BMC Public Health

RESEARCH

Open Access

Profile and management of war casualties in the context of limited resources and conflict in the Eastern Democratic Republic of Congo: a retrospective observational study

Jean-Bosco Kahindo Mbeva[1,2,3], Bives Mutume Nzanzu Vivalya[2*], Jean-Roger Kambere Syayipuma[2], Jean-Marie Vianney Tshimbila Kabangu[4], André Mubake Muzombo[4], Jean Pierre Noterman[1], Dan Kapuku[5], Mbasa Elu[3], Sébastien Matata Ngilima[4] and Prudence Mitangala Ndeba[1,2]

Abstract

Background Wartime injuries contribute to the global burden of mortality as a major public health threat. Early access to healthcare improves the quality of life of war-injured patients. The patterns of trauma care and its outcomes in war-injured patients have not been documented in conflict-affected regions of the Democratic Republic of Congo, where political crisis and civil unrest lasted more than two decades. This paper describes the pathway to care, referral patterns and treatment outcomes of war-injured patients treated at the Provincial Hospital of North Kivu (PHNK) during the January 2025 crisis in Goma.

Methods This retrospective observational study identified 239 war-injured patients admitted at the PHNK between 25th January and 31st March 2025. The study gathered information on patient demographics (age, sex, marital status, and religion), time interval between trauma occurrence and hospital admission, mode of admission, injury patterns (mechanism, site, and type), first medical aid at the trauma site, severity of injury and outcomes (mortality, length of hospital stay, and postoperative infection). Descriptive analyses performed with Stata 15.0 were summarized as proportions, medians or means and standard deviation.

Results Most war-injured patients admitted at the PHNK were male (82.3%), single (52.2%), and aged 18–49 years (76.3%). These patients were self-referred (87.1%), did not benefit from first medical aid at trauma sites (86.7%), and had a time interval ranging from 6 to 24 h between trauma occurrence and hospital admission (37.4%). Debridement was performed in 54.4% of cases. Tetanus immunization was administered to 15.9% of war-injured patients, whereas 13% benefited from physiotherapy. Only 7.1% of cases benefited from psychological management. The overall mortality rate was 4.4% (11 patients), with 9 deaths occurring within 48 h from admission. The mean length of hospital stay was 14 days, whereas 8% of war-injured patients had a postoperative infection.

*Correspondence:
Bives Mutume Nzanzu Vivalya
drmutume@uor-rdc.net

Full list of author information is available at the end of the article

Conclusion These results show the delays in care, self-referral and mortality in war-injured patients in the context of limited resources and conflict. The results call for feasible interventions within a context of high violence such as that of the Democratic Republic of Congo, aiming at strengthening the health system and enhancing community-level capacities to improve the quality of life of war-wounded individuals in conflict zones. This study also shows that a robust health system can deliver an effective response to acute crises if it is equipped with sufficient technical capacity, well-trained staff, essential medicines, and strong organizational structures.

Keywords Pathway to care, Wartime injuries, Provincial Hospital of North Kivu, War-injuries, January 2025 crisis, Goma

Background

Globally, armed conflicts impact the quality of life of individuals living in war-tone settings by causing displacement, injuries and deaths, and affecting how war-related patients access quality healthcare [1, 2]. They also increase the mortality rates [3, 4] and destroy the existing health system [5, 6]. War-related mortality ranges between 3.6% and 28.7% [7] and is associated with delays in seeking care, unavailability of trained health workers, and inappropriate use of trauma care protocols [8, 9]. Public health consequences of war andstrategies deployed to care for those affected during wartime are well documented in several countries, although they have not yet been described in conflict-affected regions of the Democratic Republic of Congo (DRC), where political crisis and civil unrest lasted more than two decades [10].

The recurrence and scale of armed conflicts make wartime injuries a major public health problem and a leading cause of mortality and disability [11]. During the 2012–2017 Libyan conflict, Daw and colleagues estimated the mortality rate at 2.7 deaths per 1000 inhabitants, the injury rate at 7.1 cases per 1000 inhabitants, and the occurrence of disabilities in 33.5% of war-injured patients [12]. Another study conducted during the 2014 Gaza war revealed that bomb explosion is the commonest mechanism of injury, whereas the trauma profile consisted of multi-organ injuries, fractures, and thoracic, abdominal, and gynecological injuries [13]. Deaths due to gunshot or bomb explosions in war-injured patients increase the in-hospital mortality rate due to the management of wartime injuries [14, 15]. Abdominal trauma is among the leading causes of death in war-injured individuals in developing countries, probably due to late diagnosis and limited treatment capacity [16]. Reviews showed that most war-injured patients have injuries affecting the arms and legs (50%), head (26%), chest (18%) [17], and limbs (33.5%); with bomb explosions the commonest injury mechanism (50.2%) [18].

During the 1998 and 2019 Colombian conflict, a study showed that the risk of death increased by 52% in children aged 0 to 5 years and by 61% in infants under 1 year [19]. A retrospective study focused on brain trauma during the Syrian war revealed that 11% of its participants were injured or killed; while the main mechanisms of injury were shells (65%) and bullets (35%), with penetrating injuries in most cases. Thirty-five per cent of patients were admitted to the intensive care unit, whereas 25% of cases underwent surgery, and 25% experienced neurological disabilities at discharge. The mortality rate during hospitalization was high (33% of cases) and, in addition to the occurrence of sequelae, associated with a high clinical and radiological severity score [20]. In Ukraine, a study focusing particularly on maxillofacial trauma in war-injured individuals showed a profile of trauma patients dominated by male subjects (96.9%), ophthalmic trauma (50.1%) and maxillofacial injuries (18%). Devastating and open injuries were treated as primary interventions in 86.3% of patients, and more than half of the patients received primary maxillofacial care within 24 h of injury [21].

Reports from the World Health Organization (WHO) and the DRC Ministry of Health, released in January 2025, indicate that 2958 war-injured patients benefited from surgical care at several hospitals in Goma, including the Provincial Hospital of North Kivu (PHNK), where nearly 2000 of them were treated. The PHNK is the main referral hospital in the North Kivu province, serving a population of more than 10 million and benefiting from various efforts to strengthen the capacities of service providers. Recently, the PHNK has implemented a structured and computerized medical record with the funding from the European Union, carried out by "ULB Cooperation" in PADISS3 and HPNK Plus projects.

Despite these efforts, the quality of care remains a significant challenge and was likely to be affected during the January 2025 war, leading Goma city to be controlled by the M23-AFC coalition, who defeated the DRC government army forces (FARDC) supported by the "Wazalendo". Clashes between these forces led to a very high number of deaths in very few days and several war-injured individuals who were treated at PHNK, according to reports from United Nations experts. To date, the patterns of trauma care and its outcomes in war-injured patients treated in hospitals of conflict-affected Eastern DRC have not been documented. Thus, this aimed to describe the pathway to care, injury characteristics, referral patterns and treatment outcomes of war-injured patients treated at PHNK during the January 2025 crisis which took place in Goma.

Method

Study design

This retrospective observational study involved participants enrolled among war-injured patients treated at the Provincial Hospital of North Kivu during the January 2025 crisis. This design was chosen to enable gathering information about pathways of care, injury and referral patterns, treatment characteristics and outcomes using a review of patient's medical records.

Study setting

The Provincial Hospital of North Kivu is a tertiary hospital providing specialized surgical and emergency care to patients living in the North Kivu province, especially those living in Goma. It benefits from support aiming at strengthening its capacity from various sources including the European Union, the International Committee of the Red Cross (ICRC), and the WHO, building the capacity of PHNK's health workers in managing patients, subsidizing health-related costs, and gradually improving the care environment and technical health package. Being equipped with sufficient technical capacity, including essential medicines and strong organizational structures, the PHNK was at the center of the care of war-injured patients following the January 2025 crisis in Goma, due to its capacity allowing the management of patients transferred from primary health care hospitals.

Participants

All war-injured patients admitted between 25th January and 31 st March 2025 and treated in the emergency unit of PHNK with available medical records were enrolled in this study. The choice of study period was based on the continued arrival of patients at the PHNK, injured during M23/AFC coalition and FARDC-Wazalendo fighting up to late April 2025. The exclusion criteria were being a war-injured patient treated at the PHNK during the study period with missing data in the medical records and registries.

Data collection procedure

War-injured patients admitted to the PHNK during the study period were treated according to the advanced trauma life support protocol [22], implemented by the ICRC [23]. The developed questionnaire was used to systematically collect information from medical records (hard copy and electronic) and in-hospital registry records from nursing, emergency, and theatre room services, using a triangulation approach. This technique aimed to maximize participant data collection from different sources to overcome the challenge of missing data availed amid crises.

After receiving ethical approval from the Ethics Committee of the North Kivu Provincial Directorate (CNES 028/DPNK/128PP/2025) and permission to collect data from the executive director of the PHNK, we collected data on sociodemographic characteristics of patients (age, sex, marital status, and address) and mode of admission (referred or self-referred). We also collected information on injury patterns (mechanisms, types, severity and site of injury), time interval between the occurrence of trauma and PHNK admission, obtaining first medical aid at the trauma site, and treatment (types and qualities), as well as the severity of injury using the estimated Injury Severity Score (ISS). The estimated ISS is a measure of the anatomical severity of the injuries based on the administrative data and location of the injuries. The ISS score is an ordinal scale ranging from 0 to 75, with A score of ISS >15 indicating major injury [24]. For this study, the injury severity was categorized as "mild injury" for estimated ISS < 9, "moderate injury" if ISS ranges between 9 and 15, "severe injury" for ISS above 15.

To ensure data reliability, the questionnaire written in French was pretested using the five medical records of war-injured patients admitted in April 2025. Data completeness was ensured by the triangulation of information encoded in the electronic patient medical file (using the CERHIS software) and hardcopy medical records and registries. A quality control check was performed by the authors (JBKM and BMNV). After receiving the list of patients from PHNK, data collection lasted from 10th to 30th June 2025.

Study variables

The independent variables included time interval from trauma occurrence to hospital admission, age, sex, marital status, religion, mode of admission, site of injury, traumatic mobility, type of injury, health worker that attended to the patient, first medical aid at trauma site, and type of management at PHNK. The dependent variables were mortality, length of hospital stay, and postoperative infection.

Statistical analyses

Data was analyzed using Stata 15.0 [StataCorp LLC, College Station, TX]. Descriptive analyses were summarized in the form of frequencies, proportions, medians or means and standard deviation. The mortality and postoperative infection rates were computed as the number of war-injured patients who died and those with infection, respectively, divided by the total number of study participants. The length of hospital stay was categorized into three groups (less than 14 days, 15 to 30 days, and more than 30 days).

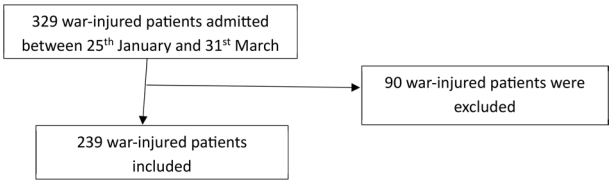

Fig. 1 Patient flow diagram

Results

Socio-demographic characteristics and pathway to care used by war-wounded individuals

Between 25th January and 31st March 2025, 329 war-injured individuals, with the mean age of 29.9 ± 13 years, were treated at the PHNK, among whom 239 were enrolled in this study (Fig. 1). Ninety patients were excluded due to lack of medical records, despite their registration in the emergency room register. Most participants were male (82.3%), aged 18–49 years (76.3%), single (52.2%), and self-referred (87.1%). Penetrating injuries were the most common mechanism of injury (76.7%), among whom 163 cases (i.e. 85.4%) were gunshot wounds. Majority of participants did not benefit from first medical aid at trauma sites (86.7%). Using the estimated ISS score, results revealed that 69.7% of participants had severe injuries. All characteristics of study participants are shown in Table 1.

Management of war-injured patients at provincial hospital of North Kivu

Fifty-seven war-injured individuals (23%) were treated by the ICRC staff. Debridement was performed in 54.4% of cases. In addition, 15.9% of war-injured patients received antitetanic immunization, 13% of cases received physiotherapy, while 7.1% benefited from psychological management, including resilience-building therapy (64.7%) (Table 2).

Outcomes of war-injured patients managed at the provincial hospital of North Kivu

Of 239 study participants, 11 died from war-related injuries (i.e., the mortality rate was 4.4%); among whom, 9 deaths (81.8%) occurred within 48 h from hospital admission, with thoracic (55.6%) and head injuries (22.2%) being the most common. Most war-injured individuals managed at the PHNK were admitted for a period of less than two weeks. Infection of war-related wounds was found in 8% of study participants (42.4%) (Table 3).

Discussion

To the best of the author's knowledge, this study conducted at the Provincial Hospital of Nord-Kivu is the first describing delays in care, referral patterns and management of war-injured individuals in a context of high violence of DRC. The findings indicated that war-injured

Table 1. Sociodemographic characteristics and pathway-to-care patterns of participants in the study on war injuries admitted between 25th January and 31st March 2025 to PHNK, Goma, North Kivu, DRC

Characteristic		Frequency	Percent
Age group (years)			
	0–17	37	14.9
	18–49	190	76.3
	≥ 50	22	8.8
Sex			
	Male	205	82.3
	Female	44	17.7
Marital status			
	Single	130	52.2
	Married	113	45.4
	Divorced	4	1.6
	Widowed	2	0.8
Mode of admission			
	Referred	32	12.8
	Self-Referred	217	87.2
Time interval between trauma occurrence and PHNK admission			
	< 6 in hours	41	16.7
	6–24 in hours	93	37.4
	25–48 in hours	88	35.3
	≥ 48 in hours	27	10.8
Place of trauma occurrence			
	House	51	20.5
	Road	65	26.1
	Workplace	24	9.6
	Other places	109	43.9
Mechanisms of injury ($n = 249$)			
	Penetrating injury	191	76.7
	Blunt injury	52	20.9
	Blast injury	6	2.4
Mechanism of penetrating injury ($n = 191$)			
	Gunshot wounds	163	85.4
	Bomb explosion wounds	18	9.5
	Stab wounds	2	1.1
Estimated ISS score ($n = 249$)			
	Severe injury	173	69.5
	Moderate injury	69	27.7
	Mild injury	7	2.8
Sites of injury			
	Limbs	107	43
	Abdomen	9	2.8
	Chest	46	18.5
	Head	12	4.8
	Others	75	30.1
First aid at trauma site			
Yes		33	13.3
No		216	86.7

Table 2 Management of war-injured patients admitted at the provincial hospital of North Kivu, DRC between 25th January and 31 st March 2025

Variables	Frequency	Percent
Beig managed by ICRC staff (Yes)	57	23
Pain killers (yes)	239	100
Tetanus immunization (Yes)	38	15.9
Antibiotics (Yes)	132	55.2
Debridement (yes)	130	54.4
Thoracic surgery (yes)	41	17.1
Neurological surgery	5	2.1
Eye surgery (Yes)	1	0.4
Abdominal surgery (Yes)	7	2.9
Physiotherapy (Yes)	31	13
Psychological management (Yes)	17	7.1
Types of Psychological therapies		
Psychoeducation	7	41.2
Cognitive behavioral therapy	4	23.5
Resilience Therapy	11	64.7

Table 3 Outcomes of war-injured patients admitted at the provincial hospital of North Kivu, DRC. Between 25th January and 31 st March 2025

Category		Frequency	Percent
Length of hospital stay			
	< 14 days	134	42.4
	15–30 days	118	37.3
	> 30 days	64	20.3
Death			
	Absent	238	95.6
	Present	11	4.4
Time of death after admission			
	≤ 48 h	9	81.8
	> 48 h	2	18.2
Sites of injuries among died war-injured patients			
	Thoracic injury	5	55.6
	Head injury	2	22.2
	Femur fracture	1	11.1
	Abdominal injury	1	11.1
Infection of wounds			
	Present	20	8
	Absent	219	92

patients were primarily young, with a mean age of 29.9 ± 13 years. Young people are usually injured during wartime, as they engage in activities exposing them to gunshot and bomb explosions to assume their family responsibilities. These results are supported by the high proportion of male war-injured individuals in our cohort, a finding that aligns with the study carried out in the Libyan conflict.

[12].

The findings indicating that the majority of war-injured patients were self-referred to the PHNK align with existing studies [25]– [26]. Trauma care during wartime is carried out in the DRC context of insufficient respect for international humanitarian law, particularly the Geneva Conventions (1949), exposing war-injured patients and their companions to being victims of gunshot and bomb explosions. The low referral rate is an effect of a dysfunction of healthcare services [8], the establishment of transfer and counter-transfer services between primary health centers to the PHNK supported by organizations such as the ICRC [23], and the high extra-hospital mortality rates reported during the January 2025 crisis in Goma. The urgency of seeking care for war-related injuries is one of the factors leading to self-referral. This is paradoxically the case in our survey, where war-injured patients revealed in their medical history having received first aid at the trauma site or in another health facility before arriving at PHNK.

The results showing that the majority of patients had penetrating injuries and gunshot wound align with previous studies carried out in war settings [21]. Gunshot and bomb explosions, common mechanisms of injury in war-tone settings, expose individuals living in conflict-affected to multi-organ and severe injuries. This was supported by the high ISS score reported in this study [24]. Severe injuries are causes of extra-hospital death and early in-hospital deaths. War-injured patients enrolled in this study arrived at the PHNK 48 h after the trauma. Although this is like studies carried out in conflict zones [18, 25], this delay is also reported in other traumas, like road trauma survivors [27]. Poor access to appropriate care, fear of being assimilated to belligerents, and financial constraints related to war could impede delays to care, leading to high mortality rates in war-injured patients. Moreover, the delay to care for war injuries calls into question the applicability of a consensual model of war-related trauma care [28], in a context where the majority of health workers in primary health care are not trained in the management of wartime injuries.

Many injured individuals living in Goma, including refugees, were treated at PHNK and benefited from trauma care during their hospitalization. Almost all the war-related injuries benefited from surgical and medical management, including debridement, tetanus immunization and pain killer, in line with the advanced trauma life support and ICRC protocols [22, 23]. Although psychological care of war-injured patients is of paramount importance, only 7.1% of patients treated at PHNK benefited from psychological management. This finding reveals poor attention to post-treatment support for trauma patients, linked to war or not. To date, there are no specific post-treatment interventions applied to limited settings of the DRC. Indeed, psychological and physiotherapy therapies are missing in trauma care for victims of stray bullets, torture, sexual violence and forced labor [3], especially in DRC conflict settings. This low rate of administration

of psychotherapy in trauma patients highlights not only the lack of psychosocial therapies in trauma care for war-injured patients, but also the undocumented burden of serious mental disorders such as depression, anxiety, post-traumatic stress disorder and substance abuse in North Kivu province since the onset of the ongoing crisis. Early and systematic provision of psychological therapies to war-injured people would manage psychological distress, strengthen resilience but prevent the development of these mental disorders [29]. The psychological first aid training applied to the war-tone settings of North Kivu is urgently needed, as well as longitudinal study aiming to assess the incidence and predictors of mental health disorders in trauma patients. These findings also highlighted the need for integrating mental health into trauma care.

Most individuals admitted at PHNK in January 2025 in Goma were injured in their homes, workplace, and other places. Although the battlefield is the site frequently associated with wartime injuries, the occurrence of clashes in the middle of cities increases the risk of stray bullets or bomb shrapnel affecting civilians and refugees in their households [23]. This chaotic situation could affect early access to trauma care of war-injured patients unable to attend PHNK services. Regarding the outcomes of care, 4.4% of war-injured patients treated at PHNK died. 81% of deaths occurred within 48 h of PHNK admission could explain the delay in care in war-tone zones. Although it align with other conflict cohorts [8, 26, 30], this low mortality rate should consider the fact that the most severely injured patients might have not survived long enough to reach a healthcare facility. Other war-trauma patients could have been managed in other hospitals of Goma city. While reports spoke of several cases of death in communities and trauma site during the active period of army fighting (more than 3000 extra-hospital deaths), our cohort consists of 239 war-injured patients treated at PHNK.

The mean length of the hospital stay of participants was 14 days. This duration is related to the context of war injuries, which generally are devastating wounds and fractures. Bone healing may be delayed with sequelae, osteitis and non-union [31–33]. Financial constraints, security liability, poor communication systems and referencing systems led to delays in care [34]. Most war-injured individuals have several complications requiring long-term treatment, including infections, which were reported in this study. During wartime, infections, neurological dysfunctions and mental disorders are usually unnoticed given the context of care and the unauthorized departure of war-injured belligerents.

Limitations

The interpretation of the results should be in line with the following limitations. First, the data collection from medical reports was limited by the absence of key pre-hospital, clinical prognostic, and therapeutic information able to predict mortality, length of hospital stays, and perioperative infection in wartime injuries. While triangulation of data was used to overcome this limitation, information about burns due to bomb explosions and their management was not captured during data collection. Details about the management of wartime injuries (procedures, prescriptions, and interventions) were lacking in both electronic and hard-copy medical records, leading to poor consideration in the analyses of the outcomes. Second, this fragmented data impaired analyses assessing the comparisons between variables, delivered versus expected resources or services and predictions of outcomes. Although the list of war-injured patients and their medical records was available at PHNK, policymakers, stakeholders and organizations should combine efforts to harmonize trauma registries and medical records and promote the implementation of integrated and standardized data collection tools in conflict zones in support of the available registries and medical records from the Ministry of Health of DRC. Third, one-third of the study participants sustained burn injuries from bomb explosions, but various sources of collected data did not provide details about burn patterns. Efforts should be made by clinicians to consider burn information from blast injuries, due to their contributing role in morbidity, mortality, and long-term outcomes in war-related injuries. Fourth, this study enrolled war-injured patients from one hospital, suggesting potential selection biais. This could affect outcomes including mortality as only those with less severe trauma could have access care. Further studies should enroll participants from several hospitals, primary or referral hospitals, to gather more details, including the referral patterns. Lastly, this study presents descriptive data crucial to understanding the phenomena of pathway to care; referral patterns and treatment outcomes of war-injured patients.

Conclusion

This study reveals delays in care, self-referral and mortality in war-injured patients in conflict-affected Eastern DRC. Its findings highlight the understanding of trauma care and contextualization of limited resources during a wartime crisis. They also show that most war-injured patients did not receive appropriate mental health care or physiotherapy, highlighting the need to integrate mental health and rehabilitation into trauma care. This study calls for feasible interventions within the context of high violence of the DRC aiming at strengthening the health system and enhancing community-level capacities to improve the quality of life of war-wounded individuals. This study also showed that, even in contexts of limited resources, a robust health system can deliver an effective

response to acute crises if it is equipped with sufficient technical capacity, well-trained staff, essential medicines, and strong organizational structures able to provide trauma care.

Recommendations

Our findings highlight the limitation of implementing the continuum of the model of trauma care during the emergency response to injuries in the limited context of conflict-affected regions of eastern DRC. The trauma care model, proposed by Wren and colleagues, includes first aid at trauma sites, complex surgical care, burn management, physiotherapy and rehabilitation of war-injured victims at different levels of the health system [28]. Our study is for practical adjustments to the model of trauma care within the health system in eastern DRC to strengthen its resilience to recurrent armed conflicts. Thus, the study findings emphasize the following recommendations aligning with the suggestions of Ugwu et al. on trauma care [35]: i) strengthening and building capacity of stakeholders based at the community level of health system (local employees of ICRC and those of civil protection agencies) on trauma care; (ii) strengthening the health capacities and package of primary health care centers in trauma care and transfer of war-injured patients to referral hospitals; (iii) strengthening and building capacity of primary referral hospitals in trauma and emergency care, resuscitation and stabilization of war-injured patients management of war injuries, physiotherapy, and psychological and mental support of war-injured patients; (iv) strengthening and building capacities of secondary referral hospitals, in management of complex war and non-related injuries, resuscitation and stabilization, physical and mental rehabilitation, establishment of an outpatient emergency medical aid and referral service for war-injured patients and medical and surgical emergencies in conflict affected settings.

Additionally, the study recommends community first responder training on trauma care, strengthened prehospital triage and referral protocols of war-injured individuals, improved communication systems between health facilities and populations. Furthermore, there is a need to integrate trauma care systems in primary health care, including strengthening the technical platform of health services. This study results highlight the need for proper management of medical records to collect key information for patients during wartime.

Abbreviations

DRC	Democratic Republic of Congo
ICRC	International Committee of Red Cross
PHNK	Provincial Hospital of North Kivu
ULB	"Université libre de Bruxelles" - Free University of Brussels
WHO	World Health Organization

Acknowledgements

Authors acknowledge ULB-cooperation Nord-Kivu and PHNK staff for their contribution and cooperation during this study.

Authors' contributions

JBKM, PMN, JRKS, JPN and BMNV conceived and designed the study. JRKS, JBKM, PMN, SMN, JMVTK, AMM and BMNV participated in data collection. JRKS and BMNV analyzed data and wrote the draft of the manuscript. JBKM, PMN, JPN, ME and DK supervised the whole process of the study. All authors have read and approved the final version of the manuscript.

Funding

This study was funded the European Union as part of the PADISS3 project, implemented by "ULB-Coopération Nord-Kivu". This contribution did not influence the study design, collection and analysis of data or the writing of this report. The opinions expressed in this research are solely those of the authors and do not commit the European Union or the NGO "ULB-Coopération".

Data availability

All data generated or analyzed during this study are available upon reasonable request to the corresponding author.

Declarations

Ethics approval and consent to participate

All methods were carried out in accordance with the recommendations of the Declaration of Helsinki. The protocol for this study was reviewed and approved by the Ethics Committee of North Kivu Provincial Directorate (CNES 028/DPNK/128PP/2025). Due to the retrospective nature of the study, the Ethics Committee waived the need to obtain informed consent.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]ULB Coopération, PADISS, Avenue de l'Hôpital, Goma, République démocratique du Congo
[2]Université Officielle de Ruwenzori, Kitulu, Butembo, République démocratique du Congo
[3]Université Libre des pays des Grands Lacs, Himbi, Goma, République démocratique du Congo
[4]Hôpital Provincial du Nord Kivu, Quartier de Volcan, Goma, République démocratique du Congo
[5]Division Provinciale de la Santé du Nord Kivu, Avenue de l'hôpital, Goma, République démocratique du Congo

Received: 27 August 2025 / Accepted: 17 November 2025
Published online: 29 November 2025

References

1. Lussy JP, Dube A, Lusi JK, Kikoli AM, Mukekulu EK, Bartels SA. Trends in sexual violence patterns and case management: a sex disaggregated analysis in Goma, Democratic Republic of congo. Confl Health. 2021;15(1):59.
2. Mukwege D, Mugisho M, Maroyi G. Obstacles to emergency medical consultation in cases of conflict-related sexual violence. PLoS ONE. 2025;20(1):e0317082.
3. Garry S, Checchi F. Armed conflict and public health: into the 21st century. J Public Health. 2020;42(3):e287–98.
4. Khazri A. Le développement durable et les conflits armés. Télescope. 2011;17(2):114–30.
5. Ekzayez A, Alhaj Ahmad Y, Alhaleb H, Checchi F. The impact of armed conflict on utilisation of health services in north-west syria: an observational study. Confl Health. 2021;15(1):91.
6. Kaseya J, Dereje N, Raji T, Ngongo AN, Fallah MP, Ndembi N. Public health emergencies in war and armed conflicts in africa: what is expected from the global health community? BMJ Global Health. 2024;9(3):e015371.

7. Bake JF, Mukama PK, Jean-Pierre MK, Medard KK, Eugene MA. Mortality of trauma patients in conflict-affected region: a retrospective observational study of ICU admissions and surgical management. BMC Surg. 2025;25(1):333.
8. Footer KH, Rubenstein LS. La santé dans les conflits armés: une approche sous l'angle des droits de l'homme. R. int. Croix-Rouge. 2013;95:93–116.
9. Truppa C, Yaacoub S, Valente M, Celentano G, Ragazzoni L, Saulnier D. Health systems resilience in fragile and conflict-affected settings: a systematic scoping review. Confl Health. 2024;18(1):2.
10. Kahindo Mbeva JB, Ahadi S, Vitale M, Prudence MN, Coppieters Y, Chinnici D, Lambert H. Urbanisation and health services: developing a new model of primary health care in Goma (Democratic Republic of Congo). Cities Health. 2022;6(1):57–61.
11. Kadir A, Shenoda S, Goldhagen J. Effects of armed conflict on child health and development: a systematic review. PLoS ONE. 2019;14(1):e0210071.
12. Daw MA, El-Bouzedi AH, Dau AA. Trends and patterns of deaths, injuries and intentional disabilities within the Libyan armed conflict: 2012–2017. PLoS ONE. 2019;14(5):e0216061.
13. Abed Y, Haddaf SA. Fatalities and injuries in the 2014 Gaza conflict: a descriptive study. Lancet. 2017;390:S4.
14. Kaya B, Özsoy S, Balandız H, Safalı M, Akyol M. Evaluation of the effects of explosions: A ten-year retrospective study. Ulus Travma Acil Cerrahi Derg. 2025;31:233–41.
15. Cardi M, Ibrahim K, Alizai SW, Mohammad H, Garatti M, Rainone A, Di Marzo F, La Torre G, Paschetto M, Carbonari L, Mingarelli V. Injury patterns and causes of death in 953 patients with penetrating abdominal war wounds in a civilian independent non-governmental organization hospital in Lashkargah, Afghanistan. World J Emerg Surg. 2019;14(1):51.
16. Awuah WA, Tan JK, Shah MH, Ahluwalia A, Roy S, Ali SH, Ferreira T, Bharadwaj HR, Adebusoye FT, Aderinto N, Mazzoleni A. Addressing abdominal trauma from conflict and warfare in under-resourced regions: A critical narrative review. Health Sci Rep. 2024;7(10):e70151.
17. Chevalley K, Zimmerman J, Mittendorf A, Sennersten F, Dalman A, Frogh S, Ringart T, Robinson Y, Sandström G. Civilian pattern of injuries in armed conflicts–a systematic review. Scand J Trauma Resusc Emerg Med. 2024;32(1):125.
18. Wild H, Stewart BT, LeBoa C, Stave CD, Wren SM. Epidemiology of injuries sustained by civilians and local combatants in contemporary armed conflict: an appeal for a shared trauma registry among humanitarian actors. World J Surg. 2020;44(6):1863–73.
19. Moe CA, Villaveces A, Montoya P, Rowhani-Rahbar A. Excess child mortality associated with colombia's armed Conflict, 1998–2019. JAMA Netw Open. 2024;7(4):e248510.
20. Hanafi I, Munder E, Ahmad S, Arabhamo I, Alziab S, Badin N, Omarain A, Jawish MK, Saleh M, Nickl V, Wipplinger T. War-related traumatic brain injuries during the Syrian armed conflict in Damascus 2014–2017: a cohort study and a literature review. BMC Emerg Med. 2023;23(1):35.
21. Prysiazhniuk O, Palyvoda R, Chepurnyi Y, Pavlychuk T, Chernogorskyi D, Fedirko I, Sazanskyi Y, Kalashnikov D, Kopchak A. War-related maxillofacial injuries in ukraine: a retrospective multicenter study. Archives Craniofac Surg. 2025;26(2):51.
22. DN K, Kiran A. Emergency trauma care: ATLS. J Adv Oral Res. 2011;2(1):13–6.
23. Giannou C, Comité International de la Croix-Rouge, Baldan M. La Chirurgie de Guerre: Travailler avec des Ressources Limitées Dans les Conflits Armés et Autres Situations de Violence. Central Institute for Cotton Research; 2010.
24. Rapsang AG, Shyam DC. Scoring systems of severity in patients with multiple trauma. Cirugía Española (English Edition). 2015;93(4):213–21.
25. Palmier B. Mise En condition de survie des blessés En opération extérieure: procédure et expérience à partir du terrain Afghan. Bull De l'Académie Nationale De médecine. 2012;196(4–5):893–907.
26. Tito MG, Makelele JP, van den Boogaard W, Ade S, Deselets A, Briskin E, Badjo C, Salviati D, Akem ET, Hejdenberg M. Reference des Cas de traumatisme par arme à Feu En afrique. Public Health Action. 2023;13(2):30–5.
27. Kamabu K, La O, Soria J, Tumwesigye D, Okedi XF, Kyomukama L, Muhumuza J, Musinguzi B, Kavuma D, Vivalya BM, Loduk M, Abdullah WS. 24 h mortality and its predictors among road traffic accident victims in a resource limited setting; a multicenter cohort study. BMC Surg. 2023;23(1):97.
28. Wren SM, Wild HB, Gurney J, Amirtharajah M, Brown ZW, Bulger EM, Burkle FM, Elster EA, Forrester JD, Garber K, Gosselin RA. A consensus framework for the humanitarian surgical response to armed conflict in 21st century warfare. JAMA Surg. 2020;155(2):114–21.
29. McDonald L. Psychosocial rehabilitation of civilians in conflict-affected settings. Trauma rehabilitation after war and conflict: Community and individual perspectives. 2010:215–4.
30. Pasquier P, De Rudnicki S, Donat N, Auroy Y, Merat S. Type et épidémiologie des blessures de guerre, à propos des deux conflicts actuels: Irak et Afghanistan. Ann Fr Anesth. 2011;30:819–27.
31. Beltrán Guzmán I, Gil Cuesta J, Trelles M, Jaweed O, Cherestal S, van Loenhout JA, Guha-Sapir D. Delays in arrival and treatment in emergency departments: women, children and non-trauma consultations the most at risk in humanitarian settings. PLoS ONE. 2019;14(3):e0213362.
32. Badkur M, Kharkongor M, Sharma N, Singh S, Khera P, Puranik A, Rodha MS. Factors influencing treatment delays in trauma patients: a three-delay model approach. J Emerg Trauma Shock. 2024;17(3):172–7.
33. Attridge K, Bricknell M. Impact of war on Health. Handbook of global Health, Security, and war. Sep. 2025;15:28–37.
34. Desmoulière F. Principes généraux de La prise En charge des plaies. Actualités Pharmaceutiques. 2020;59(601):8–12.
35. Ugwu CN, Ugwu OP, Alum EU, Eze VH, Basajja M, Ugwu JN, Ogenyi FC, Ejemot-Nwadiaro RI, Okon MB, Egba SI, Uti DE. Sustainable development goals (SDGs) and resilient healthcare systems: addressing medicine and public health challenges in conflict zones. Medicine. 2025;104(7):e41535.

Publisher's Note