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Review Article

Armed conflict and treatment interruptions: A systematic review and meta-analysis in Amhara, Ethiopia

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ABSTRACT

Background: Armed conflicts significantly disrupt healthcare systems, leading to infrastructure destruction, shortages of medical supplies, and reduced access to essential health services. The Amhara region has experienced prolonged conflict, raising concerns about its impact on healthcare delivery. Understanding the extent of these disruptions is crucial for informing policy responses and humanitarian interventions.
Objectives: This systematic review and meta-analysis aimed to assess the impact of armed conflict on healthcare delivery in the Amhara region.
Study design: Systematic review and meta-analysis.
Methods: Conducted between June 1 and July 10, 2024, this meta-analysis followed PRISMA guidelines. A comprehensive search was performed across PubMed/MEDLINE, EMBASE, CINAHL, Google Scholar, ScienceDirect, and the Cochrane Library. Eligible studies included English-language observational studies and grey literature addressing healthcare disruptions, infrastructure damage, and health crises. Data were analyzed using STATA Version 14, and study quality was assessed using a modified Newcastle-Ottawa Scale.
Results: Twelve studies, encompassing 12,037,279 participants, were included. The pooled prevalence of health impacts was 76.71 % (95 % CI: 76.63–76.78). The conflict rendered 60 % of healthcare facilities nonfunctional, disrupted medical supplies for 70 % of the population, and reduced service availability by 80 %. Chronic disease management, mental health services, maternal care, and immunization programs experienced significant declines. Subgroup analyses indicated a higher prevalence of health impacts in studies published after 2022 (70.72 %) compared to those published before 2022 (28.35 %).
Conclusion: Armed conflict in the Amhara region has severely disrupted healthcare services, leading to facility closures, medical supply shortages, and significant declines in essential health services. Urgent interventions are required to restore healthcare infrastructure and services.

1. Introduction

Armed conflicts have widespread and complex impacts on healthcare systems worldwide. They disrupt essential services, heighten vulnerabilities, and greatly undermine the health and well-being of affected populations.[1] In Ethiopia's Amhara Region, the ongoing conflict has gravely undermined healthcare delivery and infrastructure, creating a complex and worsening public health crisis.[2] The destruction of essential healthcare infrastructure, including hospitals, clinics, and supply chains, has had a devastating impact on the region's health services.[3] This devastation not only limits access to essential healthcare services but also significantly reduces the capacity to respond effectively to emergencies.[3,4] Damage to healthcare systems hampers life-saving interventions and exacerbates health disparities, particularly among vulnerable populations.[5] (see Table 5) (Table 5)

Moreover, the displacement and migration of healthcare professionals due to the conflict further intensify workforce shortages, causing significant disruptions to healthcare service delivery.[5] Healthcare workers in conflict zones encounter numerous challenges, including threats to their safety, limited resources, and logistical barriers to accessing affected populations.[6] The loss of these essential personnel puts immense pressure on an already fragile healthcare system.

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The conflict's effect on health outcomes in the Amhara Region is alarming.[5] Increased morbidity and mortality are seen not only from direct conflict-related injuries but also from indirect effects, such as a rise in infectious diseases due to halted vaccination efforts.[7] Maternal health is particularly impacted, as limited access to obstetric services results in higher maternal mortality rates and increased complications.[5,7] In addition to the physical consequences, armed conflict takes a significant psychological toll on both civilians and healthcare providers.[8,9] Researches indicates higher rates of post-traumatic stress disorder, anxiety, and depression among populations affected by conflict and displacement.[8,10] Healthcare workers are also deeply affected, experiencing burnout and psychological distress as they operate under intense and challenging conditions in conflict zones.[8]

The conflict in the Amhara Region also intensifies socioeconomic inequities, further limiting access to healthcare for vulnerable populations.[11] Displacement, economic instability, and the loss of livelihoods prevent vulnerable populations from accessing essential medical care[8,11] The collapse of infrastructure and local economies deepens the overall health crisis, creating barriers to healthcare access and exacerbating pre-existing conditions.[11]

Additionally, armed conflict presents substantial ethical and legal challenges in healthcare delivery, complicating the provision of care and the protection of both patients and healthcare workers.[12] Violations of international humanitarian law, such as targeting healthcare facilities and personnel, erode the neutrality and impartiality necessary for providing healthcare in conflict zones.[13] Ensuring ethical practices and legal protections for both patients and healthcare workers becomes progressively more challenging amid ongoing hostilities.[12]

The ongoing armed conflict in the Amhara region has significantly disrupted healthcare services, leading to widespread treatment interruptions and noncompliance among patients with chronic conditions. The original studies included in this systematic review and meta analysis highlight how war-induced challenges, such as the destruction of health facilities, shortages of essential medicines, and restricted access to healthcare providers, have exacerbated the burden on patients. Chronic disease patients in Northeast Amhara experienced substantial treatment gaps, with adverse outcomes such as disease progression and complications due to noncompliance with medication regimens.[14]

Maternal health services, including antenatal care, institutional deliveries, and postnatal care, were severely curtailed, leaving pregnant and lactating women vulnerable to adverse outcomes.[15] Immunization programs have also suffered, with vaccination rates plummeting due to logistical barriers and displacement, increasing the risk of preventable diseases.[16,17] Additionally, the psychological toll of conflict, including acute stress disorder and post-traumatic stress disorder (PTSD), has hindered patients' ability to adhere to treatment, compounding the public health crisis in the region.[18,19] These findings underscore the critical need for targeted interventions to address treatment interruptions and ensure continuity of care amidst the ongoing conflict.

As a result, this study addresses the significant research gap regarding the impacts of armed conflict on healthcare delivery in Ethiopia's Amhara region, particularly treatment interruptions in chronic disease management, mental health, maternal care, and immunization services. While prior studies have explored healthcare disruptions in conflict zones, there is limited focus on this specific region, and the available data is scattered and uncompiled. Previous research presents unprocessed raw data from individual studies without providing pooled or concise results, making this study a crucial contribution by offering a comprehensive, synthesized analysis of healthcare impacts in conflict-affected areas of Ethiopia.

2. Methods

This meta-analysis was conducted following the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[20] A thorough search was conducted across multiple databases, including PubMed, MEDLINE, EMBASE, CINAHL, Google Scholar, ScienceDirect, Web of Science, and the Cochrane Library, without time restrictions, to identify potentially relevant literature. Additionally, we explored research institutions, such as the Addis Ababa Digital Library, to locate unpublished studies. The management and organization of the identified studies were facilitated using EndNote X7 (Thomson Reuters, Philadelphia, PA, USA). The search covered the period from June 1 to July 10, 2024, and included all relevant papers published up to that date.

The search utilized a series of keywords, including (((patients[MeSH Terms]) OR (patients[Title])) AND ((Amhara region[MeSH Terms]) OR (Amhara region[Title]))) AND ((((((((((Impact of armed conflict[MeSH Terms]) OR (Treatment interruption[MeSH Terms])) OR (Impact of armed conflict[Title])) OR (Impact of war[Title])) OR (Consequence of armed conflict[Title])) OR (Effect of armed conflict[Title])) OR (Crisis of armed conflict[Title])) OR (Treatment interruption[Title])) OR (Treatment discontinuation[Title])) OR (Treatment noncompliance[Title])). These keywords were applied both individually and in combination, using Boolean operators such as "OR" and "AND" to refine and narrow the search results(Supplementary Table 1)

2.1. Inclusion and exclusion criteria

2.1.1. Inclusion criteria

This meta-analysis included studies that met the following criteria: (1) observational studies examining the impact of armed conflict on treatment interruption; (2) articles published in peer-reviewed journals or grey literature; and (3) articles written in English.

2.1.2. Exclusion criteria

We assessed study eligibility by reviewing titles and abstracts, which led to the exclusion of non-relevant papers. Relevant articles were then examined in full. Studies without accessible full texts were excluded after at least two attempts to contact the primary author via email for access. Since it was not possible to evaluate the quality of articles without full texts, these were excluded from the selection process. Furthermore, full-text reviews were conducted for articles that did not report the outcomes of interest. In addition experimental studies, panel studies, and secondary data analyses were excluded due to challenges in assessing data quality per PRISMA guidelines, as these designs often lack transparency in data collection. Focusing on primary observational studies ensured rigorous, reliable, and comparable findings (Table 1).

2.1.3. Study area

Only studies conducted in the Amhara Region were included.

2.1.4. Population

Research focused exclusively on the impact of armed conflict on the healthcare delivery system was considered.

2.1.5. Publication status

Both published and unpublished articles were included in the analysis.

2.1.6. Study design

This meta-analysis included various types of observational studies, such as cross-sectional, case-control, and cohort studies, that reported on the impact of armed conflict on healthcare delivery.

2.2. Outcome measurements

The primary outcomes are treatment interruptions (medication noncompliance and healthcare service discontinuation). Secondary outcomes include health impacts (disease progression) and factors influencing adherence, such as access to care and mental health.

The outcome variable "treatment interruption" was operationalized

Table 1
Inclusion and exclusion criteria of Armed Conflict and Treatment Interruptions: a Systematic Review and meta-analysis in Amhara, Ethiopia.

Criteria	Inclusion	Exclusion
Study Design	Observational studies examining the impact of armed conflict on treatment interruption.	Experimental studies, panel studies, and secondary data analyses due to challenges in assessing data quality per PRISMA guidelines.
Publication Type	Articles published in peer-reviewed journals or grey literature.	Non-relevant papers based on title and abstract screening.
Language	Articles written in English.	Articles written in languages other than English.
Access to Full Text	Studies with accessible full texts.	Studies without accessible full texts after at least two email attempts to contact the primary author.
Outcome Reporting	Studies reporting outcomes related to treatment interruptions caused by armed conflict.	Articles that did not report the outcomes of interest.
Data Transparency	Studies with clear and consistent data collection methods.	Studies with insufficient transparency or inconsistent data collection, including non-primary observational designs.

in this review to refer to any cessation, delay, or irregularity in accessing or adhering to prescribed medical treatments or health services due to the ongoing armed conflict. This definition was used to determine the scope of included studies and analyze outcomes by examining factors such as the duration of interruptions, the reasons for noncompliance (displacement, lack of resources, or health system disruptions), and the associated health impacts, including disease progression, complications, or reduced quality of life. Providing this clarity ensures a consistent framework for understanding and interpreting the findings across the reviewed studies.

2.2.1. Health care delivery system

The healthcare delivery system includes facilities, personnel, equipment, medicines, and infrastructure enabling care provision. Excluded are broader social determinants and policy aspects unless directly tied to service delivery.

2.2.2. About tools used by primary studies

This meta-analysis includes studies that evaluated the pooled impact of armed conflict on treatment interruption using a range of methodologies. These encompass health facility assessments, healthcare utilization surveys, analysis of morbidity and mortality data, evaluations of human resources for health, psychosocial impact assessments, qualitative research methods, indicators of health system resilience, and ethical and legal assessment tools. However, no specific tools were used as inclusion criteria for the studies in this meta-analysis. The studies employed a range of methodologies, including health facility assessments, healthcare utilization surveys, morbidity and mortality data analysis, psychosocial impact assessments, and qualitative research methods, among others, to evaluate the impact of armed conflict on treatment interruption.

2.2.3. Data extraction

Data extraction was performed using a standardized form adapted from the JBI data extraction format,[21] with two authors (MG and AG) independently extracting the required data. Any discrepancies during the data collection process were resolved through consensus and discussion, following a Delphi approach with the third reviwer(TA). When necessary, the primary author of the original research was contacted for further details or clarification. To ensure the rigor and comprehensiveness of our systematic review, we reached out to five authors of the included studies for additional information regarding specific data gaps. This transparency aims to support the reproducibility of our findings and emphasize the collaborative efforts in addressing the impact of armed conflict on healthcare delivery. The extracted data included sample size, study design, country of study, study area, primary author, publication year, and prevalence along with 95 % confidence intervals.

2.2.4. Quality assessment

Using a quality assessment tool, MG and AG independently evaluated the quality of each original study. The Newcastle-Ottawa Scale was modified and employed to specifically assess the quality of cross-sectional, cohort, and case-control studies. The tool comprises three main sections: the first assesses the methodological quality of the study, focusing on aspects such as sample size, response rate, and sampling technique, and is rated from one to five stars. The second section evaluates the comparability of study cases or cohorts, with a maximum of two stars. The final section addresses the results and statistical analysis, where up to three stars can be awarded. Any discrepancies between the reviewers were resolved by calculating the mean score of their evaluations. Articles that achieved a score of at least six out of ten were considered to be of good quality. This threshold was established based on a review of relevant research.

2.2.5. Data processing and analysis

Relevant data from each original study were systematically extracted using a Microsoft Excel spreadsheet prior to analysis. The extracted data were then imported into STATA Version 14 for further evaluation. The standard error for each study was calculated using the binomial distribution formula. Heterogeneity among the reported prevalence rates was assessed by computing p-values for the chi-square test, Q-statistics, and the I^2 test.[22] To determine the pooled effect, a random-effects meta--analysis model was employed using Der Simonian and Laird's method, due to the substantial heterogeneity observed among the included studies ($I^2 = 93.0$ %, $p < 0.001$). To address potential random fluctuations in the point estimates of major study subgroups, the analysis was stratified according to study-specific conditions, such as the country of study, publication year, and sample size.

Additionally, univariate meta-regression was employed to explore potential sources of heterogeneity, considering factors such as sample size, the country of the primary study, and publication year. However, none of these variables demonstrated statistical significance. Publication bias was assessed using Egger's and Begg's tests, which revealed no evidence of bias at the 5 % significance level.[23] A forest plot was used to visually represent point prevalence alongside 95 % confidence intervals. In this plot, each horizontal line represented the 95 % confidence interval, while the size of each box indicated the weight assigned to the corresponding study. The position of the box reflected the point estimate for each study, with the overall pooled estimate shown as a diamond at the bottom of the plot.

3. Results

Initially, a total of 4831 potentially relevant publications concerning the impact of armed conflict on treatment interruption in the Amhara region were identified from databases such as PubMed/MEDLINE, EMBASE, CINAHL, Web of Science, Scopus, Google Scholar, ScienceDirect, Cochrane Library, and other sources. From this initial pool, 872 duplicates were eliminated. After reviewing titles and abstracts, 544 articles were excluded from the remaining 3415. Furthermore, 3403 articles were found to be irrelevant to the scope of this review, and 12 additional articles were removed due to inaccessible full texts. Ultimately, 12 articles were assessed against the predetermined inclusion criteria and were deemed suitable for inclusion in the final meta-analysis

(Supplementary Fig. 1)

3.1. Characteristics of original studies

This meta-analysis incorporated a total of 817976 participants, as presented in Table 1 below. Among the studies, 42 % were published in 2022 and employed a cross-sectional design. Sample sizes varied widely, ranging from 22 to 1806 participants. The research was conducted across nine distinct zones in the Amhara region: North Gondar, North Wollo, Wag Himera, Dessie City, North Shewa, Oromo Special Zone, South Gondar, South Wollo, and West Gondar. Notably, no studies were identified from other zones or districts. The quality scores for the included studies ranged from six to eight, as indicated in Table 1.

The health consequences of armed conflict in Northwest Ethiopia are both significant and complex. The ongoing conflict has rendered 60 % of healthcare facilities inoperable, created critical shortages of medical supplies affecting 70 % of the population, and diminished service availability by 80 %. These disruptions have intensified existing health issues and further strained the already fragile healthcare system.[15]

The management of chronic diseases has been severely disrupted by the ongoing conflict, with approximately 64 % of adults (around 1920 individuals) and 42 % of children (approximately 1680 individuals) experiencing significant difficulties in accessing essential healthcare services. This disruption has led to a worsening of their conditions, further compounding the public health crisis in the region.[14,15] The conflict has severely impacted mental health, with 45 % experiencing acute stress and 40.8 % diagnosed with PTSD. Nutritional challenges have worsened, with 25 % of pregnant and lactating women facing acute malnutrition, further straining the healthcare system.[24]

The conflict has significantly worsened mental health conditions, with acute stress disorder affecting 45 % of the population[18] and post-traumatic stress disorder impacting 40.8 % among those who have survived traumatic experiences.[19] Malnutrition rates among pregnant and lactating women have surged, further complicating health outcomes and access to care.[18,24] The war has critically disrupted health services, resulting in substantial treatment interruptions and a drastic reduction in maternal care, with antenatal, delivery, and postnatal services declining by as much as 72.7 %.[15] Immunization programs have also been adversely affected, with service coverage plummeting due to security concerns and damage to infrastructure.[17] The conflict has precipitated a collapse of health systems, illustrated by extensive damage to healthcare facilities, interruptions in chronic disease management, and a significant decrease in the availability of health services.

The breakdown of health systems, evacuation of personnel, and shortages of essential supplies have led to substantial disruptions in healthcare services and chronic disease management.[4] Immunization programs have been profoundly affected due to the displacement of healthcare workers and damage to infrastructure.[17] The availability of medications and supplies is critically limited, while maternal health services have experienced significant interruptions, adversely impacting antenatal, delivery, and postnatal care(Zeru, Agalu, Balew, Salew, Tarekegn, Ayenew et al.). Furthermore, survivors of sexual violence endure severe medical and psychological ramifications.[15]

3.2. Meta-analysis

The pooled impact of armed conflict on treatment interruption in the Amhara region was found to be 76.71 % (95 % CI: 76.63, 76.78), based on the overall prevalence analysis of 12 studies included in the meta-analysis.

A random-effects meta-analysis model was used to estimate the prevalence due to the high heterogeneity observed among the studies ($I^2 = 99.6$ %, $p < 0.001$). Publication bias was assessed using Begg's and Egger's tests, which indicated no statistically significant bias in the prevalence of the impact of armed conflict on treatment interruption (p-values of 0.702 and 0.018, respectively).

3.3. Subgroup analysis

In this meta-analysis, the impact of armed conflict on treatment interruption was compared across various parameters. Subgroup analysis by sample size showed a more pronounced impact in studies with fewer than 400 participants, with a prevalence of 80.05 % (95 % CI: 68.74, 91.35). Additionally, subgroup analysis by type of impact revealed that healthcare inaccessibility had the highest prevalence, at 69.31 % (95 % CI: 60.94, 73.68) **(Insert** Table 2 **here).**

The study examined several types of impacts, including the collapse of the healthcare system, the evacuation of healthcare personnel, shortages of medical supplies, and instability caused by inadequate transportation, all of which contributed to significant treatment interruptions in the Amhara region.

3.3.1. Sensitivity analysis

In the sensitivity analysis using the leave-one-out method, excluding any individual study did not substantially alter the pooled prevalence estimates or measures of heterogeneity. This indicates that the random effects model was robust, with no single study significantly influencing the overall prevalence of the impact of armed conflict on treatment interruption **(Insert** Table 3**here) (see** Table 4**) (see** Fig. 1**).**

Publication bias was identified among the studies included in this review, as evidenced by the asymmetrical distribution observed in the funnel plot (Insert Fig. 2 here). The results from the Egger test indicated a statistically significant publication bias ($p = 0.001$). To address this, a trim-and-fill analysis was conducted, a nonparametric method used to detect and estimate the effects of potentially missing studies. This approach helps account for the bias and provides a more accurate estimate of the pooled prevalence (Supplementary Fig. 2)

4. Discussion

The pooled prevalence of the impact of armed conflict on treatment interruption in the Amhara region was estimated to be 76.71 % (95 % CI: 76.63, 76.78). This meta-analysis is the first to estimate the pooled prevalence of treatment interruption and associated factors due to armed conflict in this region. The analysis revealed a significant variation in treatment interruption prevalence, ranging from 53.53 % to 92.42 %. Overall, the pooled prevalence was 76.71 %, highlighting the substantial disruption caused by the conflict in healthcare delivery. The finding is higher than previous systematic review and meta-analysis conducted in Switzerland[25] and from other 40 countries 30.6 %.[26] The discrepancy in treatment interruption rates may be attributed to the intensified conflict and state of emergency in the Amhara region since 2023. This period has seen severe healthcare disruptions, including clinic closures, medical supply shortages, and damaged infrastructure. These factors have likely contributed to higher rates of treatment interruption compared to earlier periods with less extensive conflict.

The subgroup analysis by sample size showed that the pooled prevalence of treatment interruption due to armed conflict was highest in studies with fewer than 400 participants (80.05 %, 95 % CI: 68.74–91.35). Smaller sample sizes may reflect a higher impact of war, as these studies often include more severely affected cases, leading to less variability. In contrast, studies with larger sample sizes (over 400 participants) tend to average out extreme effects and capture a wider range of experiences, which may dilute the observed impact. Additionally, the subgroup analysis by publication year indicated that the pooled impact of armed conflict on treatment interruption was higher in studies conducted after 2022 (70.72 %, 95 % CI: 60.55–80.88).

This increase in the prevalence of treatment interruptions may be attributed to the escalation of ongoing conflicts, as well as recent surges in violence and disruptions. Earlier studies likely captured less severe conditions, while more recent research reflects the intensified and immediate impacts of armed conflict. The subgroup analysis by study design revealed a higher impact of armed conflict on treatment

Table 2
Baseline characteristics of the included studies.

Corresponding Author	P. year	Type of impact	study design	sample size	Prevalence DIAC (%)	Quality score
Mulugeta Wodaje Arage[4]	2022	collapse of the health system, evacuation of health personnel, shortage of medical supplies, and instability due to a lack of transportation	mixed method	1806	78.57143	8
Geta Asrade[17]	2022	security issues, displacement of health workers, destruction of health infrastructure, and poor coordination among stakeholders, interruptions in immunization services	mixed method	28	78.57143	7
Taye Zeru[27]	unpublished	significant disruptions in the supply of essential medicines and medical supplies	quantitative	151	76.65872	7
Nigusie Abebaw[28]	unpublished	severe interruptions in treatment, increased healthcare needs, and significant health impacts including mortality and disease	quantitative	22	80.46546	8
Getu Degu Alene[15]	2023	significant decline in the availability of these crucial health services	mixed method	22	65.40099	8
Muluemebet Kassa Mezen[16]	unpublished	Delays and interruptions in immunization coverage for children and pregnant women.	quantitative	449	72.16036	8
Gebeyaw Biset[29]	2023	high levels of post-traumatic stress syndrome among young individuals exposed to the violence and trauma	quantitative	846	65.83924	7
Assefa Agegnehu Teshome[19]	2023	Significant psychological trauma and stress among the adult population.	quantitative	812	77.70936	8
Lebeza Alemu Tenaw[30]	2022	Severe physical and mental health impacts on survivors of sexual violence.	mixed method	271	70.84871	8
Asnakew Worku[18]	2022	High levels of acute stress and psychological distress among affected individuals.	quantitative	422	92.41706	7
Aysheshim Kassahun Belew[24]	2023	Exacerbated issues of acute malnutrition among these vulnerable groups.	quantitative	1560	53.52564	6
Betelhem Mesfin[14]	2023	disruptions in chronic disease management and the associated health outcomes	mixed method	399	91.22807	8

Table 3
Baseline characteristics of the included studies and subgroup prevalence of impact of armed conflict.

Sub-group	Category	No. of studies	Sample size	Prevalence (95 % CI)	p-value	I^2
Year of publication	≤2022	4	945	28.35(68.20,92.50)	0.000	95.2 %
	>2022	5	32508	70.72 (60.55, 80.88)	0.000	99.2 %
	unpublished	3	1268110	77.05 (73.78,80.31)	0.0001	99.7 %
Study design	mixed	6	29813	76.856 63.229,90.483)	0.000	98.8 %
	quantitative	4	3640	74.369(71.570, 77.168)	0.000	99.6 %
Sample size	≤400	4	922	80.045(68.739,91.352)	0.000	94.2 %
	>400	8	1300641	53.526(51.051,56.001)	0.000	99.6 %
Population	Adults(acute)	3	1458	83(72.213,93.787)	0.000	98.9 %
	children	2	874	69.948(58.282,81.615)	0.1065	61.3 %
	Chronic follow-up	2	60732	85.755(75.209,96.300)	0.000	98.3 %
	MCH	4	31171	65.257(57.941,72.574)	0.000	97.0 %

Table 4
Baseline characteristics of the included studies and subgroup prevalence of RBCa.

Sub-group		No. of studies	Sample size	Prevalence (95 % CI)	p-value	I^2
Publication Year	≤2022	4	945	28.35(68.20,92.50)	0.000	95.2 %
	>2022	5	32508	70.72 (60.55, 80.88)	0.000	99.2 %
	unpublished	3	1268110	77.05 (73.78,80.31)	0.0001	99.7 %
Study design	mixed	6	29813	76.856 63.229,90.483)	0.000	98.8 %
	quantitative	4	3640	74.369(71.570, 77.168)	0.000	99.6 %
Sample size	≤400	4	922	80.045(68.739,91.352)	0.000	94.2 %
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	MCH	4	31171	65.257(57.941,72.574)	0.000	97.0 %
Type of impact	Displaced	4	3683	42.516 (41.524, 43.507)	0.000	97.4 %
	Death	4	3313	62.314 (60.943,63.684)	0.000	99.8 %
	Inaccessibility of health care	5	3380	69.314(60.943,73.684)	0.000	99.4 %
	PTSD	2	669	47.913 (44.499,51.326)	0.000	66.1 %
	Direct trauma	1	422	7.346 (4.857,9.835)	___	__
	Unwanted pregnancy	4	2760	10.042(8.319,11.766)	0.000	89.5 %
	Unable to visited health institutions	4	12514	16.894 (15.640,18.148)	0.000	98.2 %
	Sexual abuse	2	726	77.327 (75.851,78.802)	0.000	99.9 %
	Unsafe abortion	1	1030	8.835(7.102, 10.568)	–	————%
	Child mortality	3	2872	1.776 (1.297 2.255)	0.000	96.4 %
	Closed health institutions	1	1030	21.845(19.321,24.368)	–	———%
	Lost family member	4	3313	2.387 (1.874, 2.899)	0.000	97.0 %
	Food insecurity	3	3451	2.387 (1.874,2.899)	0.000	93.0 %

Table 5
Sensitivity analysis on the impact of armed conflict in Amhara region.

Study omitted	Estimate	[95 % Conf. Interval]	
Mulugeta Wodaje Arage (2022)	74.879082	68.121742	81.636421
Geta Asrade (2021)	74.879082	68.121742	81.636421
Taye Zeru (unpublished)	75.053154	68.260857	81.845451
Nigusie Abebaw (unpublished)	74.706718	68.002808	81.410637
Getu Degu Alene (2023)	76.077858	69.506859	82.648849
Muluemebet Kassa (unpublished)	75.462578	68.66626	82.258896
Gebeyaw Biset (2023)	76.037964	69.44278	82.633148
Assefa Agegnehu Teshome (2023)	74.957535	68.18206	81.733017
Lebeza Alemu Tenaw (2022)	75.581970	68.806305	82.357635
Asnakew Worku (2022)	73.619125	67.688171	79.550079
Aysheshim Kassahun Belew (2023)	77.158531	71.991684	82.325386
Betelhem Mesfin (2023)	73.727348	67.683769	79.770927

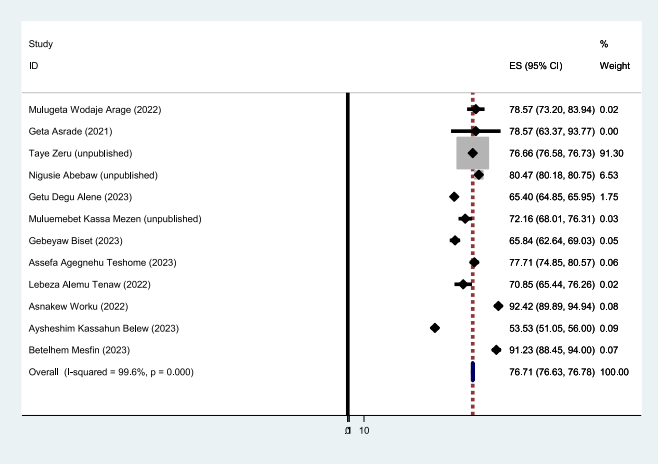

Fig. 1. Forest plot illustrating the pooled prevalence of treatment interruption due to armed Conflict in the Amhara Region.

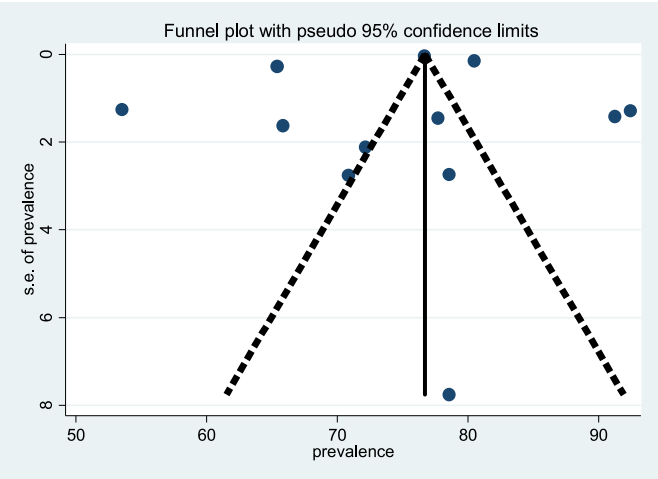

Fig. 2. Funnel plot with 95 % confidence limits of the pooled prevalence of the impact of armed conflict.

interruptions in mixed methods studies (76.86 %, 95 % CI: 63.23–90.48) compared to quantitative-only studies. Mixed methods studies may capture a broader range of experiences, incorporating both qualitative and quantitative data, which helps to reveal more severe effects. Furthermore, patients requiring chronic follow-up care experienced a higher prevalence of treatment interruptions (85.76 %, 95 % CI: 75.21–96.30) compared to adults with acute or emergency conditions (83 %, 95 % CI: 72.21–93.79). Chronic patients often face prolonged disruptions, whereas acute cases may receive more immediate attention.

4.1. Limitations of the study

This study highlights the immediate effects of armed conflict on treatment interruptions in the Amhara Region but acknowledges several limitations, including incomplete data from affected districts and unaddressed influencing factors. Additionally, focusing solely on the Amhara Region limits the generalizability of our findings, which we have explicitly noted as a limitation.

4.2. Conclusion

Armed conflict in the Amhara Region has caused severe disruptions to healthcare, leaving many facilities non-functional and resulting in shortages of medical supplies, which has led to significant treatment interruptions. Chronic disease management, mental health services, maternal care, and immunization programs have been particularly affected. Immediate restoration of healthcare infrastructure is crucial to addressing these challenges. These findings underscore the urgent need for increased support for healthcare systems in conflict zones. Future research should focus on understanding how conflict impacts the research landscape, including the availability of resources, study continuity, and the ability to conduct meaningful investigations.

Authors' contributions

All authors conceptualized the paper.

MG and AG conducted the extraction, analyses, synthesized findings, and wrote the article, with support from TA, BTA, and ADA, HA prepared the first draft of the manuscript, which was critically reviewed by all other authors. All authors read and approved the final manuscript.

Preprints

Not applicable.

Added knowledge

- Provides a comprehensive insights into the impact of armed conflict on treatment interruptions, highlighting key factors and outcomes across Amhara region, an area previously underrepresented in research.

Global health impact for policy and action

- The findings highlight the need for urgent healthcare restoration and targeted interventions in conflict zones, influencing global health policy and response strategies.

Competing of interest

'None of the authors have any competing interest'.

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Abbreviations

IOAC	Impact of Armed Conflict
CI	Confidence Interval
WHO	World Health Organization

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2025.01.039.

Ethics and concent

Not applicable.

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