
Global	Comparative analysis	Quantitative data analysis	Dataset comparison using descriptive statistics — the WHO and Insecurity Insight’s SiND datasets of publicly-reported attacks were compared event-by-event for 2017 across 47 countries to identify overlap and explain discrepancies	Underestimating attacks: comparing two sources of publicly-available data about attacks on health care in 2017
Global	Theoretical/conceptual review article	Qualitative analysis	Systematic literature review and conceptual analysis drawing on transnational advocacy literature, evidence-based decision-making research, and humanitarian governance scholarship to develop a framework for understanding how data influences change processes related to attacks on healthcare	Using Data to Create Change? Interrogating the Role of Data in Ending Attacks on Healthcare
Global	Systematic review	Systematic literature review (PRISMA methods)	Search of PubMed/Medline; 1,479 articles identified, 45 included; data extracted on geography, methodology, objectives and themes	Violence against healthcare in conflict: a systematic review of the literature and agenda for future research

Myanmar	Retrospective qualitative empirical study	Semi-structured remote interviews	Purposive and snowball sampling; 24 health workers affiliated with the Civil Disobedience Movement, interviewed remotely via encrypted app	"I will take part in the revolution with our people": a qualitative study of healthcare workers' experiences of violence and resistance after the 2021 Myanmar coup d'etat
Nepal	Retrospective qualitative empirical study	Interviews and literature review	Fieldwork-based; feminist qualitative research drawing on interviews and ethnographic methods with women who participated in the Maoist insurgency in Nepal (1996–2006)	Intimacy and the gendering of war healthcare: women's experiences of insurgency war in Nepal (1996–2006)
Nepal	Mixed-methods historical study	Oral history and descriptive analysis	Combines human rights datasets of violent incidents with systematic oral history — 80 interviews conducted in 2020–2021 across three regions of Nepal affected to varying degrees by the conflict, supplemented by analysis of quantitative health indicator data from the conflict period	"Like a Yam Between Two Stones": Remembering Healthcare at War in Nepal (1996–2006)
Syria	Retrospective qualitative empirical study	In-depth interviews	Purposive and snowball sampling of 40 health workers in northern Syria; framework method analysis	The cascading impacts of attacks on health in Syria: A qualitative study of health system and community impacts
Syria	Retrospective qualitative empirical study	In-depth interviews	Purposive sampling of health workers in northwest and northeast Syria; framework analysis	"Actually, the psychological wounds are more difficult than physical injuries:" a qualitative analysis of the impacts of attacks on health on the personal and professional lives of health workers in the Syrian conflict
Syria	Quantitative case time series	Case time series analysis	Statistical analysis of health facility attack data and service utilization data in Northwest Syria, 2017–2019	Quantifying the effects of attacks on health facilities on health service use in Northwest Syria: a case time series study from 2017 to 2019
Western Europe	Historical case study	Qualitative archival analysis	Primary source analysis (archival documents, personal diaries, memoirs, oral testimonies)	Caring Under Fire Across Three Continents: The Hadfield-Spears Ambulance, 1941–1945

