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Territorial control by non-state armed groups and gendered access to healthcare in conflict using a new complex adaptive systems framework

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The growing prevalence and influence of non-state armed groups (NSAGs) in armed conflict requires a deeper understanding of how their territorial control and contestation affect sub-national healthcare availability and outcomes, particularly with regards to gender dynamics. However, there are gaps in existing research in understanding how NSAG governance influences health care outcomes. Furthermore, a disconnect exists between the literature on international humanitarian interventions, NSAG governance and national health systems. Each perspective tends to prioritise a specific health service provider—whether NSAGs, State actors, or international humanitarian organisations—and often treats populations as homogenous. To address these gaps, we propose a complex adaptive system framework centred on the influence of territorial control for health services in intra-state conflict settings, with a gender lens. This systems framework accounts for the influence of all parties significant for health service delivery. It recognises that those governing the localised health system may differ from those physically delivering health services. Our framework enables empirical examination of health service delivery and outcomes. We apply the framework to three conflict-affected settings (Colombia, Iraq, Mali) using publicly available data and offer recommendations for policymakers and practitioners targeting health service provision in intra-state conflict contexts.

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Introduction

An accessible and equitable health system is necessary to protect the health and well-being of a population. It forms the basis of a healthy, peaceful and prosperous society. During and after intra-state conflict, an effective and functioning health system becomes even more pivotal as civilian lives are upended by warring groups and the State vying for control.

Non-state armed groups (NSAGs) increasingly shape global conflict patterns and affect the lives of civilians in areas under their control. Most armed conflicts today are intra-state and involve NSAGs fighting State forces or other NSAGs. While some of these groups have domestic objectives, such as a change in government, violent extremist groups with transnational ambitions are increasing in importance (Pettersson and Öberg, 2020). An estimated 150–160 million people live in areas controlled or contested by NSAGs (Rodenhäuser, 2020; Fidelis-Tzourou and Sjöberg, 2020; Herbet and Drevon, 2022). This includes high-intensity conflicts such as Somalia, Ethiopia and Nigeria (Davies, Pettersson, and Öberg, 2023; ACLED Armed Conflict Location Dataset, 2023).

NSAG territorial control is achieved primarily through violence. NSAGs typically gain control of hard-to-access areas where their military capabilities are to their advantage compared to government forces (Boulding, Kenneth 1962; Holtermann, 2016; Kalyvas, 2006). Where the balance of military capabilities is unclear, and parties battle for control—territories are contested leading to increased levels of violence (Humphreys and Weinstein, 2006). NSAGs and States can also assert territorial control through non-violent approaches, which can include limited provision of justice, social services and health services (Mampilly, 2015). The COVID-19 pandemic brought recognition to the role that some NSAGs play in life-saving health services provision (Herbet and Drevon, 2022). However, in settings such as Afghanistan, the pandemic response was hampered by the Taliban who, once in control of the entire country, prevented doctors from treating women without a male chaperone—effectively denying women from accessing health care (Nader and Amini, 2022). The full Taliban takeover of Afghanistan led to worsening health outcomes and increased levels of violence against women.

Existing health systems frameworks often overlook key factors related to NSAGs and their impact on healthcare access and outcomes, especially gender-specific outcomes. For example, the World Health Organisation (WHO) building blocks of the health systems framework delineate the essential components of a health system (World Health Organisation, 2010). However, there is limited comprehensive analysis of how localised violence and political dynamics influence healthcare availability, including for specific population segments. Most health research in conflict contexts examines healthcare availability from the perspective of international humanitarian interventions, including attacks against healthcare workers or infrastructure (Wise et al. 2021). However, a comprehensive understanding of health service provision during conflict requires systematic consideration of the specific influence of NSAG control and contestation. A 2015 review of 20 countries with NSAG territorial control found a significant gap in the literature on the impact of conflict on health services facilitated or impeded by NSAGs (Chatham House, 2015). In addition, the concept of 'war through welfare' remains underexplored (Williams, 2008). Furthermore, existing research rarely accounts for the impact of violence against women, which is common worldwide, especially in conflict settings (Warren et al. 2015). Growing evidence suggests that women may face a higher risk of intimate partner violence (IPV) compared to non-partner violence (NPV) in conflict settings. In addition, women exposed to IPV or NPV are also more likely to experience worse health outcomes than the general population and are more likely to seek health services (Hossain et al. 2020; Meinhart et al. 2021). Bridging research gaps is critical for the development of approaches which address the challenges posed by NSAGs, and the situation for women in conflict-affected settings.

With the growing prevalence and influence of NSAGs, there is an urgent need to understand how NSAG territorial control and contestation impacts sub-national healthcare availability and outcomes, and how this differs by gender. Notably, a research gap exists concerning the effects of rebel governance on healthcare outcomes (Loyle et al. 2023). In addition, there is a broader disconnect between the literature on international humanitarian interventions, rebel governance and national health systems as most health systems research does not focus on conflict-affected settings (Kruk et al. 2015; Saulnier et al. 2021). Each of these perspectives tends to prioritise a specific health service provider—humanitarian, State or NSAGs- while often treating populations as homogenous entities.

Our research aims to understand these gaps using a holistic, systems-level perspective while accounting for the dynamic, connected and adaptive nature of conflict, which is missing in existing research, using a complex adaptive systems (CAS) framework. CAS frameworks can be applied to understand social-ecological systems. CAS frameworks focus on the following properties: (1) contextual—how the system is influenced by the broader context; (2) open—how the system exchanges information or resources with its surroundings; (3) relational—how elements are interconnected and interactions are non-linear; (4) dynamic—how the system evolves over time; (5) adaptive—how the agents within the system can adapt their behaviours in response to changes in the system; and (6) emergent—how the overall behaviour of the system emerges from the collective actions and interactions of the individual elements and is not necessarily predictable from the individual components alone (Preiser et al. 2018).

We propose a novel CAS framework to address the research gaps in better understanding how NSAG governance affects health care in intra-state armed conflict settings. Our framework centres on the influence of territorial control and contestation by NSAG or State actors for health services, using a gender lens. The framework accounts for the influence of ALL parties significant for health service delivery in intra-state conflict contexts. Of first-order importance is who has influence or power over the localised health systems (i.e. who governs it—NSAGs, State, or contested). Of second order importance is who is physically delivering services, which could be NSAGs, the State, community providers, or international humanitarian organisations. In taking this systems approach, we bridge the largely siloed literature on international humanitarian law and health, rebel governance and health systems research. We use the key factors identified for our framework to model its effects using available empirical data. Rather than using a traditional causal analysis, we use a transdisciplinary approach to develop a CAS framework and analyse health service availability and outcomes in conflict-affected settings that feature territorial control dynamics. This analysis, grounded in complex adaptive systems theory, allows us to provide a more nuanced understanding of a dynamic and interconnected system. This enables us to identify underlying patterns, feedback loops and adaptive mechanism that influence health service provision and population health in these fragile contexts.

We aim to present an evidence-based CAS framework and recommendations which address how the dynamics of territorial control by NSAGs influence health service delivery in armed conflict settings. Our findings can inform decisions which strengthen the fulfilment of international humanitarian law (IHL)

protection by offering policymakers, donors, international organisations and practitioners a more nuanced, systems-level understanding of fragile and interconnected contexts.

Methods

We first present our framework highlighting territorial control as a key contextual factor for understanding sub-national variation in health service availability in conflict-affected settings. We developed this framework through a scoping literature review and quantitative analysis using a gender lens. We propose that territorial control reflects the relative military balance between the State and NSAGs, which, in turn, will set the conditions for domestic (State, NSAG, community) and international (humanitarian, development) healthcare providers. Next, we empirically model the framework using sub-national quantitative health service data in three conflict-affected settings. We explore differences and trends in health service data by sex and age, data permitting. Finally, our statistical modelling is triangulated with qualitative findings from the case country scoping literature review to further refine the framework. (See Annex 1 for detailed methodology).

We explored the questions:

(1) What approaches are used by NSAGs and States to gain and maintain territorial control?
(2) How does territorial control affect the mode of health service delivery and its availability? and
(3) What are the gendered implications of territorial control on health service availability and violence against women?

We used a parallel and iterative approach to examine literature across multiple disciplines (e.g., public health, conflict research, political science, humanitarian studies and development research). Areas highlighted in the World Health Organisation health system building blocks framework were used to frame our review. This included *approaches to health services* (e.g., policies, legislations and use of violence against health care providers), *service delivery and coverage* (e.g., actor providing service, type of service and conflict status) and *health financing and workforce* (e.g. approaches to financing and health services, actors involved).

Using these three concepts, a descriptive overview of our findings was created to examine healthcare within and between countries. In addition, a gender lens was applied across all themes to assess gaps and inequalities in health service access and availability that may affect short- and long-term health outcomes differently for women and men. We also sought to understand if NSAG and State actors considered provisions for gender responsiveness. Specifically, we examined how their respective approaches to healthcare provision addressed the differential health needs of women and men during and after conflict. An assessment of the implementation of these approaches was beyond the scope of this study and further research is required.

We identified relevant quantitative datasets on health service availability and use (i.e., comparable population-level data from Demographic and Health Surveys (DHS, 2024) and Multiple Indicator Cluster Surveys (MICs) (UNICEF, 2024) and sub-national-level administrative data on health services) for each case country. Finally, we used statistical modelling to identify associations between territorial control and healthcare provision by sex between 2000 and 2019 in three conflict-affected settings - Colombia, Iraq and Mali (see Annex 1 for the full list of dataset sources).

A complex adaptive systems framework. We developed and refined the framework with available quantitative and qualitative evidence to develop a complex adaptive systems (CAS) framework. CAS frameworks are useful for understanding non-linear relationships and are characterised by interconnected components and the adaptability of these elements in response to changing systems. The behaviour of a system is dependent upon interactions and feedback loops (Preiser et al. 2018; Borghi et al. 2022). This approach allows for the creation of a dynamic CAS, highlighting the importance of understanding relationships between different system components, past interactions, changes over time and the external environment.

Variable construction and definitions. To model the framework, we created quantitative datasets for each case country on health service availability and use (i.e., comparable population level data from Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICs), and sub-national-level administrative data on health services). We use available quantitative data to identify associations between territorial control and healthcare provision. Specifically, we examined (a) health services (availability, access, infrastructure, personnel and provider type) within select territorial control areas over time and (b) how country-level conflict parties (NSAGs or State) influenced health service availability within their areas of control.

1. *Country case selection, actor types and non-state armed group characteristics*
   Actors were categorised as (1) State, (2) Non-State Armed Group (NSAG), (3) international organisations, or (4) local/community-based organisations.
2. *Non-State Armed Groups*
   NSAGs were selected for our analysis if they controlled territory in their countries of operation. The specific NSAGs selected are from three conflict-affected countries: Fuerzas Armadas Revolucionarias de Colombia–Ejército del Pueblo (FARC) in Colombia; the Islamic State (IS) in Iraq; and a multitude of groups in Mali—al-Qaeda in the Islamic Maghreb (AQIM), Ansar Dine, the Coordination of Azawad Movements (CMA), Mouvement pour l'unité et le jihad en Afrique de l'Ouest (Movement for Unity and the Movement for Unity and Jihad in West Africa) (MUJAO), Jama'a Nusrat ul-Islam wa al-Muslimin (Support Group for Islam and Muslims) (JNIM), IS in Greater Sahara, and Katibat Macina. Colombia and Iraq were chosen to represent a post-conflict- and low-intensity conflict situation, and Mali continues to experience ongoing high-intensity conflict, featuring complex dynamics whereby NSAGs are marked by loose organisational structures and constantly changing group affiliations (Anders, 2020; Burchall Henningsen, 2021). (Additional details on NSAGs are provided in Annex 2).
   NSAGs are defined as '*formally organised opposition organisations*,' according to the Uppsala Conflict Data Programme. While NSAGs typically resort to criminal activity to fund their armed engagement (Clarke, 2015), this analysis excludes groups that operate as criminal gangs with no stated incompatibility. The NSAGs selected have all controlled territory to varying levels, with some exercising formal governance and others exercising informal de facto authority over different areas between 2000 and 2019.
   We selected dissimilar types of NSAG in terms of ideology (secular or religious), geographic origin (domestic or transnational) and aspirations (domestic or transnational). The NSAGs chosen are either largely motivated by political ideology (FARC in Colombia; some Mali NSAGs) or religious ideology (Islamic State in Iraq; jihadist groups/IS and Al Qaida affiliates in Mali). In Colombia and Iraq, we identified NSAGs with a significant influence in specific

geographic areas (FARC in Colombia and the Islamic State in Iraq). Mali, instead, represents a more fluid conflict situation with multiple groups and shifting alliances between domestic- and transnational armed groups.

3. *Territorial Control*
   A quantitative territorial control dataset was created for each case country classified by control status per region and calendar year. Control status of select regions was assigned to three categories: (a) State: State government control; (b) NSAG: non-state armed group with significant control, defined as control over most of the population or control over major cities; and (c) contested: State and NSAG presence but the criteria for NSAG control are not met.
   Territorial control status was determined through literature reviews, country expert assessments, and available but limited data on control. While detailed month-to-month information on control existed in some instances, datasets on health service availability and access were not detailed for a corresponding level/frequency of analysis.
   NSAGs often control only parts of a region, such as a major city, several cities, or a handful of municipalities. Since our analysis is focused on health-related outcomes or patterns characteristic of NSAG-controlled areas, this geographic scope is an important consideration. The available health data was only available at the regional level, rather than the local or municipal level. Therefore, if the NSAG's control did not extend to the majority of the region's population, key population centres, or strategic resources within a region, we classified the region as 'contested' rather than 'NSAG controlled'. This distinction is important as including regions with only partial NSAG control would skew our findings and ability to model the impacts of territorial control.
4. *Health services, health providers, health outcomes and violence*
   We first conducted a descriptive mapping of health services, their providers, access to services, and health outcomes disaggregated at the sub-national level.
   Health providers were identified seperately from the actors in control (NSAG or State), as the service provider may differ from the controlling actor. For example, under NSAG control, State-run health services may still operate. Alternatively, international humanitarian actors, community providers, or the NSAG itself may deliver the health services (Albert, 2022). Services may also be provided by a mix of actors. Our CAS framework does not presume *ex ante* the dominance of one health supplier but makes that subject to empirical examination.
   We included data on conflict-related violence, violence against women, the presence of humanitarian organisations, and availability of and access to health services that cater for the general population (e.g., number of hospital beds available, number of surgeries conducted), where available. Data on differences in access to and availability of health services by sex is limited. Therefore, we used proxy variables to assess the access of women and men to health services and health burden within regions over time and reviewed evaluations of gendered differences for healthcare within each country. In the quantitative analysis, we included data on sex differences in access to services where available, on the availability of sexual and reproductive health care and outcomes, and the prevalence of gender-based violence.
   The quantitative data analysis described trends in available services over time and areas of territorial control. A total of 75 data repositories were reviewed. The final analysis included data on health service indicators, and violence (conflict-related and violence against women) from 11 unique data sets covering the period 2000–19. The full list of variables and datasets included in the final analysis is presented in Annex 1. Relevant variables were generated as follows for the analysis.
5. *Outcomes*
   Health service type. Health services in conflict-affected settings range from the provision of trauma care, field hospitals, psychosocial care and reproductive and sexual healthcare to immunisation campaigns and structural programmes to strengthen the health system. To capture the range of services and interventions, we mapped any health-related service delivered by different actors (State, NSAG, humanitarian, local or community organisations).
   Health outcomes (women). At the regional level, we focused on women's sexual and reproductive health. We report on the impact of territorial control on women's fertility and child mortality. We report on women's sexual and reproductive health service access only. Regional-level data on men's reproductive and sexual health is rarely available for these countries.
6. *Predictor*
   Territorial control. A categorical measure was created to operationalise territorial control based on a significant body of conflict research. Variations in control status by year were assessed by collating country expert recommendations and literature reviews. The details of the territorial control and health data varied by country, region and time period. For territorial control, we had data at the sub-regional level, for large metropolitan areas or municipalities. We used information on month-by-month changes in territorial control at the municipality level in some cases (Iraq); or limited or rapidly changing territorial control information at the sub-regional level in others (Mali). However, health data was only available at the regional level with a yearly frequency. Thus, we used a combination of expert guidance and qualitative research to arrive at summaries of the territorial control data at the region-year level comparable with the health data. For each calendar year, we classify control over a region as either (a) State control (State government presence only and no NSAG control in the region); (b) NSAG control (any armed group controls territory hosting the majority of the region's population, or cities in the region that are either administratively or economically strategic); or (c) Contested (in addition to the State, there is an NSAG presence, but the criteria for NSAG control (in b) are not met).
7. *Controls*

Conflict intensity (conflict-related deaths). Our primary measure of conflict intensity is the best estimate of all conflict-related deaths recorded in the UCDP Georeferenced Event Dataset 20.1 created and maintained by the Uppsala Conflict Data Programme (UCDP) (Uppsala Conflict Data Programme and Department of Peace and Conflict Research, 2020). We also report on total civilian deaths for the descriptive overview. For both variables, we compute total deaths by calendar year in each region by adding the total number of fatalities reported by each variable for all locations included in each of our regions of interest.

Violence against women. Gender-based violence against women is common worldwide, especially in fragile and conflict settings. Women are at higher risk of intimate partner violence (IPV) than of non-partner violence (NPV) in conflict settings. Women exposed to IPV or NPV are also more likely to experience worse health outcomes compared to the general

population and are more likely to use health services. We report on past-year IPV (respondent experienced any sexual or physical violence from an intimate partner during the 12 months preceding the survey) and lifetime exposure to NPV (respondent ever experienced any physical violence from a non-partner) for all available years in each region. We include IPV as a control variable in our main specification because greater exposure to IPV and NPV has been shown to be generally associated with worse health outcomes and conflict. We also provide an alternative model specification with violence against women, IPV or NPV, as the outcome.

Geographical. The analysis was conducted separately for each country (Colombia, Iraq, Mali).

Variables excluded from the analysis: list and rationale for exclusion.

We were unable to investigate the impact of territorial control on different population sub-groups due to a lack of available data. For example, we were unable to investigate the impact of territorial control on men's health due to the lack of sex-disaggregated data. Some limited data was identified for Mali, but as it was measured inconsistently across waves, we were unable to include it in the analysis. We were also limited in the health outcomes we could include—for example, although abortion was identified as an essential and critical service for women in humanitarian settings (Radhakrishnan, Sarver, and Shubin, 2017), it could not be included as a health outcome in our analysis due to a lack of data. Other variables excluded due to a lack of data were the percentage of the population who accessed services (community and tertiary healthcare), barriers to healthcare (Mali), and the number of primary healthcare centres and hospitals (Iraq).

Quantitative analysis

Descriptive overview. We first examined trends in health outcomes and access to health services across regions and years, plotting them against changes in territorial control. This visual analysis, including years preceding periods of active conflict, highlights correlations between health trends and territorial control shifts.

We also reported yearly total and civilian-only conflict-related deaths from 1990 to 2019 in each region. We plot death counts alongside territorial control phases to identify shared patterns between conflict intensity (death counts) and territorial control.

Regression model. We estimated the association between territorial control (predictor) and health services access and health outcomes (outcomes) with a generalised least squares estimator. Controlling for violence levels (number of conflict-related deaths and violence against women), secular trends (year dummies) and geographical disparities (regional level dummies), the model used pooled cross-section data.

We report the direction and statistical significance of the association between each set of outcomes and territorial control holding all other things constant, with associations at the 95% or 99% statistical significance level. We also examine associations with control variables, to synthesise geographical disparities and secular trends in health, as well as its relationship with violence.

Gender analysis. Limited sex-disaggregated data restricted our ability to assess diverse sub-group needs. We included variables related to reproductive health and violence against women which allowed us to focus on women's specific needs. Similar data was not available for men for the regions and years required.

Results

A complex adaptive systems framework on territorial control and health. We developed a complex adaptive systems (CAS) framework to highlight how policy and programming responses can be systematically targeted in settings affected by intra-state conflict (Fig. 1). The model has been simplified to highlight the mechanisms explored in this paper.

Territorial control. The starting point for the framework is the influence of territorial control. It highlights the role of NSAGs and the State military in shaping the context that health actors—international, national and local—encounter as they directly deliver or indirectly support health services.

Territorial control is defined by the balance of military capabilities (Albert, 2022). Relative military capabilities explain why NSAGs typically control territory in remote or difficult-to-access areas such as border zones, mountains, or forests, where they can gain a localised advantage in relation to State military forces. The balance may be affected by weak State military capacity or the choice by a conflict party not to exercise its military capability in full (ICRC, 2010). The focus on relative military strength makes the framework applicable to different kinds of intra-state conflict (ethnic, ideological, etc). When an NSAG is not strong enough militarily to engage in direct confrontation with the State or another NSAG—it will engage in asymmetric warfare employing guerrilla or terrorist tactics. However, an NSAG that is militarily strong in relation to State forces can engage in conventional war through direct confrontation. This type of group can capture territory and control what occurs there (Kalyvas and Balcells, 2010).

Territorial control and violence are intimately interlinked. Overall, actors that are not in full control of the territory perpetrate more indiscriminate violence against civilians, and vice versa (Stewart and Liou, 2017; Kalyvas and Kocher, 2009). In *contested territory*—where the balance of military capabilities is unclear and parties battle for control—higher levels of violence are expected.(Humphreys and Weinstein, 2006) Control is considered a prerequisite for establishing a stable, non-violent political order including the provision of public goods (Stewart, 2018).

The degree of territorial control can be visualised as a spectrum. At one end, the NSAG is in full control and runs a parallel State—marked by visible NSAG presence, defined boundaries and no or limited violence. Short of full territorial control, the NSAG may be in *de facto* control but not visibly engaged in governance (Revkin, 2018; Albert, 2022). Thereafter, increasing levels of contestation follow. Most violence occurs in the highly contested areas—the theatre of war. At the other end of the spectrum, the State is in full control and violence is expected to be largely absent (Stewart and Liou, 2017).

Non-coercive approaches—including the delivery of health services—can be used to win legitimacy among civilian residents of a territory (Hoelscher, Miklian, and Nygård, 2017). 'Hearts and minds' campaigns build on this premise. In sum, the approach to gaining and maintaining control ranges from violence and coercion to non-violent measures including health service provision (Lilja, 2009).

The combined effect of State and NSAG approaches to territorial control (violent and non-violent) will influence which health service providers are allowed to operate in a given geographical area (i.e., State, NSAG, international, local or community providers), types of services provided, the modalities of their delivery, and the availability services—including gender-specific services.

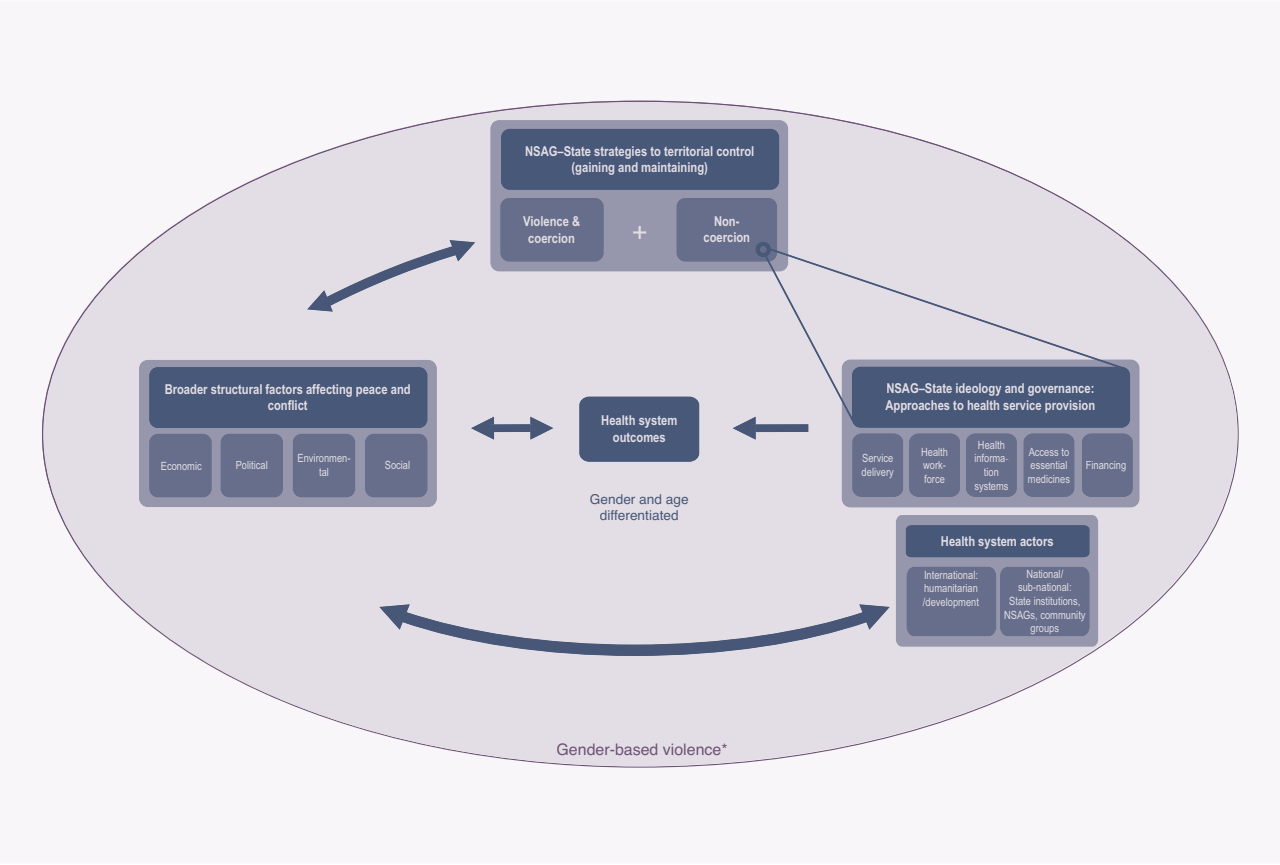

Fig. 1 Complex adaptive systems model: Influence of Non-State Armed Group and State Territorial Control on Health and Peace. *Reflected in Structural factors (e.g. political ideology, harmful social norms); NSAG-State approaches to territorial control and health systems governance; and other interpersonal violence (e.g. partner- and family violence).

Ideology, including norms around gender, affects how NSAGs or States govern their (local or national) health systems, shaping what and how health services are provided for women and girls which ultimately results in gender-differentiated health outcomes (Wood, 2009; Ruiz Austria, 2004). Gender-restrictive norms have been shown to negatively affect women's and girls' health outcomes and limit their access to services (Clark and Horton, 2019; Percival et al. 2018; Heise et al. 2019). In addition, global evidence has shown that intimate partner violence against women negatively impacts health outcomes and increases health service use. Research from conflict settings has found that women and girls experience increased levels of violence from within the family or community alongside conflict-related violence. However, there is limited research on how territorial control may influence levels of violence against women or health service use, thereby limiting targeted policies and programming.

Using this as a starting point, we explore two approaches—violent and non-violent—for gaining and maintaining territorial control. We also explore the use of available health service data to understand how these approaches combined can affect health services for women and men (Fig. 2).

What approaches are used to gain and maintain territorial control?. Territorial control is *gained* using violence. As hypothesised, *changes* in territorial control were linked to increased use of conflict-violence, evidenced by rising conflict-violence intensity, across all settings. Conflict-related deaths were the highest where territory was contested and immediately before a shift in territorial control. The extent of NSAG territorial control varies across the three countries. In Iraq, the Islamic State (IS) controlled Mosul, the most important part of the Ninawa region, between June 2014 and September 2016 (Michlig et al. 2019; Hummel, 2016). In Colombia, FARC controlled some areas of the Meta and Caquetá provinces in 1998–2002, thus exercising partial regional control but, for the most part, only held *de facto* control (Relief Web, 2002; Marks, 2002). In Mali, NSAGs briefly controlled some major cities in 2012–2013 before they were forced to disperse (Crisis Group, 2017). The State controlled the capital city in all three countries.

However, *maintaining* territorial control is done through a mixture of violence and non-violent service provision, including health service provision. Military considerations shaped NSAG approaches in Iraq and Colombia, prompting them to systematically "manage" or "oversee" health providers, including by coercion. The inability of NSAGs to attain full territorial control in Mali may explain why they were not able to focus on (non-violent) service provision. NSAGs used violence against health workers in all three countries. In IS-controlled areas of Iraq, IS selectively killed medical personnel who did not prioritise IS fighters, or who did not follow sharia (Al-Kindi, 2014). In Colombia, reports identify FARC as stopping ambulances and shooting patients, suggesting deliberate targeting of healthcare provision (Crawford et al. 2023; Taylor, 2022). In Mali, NSAGs attacked government and NGO health workers (The Safeguarding Health in Conflict Coalition, 2020).

Legitimacy concerns informed NSAG and State approaches to health provision. In all countries, the State provided health services during periods of violent contestation, and in the months immediately after NSAGs seized full control of an area. In Iraq, the central government paid healthcare workers' salaries in IS-

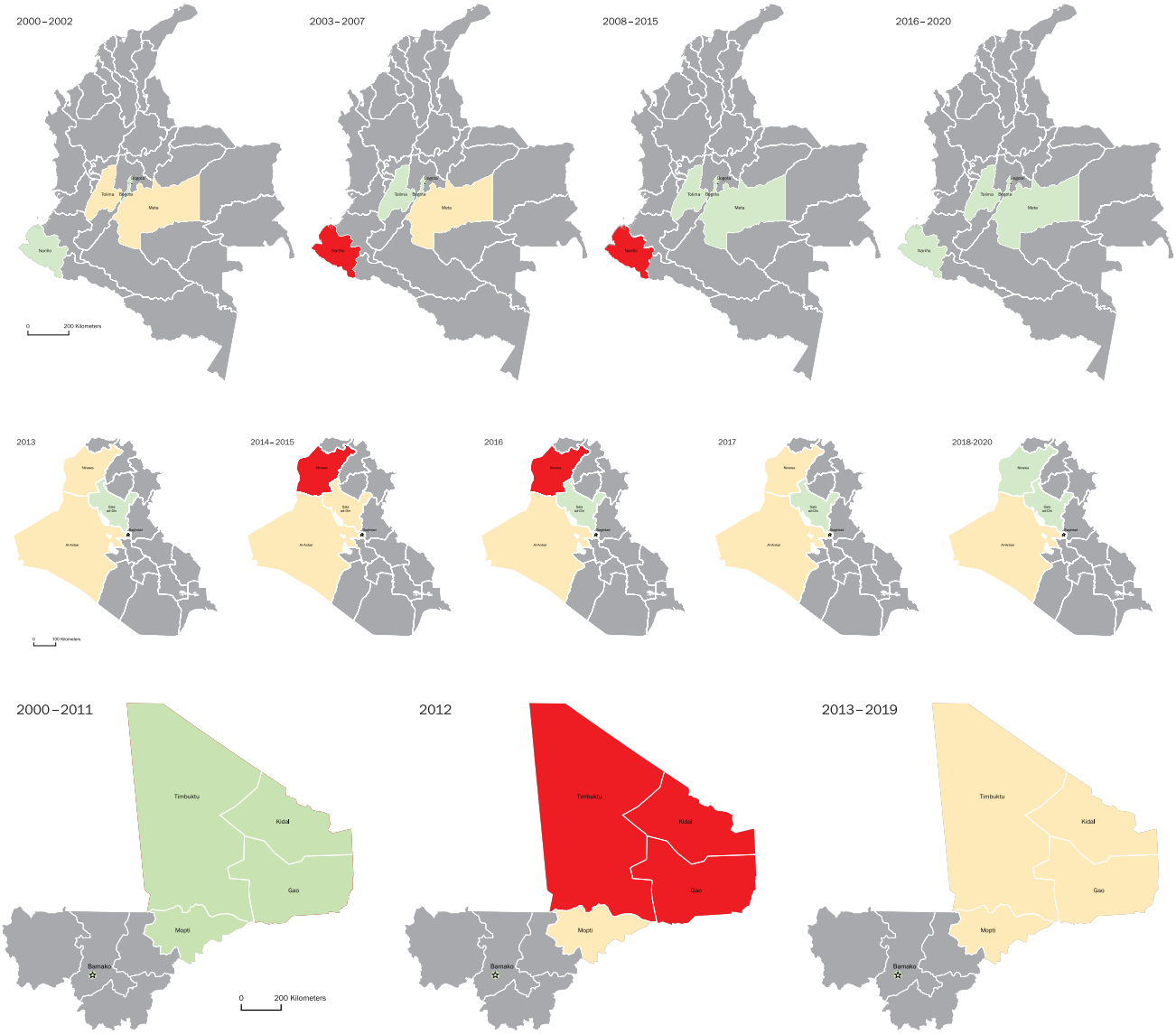

Fig. 2 Territorial control: Maps for Colombia, Iraq and Mali, 2000–2019. *Green* represents State government presence only and no significant NSAG control for each calendar year considered; *Red* represents NSAG control where any non-state armed group has significant control, defined as control over most of the population or control over major cities in the region for each calendar year considered; and *Orange* represents a contested territory with State and NSAG presence, but the criteria for NSAG control are not met. **COLOMBIA**: Map showing territorial control status for Meta, Tolima, Nariño and Bogota (Colombia), 2000–2019. **IRAQ**: Map showing territorial control status for Al-Anbar, Ninawa, Sala ad-Din and Baghdad (Iraq), 2013–2019. **MALI**: Map showing territorial control status for Timbuktu, Kidal, Gao and Bamako (Mali), 2000–2019. (Map figure credit: Hugo Ahlenius, Nordpil 2021).

seized areas for the first 12 months. Thereafter, military aims took precedence as the Iraqi government stopped paying for health workers and electricity access (Michlig et al. 2019; Al Hilfi, Lafta, and Burnham, 2013; Norway: Landinfo - Country of Origin Information Centre, 2015), and cut off supply routes for the delivery of health supplies and medicine to IS-territories (Svoboda and Redvers, 2014). Although IS permitted access to international non-governmental organisations (INGOs), IS often claimed credit for their health work (Svoboda and Redvers, 2014). In Colombia, the State continued to pay for municipal health services throughout the conflict (Bernal et al. 2024).

Pre-existing poverty and geographic inequities in State-provided health services limited opportunities for NSAGs to instrumentalize health care provision. In Colombia, many NSAG-controlled territories were remote and rural areas that lacked services before and after the conflict. For example, following the 2016 peace agreement, ex-FARC females faced continuing challenges accessing sexual and reproductive health services and other resources due to their location (Bernal et al. 2024; Reynolds et al. 2021). In Iraq, the pre-war provision of services outside the capital was variable, with the majority of health professionals and hospital beds concentrated in Baghdad (Jaff, Leatherman, and Tomaro, 2019; Al Hilfi, Lafta, and Burnham, 2013). In Mali, which faced extreme poverty rates, the limited provision of services by the State outside Bamako left a vacuum for others to fill (Grosse Frie et al. 2019). In 2019, only 57% of the population lived within 5 km of a health centre, compared to 93% in Bamako (Grosse Frie et al. 2019). While healthcare availability improved over time in all three countries, geographic and gendered inequities persisted. (Table 1)

How does NSAG territorial control affect health services?. In *full* territorial control, IS in Iraq sought to establish a parallel state which included access to health services. The IS approach to

Table 1 Literature review summary of healthcare provision by country and actor.

Type of actor	Colombia	Iraq	Mali
Approaches to healthcare provision			
State	• National policies focus on various health issues including women's health, violence, mental health, disease prevention. • After the peace process in 2012, state provision improved.	• National plans for universal health care and decentralisation but gaps in mental health and gender-specific policies and funding. • Delivery of healthcare supplies to ISIS-controlled areas prevented.	• National policies focus on decentralisation, community engagement, gender equality and services for women and children. • Community health worker programme established in 2009.
Gender-specific	• Gender mainstreaming policies established through civil society engagement. VAW prevention and justice legislation introduced.	• Limited policies and funding for gender-specific issues. Over 1 million female widows with caring responsibilities, limited education and lack of employment.	• Ministry for the Promotion of Women, Children and the Family established in 1997. • 2015 Peace agreement neglected women's priorities.
NSAGs	• No parallel state. FARC filled in gaps in health-related services, especially in rural and remote areas through rural health brigades. • FARC's unofficial health strategy is based on political and military interests, with limited access to external providers. • Infiltrated community groups to ensure work-supported ideology.	• Attempts to create a parallel state and control healthcare under strict morality laws. • Violence and intimidation targeted healthcare workers who did not prioritise ISIS fighters. • Limited access to outside organisations.• Taxed health workers' salaries to fund the war economy.	• Ongoing conflict in 2019. No parallel state was established. • Facilitated access to external providers to fill health service gaps. • Government health workers and NGO staff targeted by some NSAGs. • Violence against healthcare workers and obstruction of services in 2019, primarily motivated by maternal gain.
Gender-specific	• Predominantly harmful gender-specific approaches used, including direct attacks and intimidation against midwives and women leaders in rural communities disrupting local social networks.	• Contraception banned to increase population. • Establishment of gender-segregated women's divisions.	• None identified.
Humanitarian organisations	• Mediated relationships between state providers and NSAGs. • Provided primary care and trauma services in conflict-affected areas.	• Collaborative approach with limited access to work with communities and local groups. • Worked with the military during contested period.	• Adopted local strategies to partner with NSAGs and State military for access/security support. • Coordination between actors crucial for access to conflict regions and supporting government structures. • Neutrality/non-discrimination policy.
Gender-specific	• Implemented projects to improve women's access to services. • Conducted training for men on new masculinities.	• Prioritised filling service gaps not provided by the State: trauma care, reproductive health, maternal and child health, mental health, gender-based violence services.	• Prioritised filling service gaps not provided by the State: trauma care, reproductive health, maternal and child health, mental health, gender-based violence services.
Community Groups	• Focus on social projects in rural areas. • Financed/influenced by FARC during the conflict	• Community volunteers worked with INGOs/NNGOs to address local gaps in services.	• Religious and community leaders in Timbuktu took over administration after the State left. • Jihadists partnered with humanitarian and NSAGs to ensure the functioning of hospitals, including the provision of electricity and fuel.
Gender-specific	• None identified.	• None identified.	• None identified.
Health services			
State	• Limited health services in rural areas. • Inadequate operational capacity in 3 large rural departments controlled by FARC and prioritised by the National Rural Health Plan.	• Health services limited outside of capital, associated with geographic and economic inequalities. • Arrival of ISIS in 2014–2017 led to collapse of the health system. • Women displaced by conflict lacked access to health services. • Medicine/medical equipment deliveries were irregular due to insecurity, shortages of electricity and fuel, and supply route disruptions to areas controlled by ISIS.	• Health services limited in conflict-affected regions with 57% having access within 5 km compared to 93% in the capital in 2019. • Community health centres are the main providers of services in contested areas.
NSAGs	• FARC operated mobile clinics in remote/rural areas lacking services in 2002. • Post-conflict, 98% of former combatants affiliated with the public health system, but access was limited to emergency health care.	• Limited service availability in 2014–2017. Private clinics closed due to a lack of supplies, pharmacies were unaffordable, and infrastructure was destroyed.	• Limited services provided by State, humanitarian, local /community groups with some NSAGs providing direct services in some regions.

Table 1 (continued)

Type of actor	Colombia	Iraq	Mali
Gender-specific	• Female ex-combatants faced additional challenges accessing care. • FARC used reproductive violence against female combatants. Approximately 45% faced sexual abuse, forced use of contraception, abortion. • Forced recruitment of girls and boys.	• Limited access to contraception.	• Limited access to contraception.
Humanitarian organisations	• Targeted gaps in conflict-affected areas, especially for displaced populations. • UN intervention focused on human right empowerment, humanitarian assistance. • INGOs prioritised mental health, Gender-based violence, contraception, mobile clinics, health facilities.	• Focused on northern regions, addressed service gaps. • International aid distributed through local counterparts and individuals with good relations with IS. • Humanitarian services focused on IDPs. • During contested periods, addressed gaps through field hospitals, primary and secondary care,	• Addressed gaps in health services, especially in the north. • Prioritisation of sexual reproductive health, family planning, maternal child health, HIV, nutrition, malaria, mental health and gender-based violence. • Supported community groups, including payments for community health workers and care for displaced populations.
Gender-specific	• Provided GBV support, contraception.	• Provided GBV support.	• Improvements in maternal mortality since 2013 may be associated with focus on vulnerable populations in conflict-affected regions.
Community groups	• None identified.	• Volunteers established field hospitals, collected dead bodies, treated patients in secret. • Collaborated with external actors to provide targeted, localised small-scale services.	• Collaborated with external INGOs to facilitate service delivery, support, hospital functioning.
Health workforce and financing approaches			
State	• Paid costs of municipal health services/ staff during conflict. • Limited resources to finance policy priorities.	• Paid healthcare workers salaries but irregularly, leading to strikes. • Baghdad received increasing health budget allocation between 2009–2010. • Majority of public sector health workforce working in private sector due to irregular salaries from government in 2019. Iraqis more vulnerable to poverty due to health expenditures.	• Health sector heavily reliant on foreign donors, limiting the government's ability to maintain a stable health system. • Sharp fall in health financing during the 2010–2019 crisis but State resources increased from 34% to 70% in 2013–2014. • Health sector expenditure was 4% of GDP in 2017. Corruption, misappropriation of funds, limited resources cited as main reasons for weak health system.
NSAGs	• FARC budgeted for health services for members in 1993 and funded social services under its supervision. • FARC relied on State funding for health services. • Illicit economies such as drug trafficking / illegal mining supported public service provision where State was not able to provide. • Outreach programmes (i.e., vaccination teams comprised of women) were prevented from entering conflict-affected communities. • 40% of attacks on health teams affected women and children, especially in rural and Afro-Colombian women.	• No dedicated funding for health care; health care in Mosul heavily reliant on state and external funding. • Oil revenues for ISIS interdicted, reducing available funding. • Salaries of healthcare workers taken to fund NSAG activities. Health system collapsed after State stopped payments, international health workers killed.	• Corruption reports from donor funds.
Humanitarian organisations	• None identified.	• None identified.	• UNFPA largest actor in Mali, total spending of USD 5,505,032 compared to other NGOs (USD 1,891,869) and the Malian government (USD 443,494) in 2019.
Community Groups	• Limited funding from FARC who infiltrated community groups. • Midwives, traditional healers, health promoters filled health service gaps in rural areas facing conflict violence.	• None identified.	• Volunteers or limited support from INGOs.

Summary of the scoping literature review by health system areas examined. The table presents a summary by Type of Actor and Country. A detailed table with associated references is included in Annex 3. General and gender-specific approaches are noted.

health service provision was ideologically driven—available only to IS supporters and with limited access for women and girls (Bedolla and Bedolla, 2016). IS relied on State-funded health workers who were killed if they did not prioritise IS fighters or violated IS-interpreted Sharia laws (Michlig et al. 2019; Al-Kindi, 2014; The Safeguarding Health in Conflict Coalition, 2020). Medics could only treat patients of the same sex while female medics were restricted to working only daytime hours with covered eyes and hands. IS also imposed additional regressive health policies for women, such as banning contraception (Michlig et al. 2019; Lafta, Cetorelli, and Burnham, 2019). International and community providers were allowed to operate in the area only if IS could control their actions (Hummel, 2016).

The partial or *de facto* territorial control held by FARC in Colombia translated into an unofficial health strategy which combined political and military objectives. FARC engaged in comprehensive health system planning and deployed rural health brigades (Ramos Jaraba et al. 2020; Benavides, 2018). They ran mobile clinics for surgeries and vaccinations and provided some training for medics in remote communities (Benavides, 2018). However, FARC was most often reported as supervising services provided by external providers (Phelan, 2021).

Full or partial NSAG control thus implied restricted and 'managed' international and national health actors. In some places, IS in Iraq did not permit INGOs to directly provide services but allowed them to sub-contract community groups that were more easily controlled by IS (Hummel, 2016). Similarly, FARC largely 'managed' or oversaw other healthcare providers by granting limited access to international health actors, or infiltrating community groups (Jaff, Leatherman, and Tomaro, 2019; Phelan, 2021; Urrego-Mendoza, 2015). According to reports, FARC directly attacked and intimidated community workers and midwives in rural communities (Urrego-Mendoza, 2015).

In highly contested areas with significant health service gaps, NSAGs did not develop systematic approaches to health service delivery. This was the case for NSAGs in Mali (Michlig et al. 2019). NSAGs would selectively allow or prohibit health provision by community-based or international organisations, although there were some exceptions. For example, Jihadist NSAGs in 2012 joined other actors, including an international aid organisation, in managing Timbuktu city's hospital facility in Mali (Lackenbauer, Lindell, and Ingerstad, 2015; Walch, 2018). However, Jihadists were ousted from cities around 2015 forcing them to regroup in rural areas (Crisis Group, 2017). Some reports suggest that Jihadist NSAGs established gendered forms of governance by restricting women's mobility and imposing supervision by male relatives (Lackenbauer, Lindell, and Ingerstad, 2015).

Community or local organisations often stepped in to fill service gaps in NSAG-controlled or contested areas across the three countries either by volunteering or by forming relationships with international organisations. In Iraq, community groups worked with international actors to provide small-scale local services (Svoboda and Redvers, 2014). Volunteers set up field hospitals and collected dead bodies while medics treated patients in secret (Haiges, 2018; Garber et al. 2020; Quinn V, Amouri, and Reed, 2018). In Colombia, community and local NGOs provided services overseen by FARC (Urrego-Mendoza, 2015). In Mali, community groups addressed local needs in the absence of the State by working directly with international health organisations (Marin, 2017).

International aid plays an important role in promoting women and child health services. This was notable in NSAG-controlled northern Mali where State-provided health services were extremely limited. International actors negotiated access with NSAGs to partner with community- and civil-society organisations to provide trauma, mental health, reproductive and sexual health and child healthcare services.

What are the gendered implications of territorial control on health service availability and violence against women?. Under full NSAG control in Iraq, there was an associated reduction in service access which was notable among services targeted for women. Decreases were recorded in women's access to health services for recent illness or injury (−0.1, 95% CI −0.2 to −0.01) and chronic illness or disability (−0.2, 95% CI −0.3 to −0.1), compared to State control. We found regional disparities across all health outcomes. The provinces of Ninawa, Sala ad-Din and Al-Anbar record worse health outcomes and health access indicators than the government-held capital, Baghdad. Only in Al-Anbar is the use of 'contraception methods requiring support from a medical professional' higher than in Baghdad, all other things equal. Following the defeat of IS in 2017, women's access to sexual and reproductive healthcare appears stable and improved compared to NSAG-controlled periods.

Identification of who had territorial control is not always easily disaggregated. Colombia offers one such example. Colombia represents a setting with variable levels of regionally concentrated NSAG control. We found health service use increases in contested areas across 11 out of 13 health service domains and decreases only for six compared to State-controlled areas. Contested areas record increases in most sexual and reproductive health service access, though hospital-based deliveries are an exception (−19, 95% CI −27 to −10). There was also an increase in other services including surgeries performed (163, 95% CI 13 to 314), lab exams (5057, 95% CI 3799–6316) and total medical consultations (8826, 95% CI 5618–12034). However, they record a decrease in the number of days of intensive or intermediate care, similar to NSAG-controlled areas. These areas record larger decreases in intensive care stay days (−160, 95% CI −200 to −119 vs. −92, 95% CI −129 to −54). Access to women's health services was reduced in NSAG-controlled areas which record decreases in access to sexual and reproductive healthcare, with fewer nurse-led antenatal care community visits (−1084, 95% CI −1853 to −316), obstetric and gynaecological discharges (−54, 95% CI −81 to −26) and cervical smears taken (−291, 95% CI −386 to −197). We found an increase in antenatal care access and delivery by health professionals in both NSAG-controlled and contested areas ($p < 0.00$), compared to state-controlled settings. Increases in conflict intensity correlated with an increase in intensive and intermediate care days ($p < 0.001$) and a decrease in the use of other services including medical consultations ($p < 0.001$). Time trends suggest the duration of hospital stays and ANC nurse visits in the community increased overall as conflict violence escalates. ANC nurse visits decreased sharply in 2016, the year of the peace agreement, all other things being equal (Table 2).

In contested settings marked by pre-existing poverty and significant health service gaps such as Mali, the smaller number of healthcare workers alone is sufficient to explain the higher service availability in State-controlled areas. Access to reproductive healthcare is lower across all NSAG contested regions compared to the capital Bamako. Over time, the number of healthcare workers and public hospitals increases, while the number of community health centres decreases (not shown). Increased conflict intensity does not have a sizeable impact on reproductive health indicators. However, NSAG-controlled areas record a decrease in health facility deliveries (−0.1, 95% CI −0.1 to −0.02). Contested regions report higher antenatal care levels (0.11, 95% CI 0.01 to 0.22) and more frequent deliveries by professionals compared to state-controlled areas (Table 2).

Table 2 Country-level regression analysis (Colombia, Mali, Iraq).

Variable	Territorial control (reference category: State control)				Violence (Conflict deaths/intimate partner violence (IPV))				Base case	
	NSAG	95% CI	Contested	95% CI	Conflict deaths	95% CI	IPV	95% CI	Intercept	95% CI
Colombia										
Table 2a Colombia: Health resources use										
Cervicovaginal smears taken	−291.1	−385.5 to −196.7	412.7	324.3 to 501.0	0.0	−1.2 to 1.3	251.5	−14.5 to 517.5	185.5	121.3 to 249.6
P-value	0.000		0.000		0.967		0.064		0.000	
Laboratory exams	−7745.6	−9090.4 to −6400.8	5057.0	3798.5 to 6315.5	−28.2	−46.3 to −10.2	8862.0	5073.6 to 12650.5	4964.8	4051.2 to 5878.4
P-value	0.000		0.000		0.002		0.000		0.000	
Number of diagnostic images taken	−390.6	−904.0 to 122.8	758.8	278.4 to 1239.3	−10.3	−17.1 to −3.4	898.7	−547.5 to 2345.0	764.7	415.9 to 1113.5
P-value	0.136		0.002		0.003		0.223		0.000	
Elective general medicine consultations performed	2249.6	703.6 to 3795.6	5394.3	3947.4 to 6841.1	−54.7	−75.4 to −34.0	7434.2	3078.7 to 11789.6	1602.9	552.5 to 2653.2
P-value	0.004		0.000		0.000		0.001		0.003	
Urgent general medicine consultations made	−158.3	−1642.1 to 1325.5	2326.8	938.1 to 3715.4	−31.2	−51.1 to −11.3	1738.3	−2441.9 to 5918.5	1299.6	291.5 to 2307.6
P-value	0.834		0.001		0.002		0.415		0.012	
Elective speciality medicine consultations performed	125.1	−556.8 to 807.0	1206.8	568.6 to 1845.0	−15.6	−24.7 to −6.4	3204.3	1283.2 to 5125.5	1045.4	582.1 to 1508.7
P-value	0.719		0.000		0.001		0.001		0.000	
Total consultations	1560.5	−1867.4 to 4988.4	8826.1	5618.1 to 12034.1	−95.2	−141.2 to −49.3	13055.1	3398.0 to 22712.2	3682.5	1353.6 to 6011.3
P-value	0.372		0.000		0.000		0.008		0.002	
Nurses ANC, growth and development	−1084.2	−1852.5 to −315.8	822.5	103.5 to 1541.6	8.8	−1.5 to 19.1	−62.0	−2226.6 to 2102.5	436.8	−85.2 to 958.8
P-value	0.006		0.025		0.094		0.955		0.101	
Vaginal deliveries	1.9	−4.2 to 8.0	−20.4	−26.1 to −14.6	0.1	0.1 to 0.2	22.1	4.9 to 39.3	38.2	34.0 to 42.3
P-value	0.550		0.000		0.001		0.012		0.000	
Caesarean deliveries	−4.8	−9.8 to 0.2	1.6	−3.1 to 6.2	−0.0	−0.1 to 0.0	13.9	−0.2 to 28.0	13.5	10.1 to 16.9
P-value	0.058		0.516		0.362		0.054		0.000	
Total deliveries	−3.0	−12.0 to 6.1	−18.8	−27.3 to −10.3	0.1	−0.0 to 0.2	36.0	10.4 to 61.5	51.7	45.5 to 57.8
P-value	0.519		0.000		0.094		0.006		0.000	
Total discharges	26.0	−311.4 to 363.4	297.7	−18.0 to 613.5	−5.9	−10.4 to −1.4	398.2	−552.2 to 1348.7	316.2	87.0 to 545.4
P-value	0.880		0.065		0.011		0.412		0.007	
Obstetric discharges	−9.8	−30.7 to 11.1	28.0	8.4 to 47.6	−0.2	−0.5 to 0.0	34.8	−24.1 to 93.8	74.8	60.6 to 89.0
P-value	0.360		0.005		0.097		0.246		0.000	
Total days spent (discharged patients)	−389.9	−994.3 to 214.6	233.1	−332.6 to 798.8	−10.6	−18.7 to −2.5	2305.8	602.9 to 4008.7	817.4	406.7 to 1228.0
P-value	0.206		0.419		0.010		0.008		0.000	
Stay days of obstetric discharges	−53.6	−81.4 to −25.7	7.3	−18.8 to 33.4	−0.2	−0.6 to 0.2	51.8	−26.8 to 130.4	120.5	101.6 to 139.5
P-value	0.000		0.584		0.250		0.196		0.000	
Stay days of surgical discharges	−87.0	−198.5 to 24.5	53.4	−50.9 to 157.8	−1.5	−3.0 to 0.0	283.8	−30.3 to 597.9	140.1	64.4 to 215.9
P-value	0.126		0.316		0.055		0.077		0.000	
Stay days of non-surgical discharges (excluding mental health, deliveries)	−211.5	−806.0 to 382.9	−7.7	−564.0 to 548.7	−7.6	−15.6 to 0.4	1917.0	242.2 to 3591.7	294.3	−109.6 to 698.2
P-value	0.486		0.978		0.062		0.025		0.153	
Patients in Intermediate Care	−14.5	−17.1 to −11.8	−16.4	−18.9 to −14.0	0.1	0.1 to 0.1	11.0	3.5 to 18.4	3.4	1.6 to 5.2
P-value	0.000		0.000		0.000		0.004		0.000	
Intermediate care stay days.	−56.6	−78.3 to −34.9	−75.4	−95.7 to −55.1	0.6	0.3 to 0.9	−2.9	−64.0 to 58.2	18.6	3.9 to 33.3
P-value	0.000		0.000		0.000		0.926		0.013	
Intensive care stay days	−159.5	−199.6 to −119.4	−91.9	−129.4 to −54.4	1.4	0.9 to 1.9	117.8	4.8 to 230.8	−2.6	−29.9 to 24.6
P-value	0.000		0.000		0.000		0.041		0.849	
Total occupied bed days	−79.0	−462.7 to 304.8	712.2	353.0 to 1071.3	−9.9	−15.1 to −4.8	1721.8	640.7 to 2802.8	963.6	702.9 to 1224.3
P-value	0.687		0.000		0.000		0.002		0.000	
Total bed days available	−342.1	−730.2 to 46.1	865.8	502.5 to 1229.1	−6.7	−11.9 to −1.5	912.9	−180.7 to 2006.5	1261.2	997.5 to 1524.9
P-value	0.084		0.000		0.011		0.102		0.000	
Total surgeries performed (excluding deliveries)	50.1	−110.4 to 210.6	163.2	13.0 to 313.5	−2.8	−5.0 to −0.7	230.4	−221.9 to 682.7	171.0	61.9 to 280.0
P-value	0.541		0.033		0.011		0.318		0.002	
Table 2b. Colombia: Women's health services access										
Non-partner physical violence, ever	−0.02	−0.08 to 0.04	0.02	−0.04 to 0.07	−0.00	−0.00 to 0.00	0.21	0.04 to 0.39	0.13	0.09 to 0.17
P-value	0.556		0.582		0.909		0.016		0.000	
Received ANC	0.33	0.15 to 0.51	0.26	0.09 to 0.43	−0.00	−0.01 to −0.00	0.15	−0.36 to 0.67	0.94	0.81 to 1.06
P-value	0.000		0.003		0.021		0.556		0.000	
Delivery by a medical professional	0.08	0.04 to 0.13	0.10	0.06 to 0.14	−0.00	−0.00 to −0.00	−0.18	−0.30 to −0.05	1.06	1.03 to 1.09
P-value	0.000		0.000		0.000		0.007		0.000	
Delivery at the health facility	0.03	−0.14 to 0.21	0.15	−0.01 to 0.31	−0.00	−0.00 to 0.00	−0.27	−0.75 to 0.22	1.07	0.95 to 1.19
P-value	0.696		0.075		0.703		0.280		0.000	

Table 2 (continued)

Variable	Territorial control (reference category: State control)				Violence (Conflict deaths/intimate partner violence (IPV))				Base case	
	NSAG	95% CI	Contested	95% CI	Conflict deaths	95% CI	IPV	95% CI	Intercept	95% CI
Uses contraception method	0.07	−0.06 to 0.19	0.13	0.01 to 0.24	−0.00	−0.00 to 0.00	−0.27	−0.62 to 0.08	0.99	0.90 to 1.07
P-value	0.293		0.030		0.318		0.131		0.000	
Contraception method requiring access to health services	−0.15	−0.30 to −0.00	−0.01	−0.14 to 0.13	−0.00	−0.00 to 0.00	−0.31	−0.73 to 0.10	0.94	0.84 to 1.04
P-value	0.044		0.938		0.598		0.142		0.000	
Children ever born, average	−1.66	−3.60 to 0.29	−0.98	−2.80 to 0.84	0.00	−0.02 to 0.03	0.46	−5.01 to 5.93	2.99	1.67 to 4.31
P-value	0.095		0.290		0.708		0.869		0.000	

Variable	Territorial control (reference category: State control)				Violence (Conflict deaths/intimate partner violence (IPV))				Base case
	NSAG	95% CI	Contested	95% CI	Conflict deaths	95% CI	Intercept	95% CI	
Table 2c. Colombia: Violence against women									
Non-partner physical violence, ever	−0.03	−0.10 to 0.04	−0.01	−0.07 to 0.05	0.00	−0.00 to 0.00	0.24	0.20 to 0.28	
P-value	0.335		0.764		0.752		0.000		
Intimate partner violence, past year	−0.08	−0.25 to 0.09	−0.12	−0.27 to 0.03	0.00	−0.00 to 0.00	0.18	0.11 to 0.24	
P-value	0.386		0.120		0.421		0.000		

Variable	Territorial control (reference category: State control)				Violence (Conflict deaths/intimate partner violence (IPV))				Base case	
	NSAG	95% CI	Contested	95% CI	Conflict deaths	95% CI	IPV	95% CI	Intercept	95% CI
Mali										
Table 2d. Mali: Health services availability, seven-year smoothing										
Community health centre	4.5	−4.4 to 13.4	2.3	−3.1 to 7.8	0.1	0.0 to 0.3	78.7	30.3 to 127.1	32.3	21.9 to 42.7
P-value	0.323		0.403		0.010		0.001		0.000	
Community referral centre	−4.3	−8.6 to 0.1	−5.9	−8.5 to −3.3	−0.0	−0.1 to 0.1	74.8	51.5 to 98.2	−0.3	−5.8 to 5.2
P-value	0.053		0.000		0.885		0.000		0.918	
Distance home-surgery is up to 4.9 km	−0.6	−7.4 to 6.3	−0.8	−5.0 to 3.4	−0.0	−0.1 to 0.0	39.3	2.1 to 76.4	75.9	67.1 to 84.7
P-value	0.867		0.703		0.272		0.038		0.000	
Nurse student, number	−128.0	−162.7 to −93.3	−107.7	−136.2 to −79.3	0.1	−0.2 to 0.5	466.0	195.6 to 736.3	121.5	67.5 to 175.6
P-value	0.000		0.000		0.475		0.001		0.000	
Nurse, number	−28.0	−40.4 to −15.5	−1.4	−11.6 to 8.8	−0.0	−0.2 to 0.1	25.8	−71.3 to 122.8	98.5	79.1 to 117.9
P-value	0.000		0.790		0.549		0.603		0.000	
Doctor, number	−34.0	−48.0 to −20.0	−7.3	−16.1 to 1.5	−0.1	−0.2 to 0.1	64.2	−16.5 to 144.8	143.3	124.7 to 161.9
P-value	0.000		0.104		0.375		0.119		0.000	
Midwife, number	−37.4	−54.7 to −20.2	−13.1	−24.0 to −2.3	−0.0	−0.2 to 0.1	67.5	−31.9 to 166.8	254.4	231.5 to 277.4
P-value	0.000		0.018		0.717		0.183		0.000	
Public hospital	2.9	−3.5 to 9.2	5.0	1.1 to 8.8	−0.1	−0.2 to −0.0	−77.7	−112.1 to −43.3	27.7	20.3 to 35.1
P-value	0.379		0.012		0.025		0.000		0.000	
Pharmacy	−0.1	−1.7 to 1.5	0.4	−0.6 to 1.4	−0.0	−0.0 to 0.0	−22.3	−30.9 to −13.6	8.6	6.6 to 10.7
P-value	0.858		0.424		0.132		0.000		0.000	
Table 2e Mali: Women's health services access, seven-year smoothing										
Received ANC	0.06	−0.12 to 0.24	0.11	0.01 to 0.22	−0.00	−0.00 to 0.00	−1.21	−2.16 to −0.27	1.13	0.91 to 1.36
P-value	0.541		0.038		0.308		0.012		0.000	
Delivery by a medical professional	0.04	−0.00 to 0.08	0.07	0.05 to 0.09	−0.00	−0.00 to 0.00	−0.32	−0.53 to −0.12	1.03	0.98 to 1.08
P-value	0.073		0.000		0.252		0.002		0.000	

Table 2 (continued)

Variable	Territorial control (reference category: State control)				Violence (Conflict deaths/intimate partner violence (IPV))				Base case	
	NSAG	95% CI	Contested	95% CI	Conflict deaths	95% CI	IPV	95% CI	Intercept	95% CI
Delivery at the health facility	−0.07	−0.13 to −0.02	−0.12	−0.15 to −0.09	0.00	−0.00 to 0.00	1.26	0.99 to 1.54	0.70	0.63 to 0.76
P-value	0.007		0.000		0.917		0.000		0.000	
Uses contraception method	−0.02	−0.08 to 0.05	−0.04	−0.08 to −0.00	−0.00	−0.00 to 0.00	0.06	−0.29 to 0.40	0.27	0.19 to 0.36
P-value	0.645		0.034		0.593		0.749		0.000	
Contraception method requiring access to health services	−0.02	−0.24 to 0.20	−0.05	−0.18 to 0.08	−0.00	−0.00 to 0.00	2.95	1.79 to 4.11	0.36	0.08 to 0.64
P-value	0.859		0.426		0.630		0.000		0.013	
Children ever born, average	−0.28	−0.54 to −0.01	−0.45	−0.61 to −0.30	−0.00	−0.00 to 0.00	2.99	1.62 to 4.36	4.68	4.35 to 5.01
P-value	0.038		0.000		0.511		0.000		0.000	

Variable	Territorial control (reference category: State control)				Violence (Conflict deaths)		Base case	
	NSAG	95% CI	Contested	95% CI	Conflict deaths	95% CI	Intercept	95% CI
Table 2f Mali: Violence against women, 7-year smoothing								
Past year IPV	0.04	−0.00 to 0.08	0.06	0.03 to 0.08	0.00	0.00 to 0.00	0.18	0.14 to 0.21
P-value	0.079		0.000		0.039		0.000	
Iraq								
Table 2g. Iraq: Health services availability, women and men (3-year smoothing)								
Distance from a public hospital	0.010	−0.011 to 0.030	−0.003	−0.015 to 0.009	0.000	0.000 to 0.000	0.819	0.807 to 0.831
P-value	0.350		0.648		0.000		0.000	
Distance from a private hospital	0.002	−0.007 to 0.010	0.007	0.002 to 0.012	−0.000	−0.000 to −0.000	0.753	0.749 to 0.758
P-value	0.678		0.006		0.000		0.000	
Distance from a pharmacy	−0.010	−0.055 to 0.035	−0.007	−0.034 to 0.020	0.000	−0.000 to 0.000	0.960	0.934 to 0.987
P-value	0.666		0.604		0.151		0.000	
Distance from a primary care facility	−0.011	−0.032 to 0.009	−0.008	−0.020 to 0.004	−0.000	−0.000 to 0.000	0.940	0.929 to 0.952
P-value	0.265		0.175		0.455		0.000	
Distance from a health facility	−0.018	−0.045 to 0.009	−0.010	−0.026 to 0.006	−0.000	−0.000 to −0.000	0.999	0.974 to 1.024
P-value	0.197		0.230		0.006		0.000	
Table 2h Iraq: Women's health services access, 7-year smoothing								
Received ANC	0.01	−0.03 to 0.05	−0.02	−0.05 to 0.00	−0.00	−0.00 to 0.00	0.90	0.87 to 0.92
P-value	0.625		0.099		0.550		0.000	
Delivery by medical professional	0.01	−0.04 to 0.05	−0.03	−0.06 to 0.00	0.00	0.00 to 0.00	0.89	0.87 to 0.92
P-value	0.716		0.333		0.000		0.000	
Delivery at health facility	0.01	−0.04 to 0.06	−0.02	−0.05 to 0.01	0.00	0.00 to 0.00	0.69	0.66 to 0.73
P-value	0.579		0.229		0.029		0.000	
Uses contraception method	0.00	−0.03 to 0.03	0.03	0.01 to 0.05	−0.00	−0.00 to 0.00	0.59	0.57 to 0.61
P-value	0.845		0.001		0.566		0.000	
Contraception method requiring access to health services	0.00	−0.03 to 0.04	−0.03	−0.05 to −0.01	0.00	0.00 to 0.00	0.77	0.74 to 0.80
P-value	0.978		0.014		0.041		0.000	
Children ever born, average	−0.06	−0.21 to 0.08	−0.13	−0.22 to −0.05	−0.00	−0.00 to 0.00	2.28	2.16 to 2.40
P-value	0.406		0.002		0.099		0.000	
Received health care, recent illness, or injury	−0.11	−0.21 to −0.01	−0.07	−0.11 to −0.03	−0.00	−0.00 to −0.00	1.02	0.99 to 1.04
P-value	0.032		0.000		0.000		0.000	
Received health care, chronic illness or disability	−0.16	−0.26 to −0.05	0.00	−0.04 to 0.04	0.00	−0.00 to 0.00	0.86	0.82 to 0.89
P-value	0.004		0.939		0.180		0.000	
Table .2i Iraq: Health services access by gender, 5-year smoothing								
a) Health services access, women and men combined.								

Table 2 (continued)

Variable	Territorial control (reference category: State control)				Violence (Conflict deaths)		Base case	
	NSAG	95% CI	Contested	95% CI	Conflict deaths	95% CI	Intercept	95% CI
Received health care, recent illness, or injury	−0.11	−0.21 to −0.01	−0.07	−0.11 to −0.03	0.00	−0.00 to 0.00	0.91	0.87 to 0.95
P-value	0.032		0.000		0.631		0.000	
Received health care, chronic illness or disability	−0.16	−0.26 to −0.05	0.00	−0.04 to 0.04	0.00	0.00 to 0.00	0.82	0.76 to 0.88
P-value	0.004		0.939		0.002		0.000	
b) Health services access, men only								
Received health care, recent illness, or injury	−0.027	−0.057 to 0.002	−0.031	−0.049 to −0.013	−0.000	−0.000 to −0.000	1.039	1.009 to 1.070
P-value	0.072		0.001		0.000		0.000	
Received health care, chronic illness or disability	0.021	−0.004 to 0.046	0.036	0.021 to 0.051	−0.000	−0.000 to −0.000	0.894	0.878 to 0.910
P-value	0.100		0.000		0.027		0.000	

The table reports estimates of the association between territorial control (predictor) and health resources use (Colombia) or health services access (all countries) and health outcomes (outcomes) with a generalised least squares estimator. We controlled for violence levels (number of conflict-related deaths and violence against women), secular trends (year dummies, not reported) and geographical disparities (regional level dummies, not reported). The base case is the regression intercept, which captures a situation of state control in the capital region, with zero conflict-related deaths and no intimate partner violence, in the base year for each country. The base year is the first year for which we have a complete observation: 2004 for Colombia, 2000 for Mali and 2013 for Iraq. We report on estimates that meet the 95% threshold for statistical significance at a minimum.

Conflict violence was associated with increasing levels of violence against women. Violence against women increased in NSAG-controlled and contested areas in two settings. In Mali, NSAG control is associated with a 4%-point increase in exposure to IPV ($p < 0.1$); contested areas record a 6%-point increase ($p < 0.001$) compared to State-controlled areas (Table 1).

Irrespective of territorial control status, women who experience intimate partner violence (IPV) use more health services. We found a strong association between violence against women and the use of health services where data are available. In Colombia, there is a positive correlation between the past year's experience of IPV (physical or sexual) and increased use of and access to health services of a magnitude that always exceeds estimates for the territorial control predictors. These include number of hospital bed days (1721, 95% CI 641–2803), intensive care stay days (118, 95% CI 5–231), total hospital consultations (13055, 95% CI 3398 to 22712), lab exams (8862, 95% CI 5073–12651) and vaginal deliveries (22, 95% CI 5–39). Past-year IPV is negatively associated with delivery by a medical professional (−0.2, 95% CI −0.3 to −0.1). It is also negatively associated with delivery at health facilities, contraception use and the use of contraception methods requiring delivery by a medical professional, though none of these associations are statistically significant. Moreover, women exposed to past-year IPV are also more likely to have more children than non-exposed women, all other things being equal (not statistically significant). In Mali, we found a negative correlation with health service use indicators, including a decrease in antenatal care use (−1, 95% CI −2 to −0.3) and delivery by a medical professional (−0.3, 95% CI −0.5 to −0.1). Moreover, exposure to IPV was positively associated with an increase in number of children (3, 95% CI 2–4). However, we found a positive correlation with delivery at a health facility (1, 95% CI 1–2) and with medically administered contraception (3.0, 95% CI 2 to 4). Women who reported past year IPV were also more likely to report living near health facilities (Table 2).

Varying forms of non-partner violence against women were found across all settings. We were unable to compute estimates for non-partner violence due to insufficient data points. However, among available qualitative studies and reports, we found evidence of violence against women and men during and after the conflict (Red de Mujeres Víctimas y Profesionales (RMVP), Focal Groups of Male Victims of Sexual Violence and All Survivors Project, 2022; Svallfors, 2023). In Colombia, reproductive violence was reported by female FARC members with one study documenting 1810 forced or unsafe abortions each year. Sexual abuse of female combatants was not uncommon (Arturo, Valoyes Valoyes (2015)). Gender inequalities that existed before the Colombian conflict were exacerbated during the conflict (Yoshida and Céspedes-Báez, 2021).

Discussion

Our CAS framework provides a starting point for understanding the conditions that health actors need to navigate in intra-state conflict settings. The framework captures the influence of NSAG- and State control and contestation in shaping health service availability and outcomes. The model does not assume in advance a central role for international health service provision. Health service providers could be national (NSAG, State, community-based) or international (humanitarian or development). By empirically exploring the dynamics of territorial control involving NSAGs using available data, our analysis highlights that w*ho* governs a localised health system matters. Rather than a simple linear approach, the framework presents some of the fundamental factors influencing health equity and longer-term peace within a complex adaptive system using a gender lens. Our framework

highlights how NSAG and State governance can result in new risks and vulnerabilities.

Our framework fills knowledge gaps on sub-national (geographic) variation in conflict-affected settings, as well as (demographic) variation between women and men. Our findings confirm other research showing that improvements in maternal mortality, even during conflict, are often associated with internationally supported efforts. The importance of a gendered analysis is underscored by the finding that violence against women increases in conflict, alongside an increased need for health services. In NSAG-contested and controlled areas with low State service provision, internationally supported efforts delivered through community groups can be critical.

Importantly, we present a complex adaptive systems perspective for international and national policymakers and practitioners each working within their own restricted mandates toward improving health outcomes. Our empirical modelling yielded the following findings:

First, territorial control is gained using violence, but territorial control is maintained through a mixture of violent and non-violent approaches: Legitimacy concerns inform NSAG and State approaches to health provision. Poverty and geographic inequities in State-provided health services create constraints and opportunities for NSAGs to govern the local healthcare system.

Second, the extent of NSAG (and State) territorial control and ideology impacts if and how health services are provided: When NSAGs hold control, health service provision is shaped by ideology, including repressive gender norms, which results in decreased access to health services for non-NSAG supporters, women and girls. Territorial control by NSAGs is associated with decreased health service use across all case country settings. This may reflect NSAG-controlled areas facing restricted supplies of medical equipment and medicines or the competing priority to fight against the government or rival armed groups in other locations. Under contested control, NSAGs would not provide health services themselves but seek to 'manage' health providers. Local civil society, community actors and women's groups become essential in NSAG-controlled or contested areas where State and international organisations cannot reach.

Third, long periods of stable unchanging territorial control can lead to improvements in health service access and outcomes, irrespective of the actor in control: However, when territorial control is changed (through violence), there is an immediate reduction in health service utilisation in the ensuing period. Further research is needed to understand the underlying mechanisms. Higher levels of conflict intensity are generally associated with lower levels of access to health services and worse health outcomes across all contexts.

Fourth, NSAG territorial control has a gendered impact on healthcare use: The relevance of NSAG ideology was strongly evident in Iraq, where IS control was associated with a decrease in women's access to health services. Across all settings, health service access decreased when NSAGs held control compared to areas under State control, all other things being equal. Our analysis found that levels of partner violence increased during periods of contestation where conflict violence levels were higher. Other research has shown that women subject to partner violence are more likely to use health services, which suggests that during periods of violence, the need for accessible health services is even more important. Our analysis found that violence against women was positively correlated with increased use of health services, except for antenatal care. NSAG territorial control creates a complex scenario for women's access to healthcare, as NSAGs are often both the provider and the barrier to accessing care. This, combined with the gendered impact of conflict, suggests that targeted interventions are needed to improve healthcare access for women.

Our empirical findings validate the relevance of the framework's scope restriction to only include politically motivated NSAGs, as opposed to mere criminal gangs, in highlighting the relevance of (religious) ideology for gender unequal health outcomes. The example of Iraq shows that the NSAG in control was more concerned about fulfilling religious obligations than with IHL compliance. This is also consistent with a broader trend of lacking traction for IHL-centred approaches in dealing with NSAGs.

When IS was ousted from Iraq, it expanded into West Africa, giving rise to concerns about the future impacts of the expansion of global jihadism on women's and girls' health in African conflict settings. While higher levels of conflict intensity are generally associated with lower levels of access to health services and worse health outcomes across all contexts, this is not always the case. As seen in 2024 Afghanistan, conflict violence has effectively stopped, but women continue to bear the brunt of the Taliban ideology leading to high levels of violence, arrests and extremely restricted or no access to health and social services.

However, conflict-affected countries are typically characterised by a lack of data (Hoogeveen and Pape, 2019). No data set captured differential access to services (i.e., by sex, age, disability, or minority group). To address this, we used population-based surveys to understand women's access to reproductive health-related services and balanced this with qualitative research and interviews. Therefore, statistical associations should be interpreted with caution.

Conclusion

The growing prevalence and influence of NSAGs in intra-state armed conflict requires a broader, multi-disciplinary systems understanding of how NSAG territorial control and contestation affect sub-national healthcare, particularly with regard to gender dynamics. Our framework allows us to produce a geographically and demographically differentiated analysis, addressing significant gaps in the siloed evidence base. Whereas previous research on civil war impacts identifies negative health impacts on civilians beyond conflict violence, it has primarily focussed on the national level rather than on the sub-national level. Similarly, existing health system research does not sufficiently consider sub-national variation in government control within conflict contexts. In addition, the literature on NSAG governance has largely overlooked its effects on civilian populations, including health outcomes (Loyle et al. 2023; Lilja and Ahmad 2023; Ghobarah, Huth, and Russett 2003).

To address these gaps, we developed a complex adaptive systems framework and presented evidence-based recommendations for policymakers, donors, international organisations and health service providers who need to understand how the dynamics of territorial control may influence health service delivery in conflict settings involving NSAGs. Our aim is to contribute to strengthening the fulfilment of international humanitarian law and its protection provisions, especially as they relate to the provision of essential medical services using a gendered lens.

Our framework is an important new tool that can help address healthcare challenges in conflict settings. Specifically, it differs from related frameworks as we used a complex adaptive systems approach based on transdisciplinary knowledge, focused on gender dynamics and recognising the diversity of health service providers. Through statistical modelling, we demonstrated its applicability across different conflict settings.

Based on our analysis, we recommend:

First, to invest in robust sub-national sex-disaggregated data collection: Disaggregated longitudinal data could inform a more differentiated analysis beyond ad hoc humanitarian needs assessments.

Second, to systematically develop more territorially and demographically tailored health policies, strategies, planning, programming and implementation approaches to meet the varying needs and conditions of affected populations beyond the short-term crisis response: Our finding that violence against women was positively correlated with increased use of health services, also corroborates that the health sector can be a key entry point for addressing gender-based violence in conflict settings.

Third, to invest in frontline health provider capacity building, long-term local partnerships and protection measures. Local civil society, community actors, and women's groups may be essential in NSAG-controlled or contested areas where State and international organisations cannot reach: Frontline providers help address health service gaps, and their work merits attention and targeted funding from State budgets and international aid. Reinforced and novel approaches to protect these health providers and their families are critical.

Data availability

All datasets used are open-access and available for download on their respective websites. See Annex 1 for dataset references.

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Author contributions

JL and MH contributed equally to this work and, therefore, shared joint authorship. JL and MH conceived the research and developed the framework. JL provided oversight on all research activities and funding. MH developed the research design and methodology. JL supervised the case country study literature review team – JA conducted the Colombia case study, GAK conducted the Mali case study, and LF conducted the Iraq case study. MH supervised the quantitative modelling analysis team—LK curated the datasets, and GF led the statistical data analysis. All authors contributed to data interpretation. JL and MH drafted the paper and framework which was reviewed by all authors. All members of the research team had full access to the underlying data used to develop the framework.

Competing interests

The authors declare no competing interests.

Ethical approval

This study did not involve human participants, as it was based solely on a scoping literature review and publicly available quantitative datasets. All data used to develop and model the framework has already been approved for re-analysis and is anonymised. Therefore, no ethical approval was required for conducting this research.

Informed consent

This article does not contain any studies with human participants performed by any of the authors. Therefore, informed consent was not required.

Additional information

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