

Healthcare system challenges in the Gaza Strip during armed conflict: findings from a cross-sectional survey of medical professionals

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A – Development of the concept and methodology of the study; B – Query – a review and analysis of the literature; C – Submission of the application to the appropriate Bioethics Committee; D – Collection of research material; E – Analysis of the research material; F – Preparation of draft version of manuscript; G – Critical analysis of manuscript draft version; H – Statistical analysis of the research material; I – Interpretation of the performed statistical analysis; K – Technical preparation of manuscript in accordance with the journal regulations; L – Supervision of the research and preparation of the manuscript

Abstract

Introduction. Armed conflicts place considerable strain on healthcare systems by damaging infrastructure, limiting access to essential medical resources and increasing demand for emergency care. This study assessed the functioning of the healthcare system in the Gaza Strip during the ongoing conflict from the perspective of healthcare professionals working in the region.

Material and methods. A cross-sectional survey was conducted between December 2023 and May 2024 among 57 healthcare professionals working in six major hospitals in the Gaza Strip. The questionnaire assessed healthcare system performance, availability of personnel and medical resources and the types of injuries encountered in daily practice. Descriptive statistics, the chi-square test and the Wilcoxon signed-rank test were used for data analysis.

Results. The most commonly reported shortages involved dressing materials (26.0%), water (20.1%), medications (16.0%), and specialized medical equipment (12.4%). More than half of respondents reported that at least half of injured patients required immediate medical attention. The distribution of reported injuries associated with mortality differed significantly from the expected distribution ($\chi^2(15) = 51.87$; $p < 0.001$), with burns reported more frequently than expected. Respondents also reported a marked decline in the healthcare system performance after the onset of the conflict (mean score 2.82 vs. 1.49; $Z = -5.55$; $p < 0.001$).

Conclusions. The findings show that the deterioration of healthcare delivery in the Gaza Strip is driven not only by damage to medical infrastructure but also by shortages of essential supplies and the increasing burden placed on healthcare workers. Overall, these challenges may limit the capacity to provide timely and effective care, particularly for patients with severe trauma. The strengthening of healthcare systems in conflict settings requires protecting healthcare personnel, maintaining reliable supply chains and ensuring uninterrupted access to essential medical resources.

Keywords: health systems resilience, armed conflicts, health services accessibility, wounds and injuries, Gaza Strip.

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INTRODUCTION

The healthcare system in the Gaza Strip faces severe structural constraints that limit the delivery of essential medical services during periods of armed conflict. With a population of approximately 2 million people living in one of the most densely populated areas in the world, the healthcare infrastructure operates under sustained pressure related to shortages of essential supplies, restrictions on the movement of patients and medical personnel, and repeated disruptions to supply chains [1-4]. Hospitals that are still operating, including Al-Shifa Medical Complex, continue to face serious shortages of medicines, medical supplies and equipment, along with limited access to water and other essential services. Other facilities, such as the European Gaza Hospital, have been forced to close and have remained out of service since May 2025 [4,5].

According to the latest WHO data, approximately half of Gaza's hospitals remain at least partially functional, with a similar proportion of primary healthcare centres still in operation. Damage to infrastructure, shortages of equipment and interruptions in electricity supply continue to affect the provision of emergency and specialized services. Similar patterns of disruption to healthcare delivery during armed conflict have been documented in other conflict-affected settings, including Syria, Ukraine and Sudan, where attacks on health facilities and personnel substantially reduced access to care and weakened system capacity [8-11,19].

Understanding how these constraints affect the healthcare delivery from the perspective of frontline professionals is essential for identifying priority needs and strengthening health system resilience in fragile settings. The present study therefore aimed to assess the perceived functioning of the healthcare system in the Gaza Strip during ongoing armed conflict,

to identify critical shortages affecting service delivery and characterize injury patterns encountered by healthcare workers providing care under emergency conditions.

MATERIALS AND METHODS

A cross-sectional survey was conducted between December 2023 and May 2024 among healthcare professionals working in major referral hospitals in the Gaza Strip during the ongoing armed conflict. Participants were recruited using purposive sampling from institutions providing emergency and trauma care. Due to operational constraints, including disruptions to communication and staff availability, the response rate could not be formally calculated.

The study included 57 healthcare professionals from six key secondary and tertiary care hospitals: Shuhada Alaqsa Hospital, Abu Yousef Alnajjar Hospital, Al-Shifa Medical Complex, Kamal Udwan Hospital, Naser Hospital and the European Gaza Hospital. Physicians constituted 91.2% of respondents and paramedical personnel 8.8%, with professional experience ranging from 1 to 20 years (mean = 7.56; SD = 6.41).

A structured questionnaire assessed workforce availability, infrastructure functionality, access to essential supplies, injury patterns and perceived changes in healthcare system performance before and after the onset of hostilities. Open-ended responses were analysed using thematic content analysis, while quantitative data were examined using descriptive statistics and inferential methods.

Differences between observed and expected distributions were evaluated using the chi-square test of concordance, and changes in system performance were analysed using the Wilcoxon signed-rank test ($p < 0.05$).

Ethical approval was obtained from the Ministry of Health of the State of Palestine. Participation was voluntary, written informed consent was obtained, and responses were anonymized prior to analysis.

RESULTS

Most respondents reported that they most frequently provided medical first aid (63.2%), while 36.8% indicated surgical interventions as their primary form of emergency assistance. Participants identified several major consequences associated with attacks on medical facilities, including insufficient medical staff (23.7%) and lack of proper medical equipment (20.6%). Other commonly reported challenges included high patient mortality rates (17.5%), depression resulting from lived experiences (12.4%), difficult working conditions for doctors (9.3%), and total destruction of the healthcare system (7.2%). Working under stress (7.2%) and limited access to water and electricity (2.1%) were reported less frequently.

Regarding injury patterns, burns were reported most frequently (16.9%), followed by head injuries and multi-organ injuries (13.5% each), hemorrhages (12.4%), and explosion-related injuries (10.1%). Abdominal perforations and infections were each reported by 9.0% of respondents, while gunshot injuries accounted for 6.7%. Hypovolemic shock (4.5%), fractures (3.4%), and sepsis (1.1%) were reported less often.

Overall, more than half of respondents (54.4%) indicated that at least 50% of patients required immediate medical assistance during the armed conflict. Although the distribution of responses did not differ significantly from expected frequencies

($\chi^2(3) = 3.42$; $p = 0.331$), these findings suggest a substantial increase in the demand for urgent care with important implications for emergency preparedness, workforce capacity, and resource allocation.

Further analysis of critical deficiencies in medical facilities demonstrated significant differences between observed and expected response frequencies ($\chi^2(7) = 58.17$; $p < 0.001$). Dressing materials (26.0%) and water shortages (20.1%) were reported most frequently, followed by shortages of medications (16.0%) and specialized equipment (12.4%). Electricity (9.5%) and surgical instruments (8.3%) were reported less often, while medical personnel (4.1%) and hospital beds (3.6%) were least frequently identified as primary limiting factors. Overall, these findings highlight major disruptions in access to essential consumables and infrastructure required to maintain continuity of care during armed conflict.

During the ongoing armed conflict, the most common injuries experienced by victims included burns, multi-organ injuries and limb fractures. To verify this observation, a chi-square (χ^2)

TABLE 1. Most common injuries that result in the death of the injured.

Responses	f_o	%	f_e	R	SR	χ^2
Injuries after the explosion	11	10.9%	6.7	4.3	1.6	51.87; $p < 0,001$
Amputation of limbs	8	7.9%	6.7	1.3	0.5	
Burns	20	19.8%	6.7	13.3	5.1	
Trauma	2	2.0%	6.7	-4.7	-1.8	
Fractures	9	8.9%	6.7	2.3	0.9	
Head injuries	9	8.9%	6.7	2.3	0.9	
Chest injuries	6	5.9%	6.7	-0.7	-0.3	
Extremity injuries	5	5.0%	6.7	-1.7	-0.7	
Penetrating injuries	4	4.0%	6.7	-2.7	-1.1	
Multi-organ injuries	5	5.0%	6.7	-1.7	-0.7	
Injuries to the abdomen and internal organs	10	9.9%	6.7	3.3	1.3	
Hypovolemic shock (blood shortage)	3	3.0%	6.7	-3.7	-1.4	
Blunt injuries	5	5.0%	6.7	-1.7	-0.7	
Hemorrhages	3	3.0%	6.7	-3.7	-1.4	
Retinal detachment	1	1.0%	6.7	-5.7	-2.2	
Total	101	100.0%	101			

Annotation. f_o – observed counts; f_e , expected counts; R – residuals (difference between observed and expected counts); SR, standardized residuals.

test of concordance was conducted. The distribution of responses to the question “What are the most common injuries that result in the death of the injured?” was subsequently analyzed.

The above analysis in Table 1 showed significant deviations of the observed abundance from the expected abundance, $\chi^2(15) = 51.87$; $p < 0,001$. Burns were indicated significantly more often (19.8%). In contrast, retinal detachment was significantly less frequent (1%). The number of responses that did not differ significantly from the expected value ($f_e = 6.3$) were blast injuries (10.9%), limb amputation (7.9%), trauma (2%), fractures (8.9%), head injuries (8.9%), chest injuries (5.9%), limb injuries (5%), penetrating injuries (4%), multi-organ injuries (5%), abdominal and internal organ injuries (9.9%), hypovolemic shock (3%), blunt injuries (5%), and hemorrhages (3%). According to the above data, “burns” was indicated

significantly more often. These findings suggest that burn-related injuries may represent a disproportionately critical driver of mortality in this setting and highlighting the need for targeted resources and specialized care capacity in managing such trauma under conflict conditions.

The questionnaire results indicated a statistically significant difference in respondents' assessments of the Palestinian healthcare system before and after the outbreak of armed conflict. The condition of the healthcare system prior to the conflict was rated substantially higher (mean = 2.82; median = 3.0) than after the onset of hostilities (mean = 1.49; median = 1.0), with a significant difference confirmed by the Wilcoxon signed-rank test ($Z = -5.55$; $p < 0.001$; $r = 0.98$). These findings indicate a marked deterioration in healthcare system performance associated with increased pressure on personnel, infrastructure limitations and restricted access to essential supplies.

DISCUSSION

The study findings indicate that the deterioration of healthcare delivery during the ongoing conflict cannot be explained solely by damage to hospitals and other medical facilities. Disruptions in the supply of essential materials, together with the growing workload faced by healthcare professionals, appear to have had an equally important impact on the ability to provide timely and effective care. Although shortages of medical personnel were reported less frequently than deficits in dressings, water and medications, these problems are closely related and collectively weaken the capacity of the healthcare system. The high proportion of burn injuries among fatal cases also reflects the specific pattern of trauma observed in densely populated urban conflict settings and underlines the need for adequate burn care resources. Similar disruptions have been reported in other conflict-affected regions, where attacks on healthcare infrastructure, shortages of essential supplies and limited workforce capacity have substantially reduced access to both emergency and routine medical services [15-20].

Blanchet also noted that effective support for people affected by armed conflict often depends on cooperation between different organizations, including charities and religious institutions [15]. Similarly, Abed highlighted the need to maintain the psychological well-being of healthcare workers exposed to prolonged stress, trauma and responsibility related to civilian casualties, including children, which may impair decision-making capacity and increase the risk of mental disorders and post-traumatic stress disorder (PTSD) [16]. Limited access to essential supplies, electricity and clean water further intensifies feelings of helplessness among medical staff and reduces their ability to provide effective care.

Similar challenges have been reported in other conflict-affected settings, where shortages of healthcare personnel and limited access to essential services place additional pressure on already strained health systems [17,18]. In Afghanistan, these difficulties have been linked to staff shortages, financial barriers and disruptions in access to care [18]. In Tigray, the war severely restricted access to healthcare and contributed to increased mortality among children under five [19]. The conflict in Sudan has also affected medical education, with more than half of medical schools in conflict-affected areas reporting attacks during the first months of the war [20]. Together, these examples show how armed conflict can affect healthcare at different levels, from access to essential services to the training of future healthcare professionals.

Several limitations should be considered when interpreting these results. The relatively small sample size ($n = 57$) limits the statistical power and generalizability. In addition, reliance on self-reported survey data introduces potential recall and reporting bias, particularly in a high-stress conflict environment. Finally, the cross-sectional design does not allow assessment of temporal trends or causal relationships between armed conflict exposure and changes in healthcare system performance.

Moreover, the sample was limited to hospital-based professionals and did not include perspectives from primary care providers or humanitarian field staff. The use of open-ended questions may have introduced subjectivity despite standardized analysis procedures, and the absence of triangulation with objective system-level indicators further constrains interpretation. The findings reflect the situation at the time of the study and should be interpreted with caution, as conditions in an ongoing armed conflict can change rapidly.

CONCLUSIONS

The study showed that the healthcare system was already rated relatively poorly in the Gaza Strip and a further marked decline following the onset of the conflict. Although fewer than half of patients required immediate medical attention, restricted access to medicines and specialized equipment significantly limited the ability to provide adequate care for injured patients. These constraints may adversely affect clinical outcomes, particularly among patients with burns and blast injuries, which are frequently associated with multi-organ trauma, head injuries, and internal organ damage.

The survey findings indicate a critical shortage of healthcare personnel, with only 4.1% of respondents reporting adequate staffing levels. Overburdened hospitals also experienced prolonged hospital stays due to insufficient bed availability (3.6%) and delayed access to procedures. Shortages of essential resources were also frequently reported, particularly dressing materials (26%), water (20.1%), and medications, indicate substantial constraints in the availability of essential resources and contribute to worsening clinical outcomes.

Statistical analysis confirmed a significant decline in healthcare system performance following the onset of conflict ($Z = -5.55$; $p < 0.001$), with mean and median ratings decreasing from 2.82 and 3.0 before the conflict to 1.49 and 1.0 afterward. The predominance of high-severity injuries, especially burns and multi-organ trauma, suggests a shift toward emergency-dominated care, reducing the capacity to manage routine and chronic conditions.

Overall, these findings confirm that healthcare systems in conflict-affected regions face severe shortages of personnel, infrastructure and essential supplies, contributing to a transition toward crisis-oriented care and directly influencing clinical outcomes.

Ethics approval and consent to participate

We confirm that ethical approval has been obtained for the study conducted and the Minister of Health of the State of Palestine.

Declaration of participation

Each participant in the study gave informed consent to participate. The statement is also part of the research questionnaire.

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AI statement

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) to assist with literature searches, abstract shortening, and the linguistic refinement of selected sentences. The authors have reviewed and edited the output and take full responsibility for the content of this publication.

REFERENCES

1. Aly S, Surapaneni T, Subeh M, et al. Spatial-temporal patterns and typology of attacks against healthcare in the Occupied Palestinian Territory. *East Mediterr Health J.* 2025;31(2):59-67.
2. Palestinian Central Bureau of Statistics. Ramallah: PCBS. Available from: <https://www.pcbs.gov.ps> [cited 2023 Oct 15]
3. World Health Organization. Occupied Palestinian Territory: WHO Health Emergency Appeal 2026. Geneva: World Health Organization; 2026. Available from: <https://www.who.int/publications/m/item/occupied-palestinian-territory--who-health-emergency-appeal-2026> [cited 2026 Sep 29]
4. Poole DN, Andersen D, Raymond NA, et al. Damage to medical complexes in the Gaza Strip during the Israel–Hamas war: a geospatial analysis. *BMJ Glob Health.* 2024;9(4):e014768. <https://doi.org/10.1136/bmjgh-2023-014768>
5. World Health Organization. HeRAMS occupied Palestinian territory: Gaza infographics April 2026. Geneva: World Health Organization; 2026. Available from: <https://www.who.int/publications/m/item/herams-opt-gaza-infographics-2026-07> [cited 2026 Sep 29]
6. Safeguarding Health in Conflict Coalition. Care in the Crosshairs: Violence Against Health Care in Conflict 2025. Washington (DC): SHCC; 2026. Available from: <https://www.insecurityinsight.org/wp-content/uploads/2026/04/2025-SHCC-Annual-Report.pdf> [cited 2026 Sep 29]
7. Afzal MH, Jafar AJN. A scoping review of the wider and long-term impacts of attacks on healthcare in conflict zones. *Med Confl Surviv.* 2019;35(1):43-64. <https://doi.org/10.1080/13623699.2019.1589687>
8. Bielka K, Kuchyn I, Horoshko V. Intensive care units during the Ukraine war: challenges and opportunities. *Intensive Care Med.* 2023;49:1011-1014. <https://doi.org/10.1007/s00134-023-07117-5>
9. Gostin LO, Rubenstein LS. Attacks on health care in the war in Ukraine: international law and the need for accountability. *JAMA.* 2022;327(16):1541-1542. <https://doi.org/10.1001/jama.2022.6045>
10. Barten DG, Tin D, Granholm F, et al. Attacks on Ukrainian healthcare facilities during the first year of the full-scale Russian invasion of Ukraine. *Confl Health.* 2023;17:57. <https://doi.org/10.1186/s13031-023-00557-2>
11. Fouad FM, Sparrow A, Tarakji A, et al. Health workers and the weaponisation of health care in Syria: a preliminary inquiry for The Lancet-American University of Beirut Commission on Syria. *Lancet.* 2017;390(10111):2516-2526. [https://doi.org/10.1016/S0140-6736\(17\)30741-9](https://doi.org/10.1016/S0140-6736(17)30741-9)
12. Meier BM, Rice H, Bandara S. Monitoring attacks on health care as a basis to facilitate accountability for human rights violations. *Health Hum Rights.* 2021;23(1):55-70.
13. Agresti A. Categorical data analysis. 2nd ed. Hoboken (NJ): John Wiley & Sons; 2002.
14. George D, Mallery P. IBM SPSS statistics 26 step by step: a simple guide and reference. 16th ed. New York: Routledge; 2020.
15. Górska E. Development aid in Palestine: wrong assumptions and maintaining the status quo. *Politeja.* 2019;16(4):317-339. <https://doi.org/10.12797/Politeja.16.2019.61.18>
16. Blanchet K, Najem M, Shadid L, et al. Rebuilding the health sector in Gaza: alternative humanitarian voices. *Confl Health.* 2024;18(1):42. <https://doi.org/10.1186/s13031-024-00599-0>
17. Abed Alah M. Echoes of conflict: the enduring mental health struggle of Gaza healthcare workers. *Confl Health.* 2024;18(1):21. <https://doi.org/10.1186/s13031-024-00577-6>
18. Lamberti-Castronuovo A, Valente M, Bocchini F, et al. Exploring barriers to access to care following the 2021 socio-political changes in Afghanistan: a qualitative study. *Confl Health.* 2024;18(1):36. <https://doi.org/10.1186/s13031-024-00595-4>
19. Abreha BB, Fisseha G, Tsadik M, et al. Under-five mortality during the war in Tigray: a community-based study. *Confl Health.* 2024;18(1):55. <https://doi.org/10.1186/s13031-024-00614-4>
20. Mahgoub EAA, Khairy A, Osman S, et al. War and education: the attacks on medical schools amidst ongoing armed conflict, Sudan 2023. *Confl Health.* 2024;18:23. <https://doi.org/10.1186/s13031-024-00584-7>
21. Makali SL, Lembebu JC, Boroto R, et al. Violence against health care workers in a crisis context: a mixed cross-sectional study in Eastern Democratic Republic of Congo. *Confl Health.* 2023;17:44. <https://doi.org/10.1186/s13031-023-00541-w>

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