International Journal of Academic Health and Medical Research (IJAHMR)
ISSN: 2643-9824
Vol. 10 Issue 8 August - 2026, Pages: 146-151

The Effect of the War in Sudan on the Health System in Wad Medani, Gezira State

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***Abstract**: The armed conflict that began in Sudan on 15 April 2023 has produced a profound humanitarian and health-system crisis. Wad Medani (Wad Madani), the capital of Gezira State, became an important refuge and service centre during the early stages of the conflict, but the expansion of fighting into Gezira in December 2023 severely disrupted healthcare delivery. This narrative review examines the effects of the war on the health system in Wad Medani, focusing on health infrastructure, health workers, medicines and medical supplies, service delivery, infectious diseases, maternal and child health, chronic disease and specialized care, displacement, mental health, and health-system resilience. Evidence from peer-reviewed literature and humanitarian reports indicates that conflict-related insecurity, attacks and occupation of health facilities, displacement of health professionals, shortages of medicines and supplies, interrupted referral pathways, and damage to essential infrastructure have substantially reduced access to care. In Madani locality, UNICEF reported supporting 35 of 75 health facilities in February 2024, illustrating both the scale of disruption and the importance of humanitarian support. Specialized services, including oncology and dialysis, have been particularly vulnerable to interruption. The review argues that recovery requires more than reopening facilities: it requires protection of health workers and patients, restoration of supply chains and referral networks, sustained financing, support for primary healthcare, disease surveillance, mental-health services, and long-term reconstruction based on resilience and local leadership.*

Keywords
Sudan; armed conflict; Wad Medani; Wad Madani; Gezira State; health system; healthcare access; hospitals; health workers; displacement; humanitarian crisis.

1. Introduction

Sudan's armed conflict began on 15 April 2023 between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF). The conflict rapidly damaged an already under-resourced health system through violence against healthcare, displacement, loss of personnel, interruption of supply chains, and closure or reduced functioning of health facilities. A peer-reviewed analysis described the national health system as facing destruction, disruption, and disaster, reporting that only about one-third of hospitals in conflict zones were operational at the time of its assessment and that essential services such as emergency care, obstetric services, and dialysis were severely disrupted [1].

Wad Medani is the capital and major urban centre of Gezira State and has historically served as an important centre for healthcare, education, agriculture, and referral services. Its health institutions include referral hospitals and specialized facilities linked to the University of Gezira. The city therefore became particularly important when fighting and displacement disrupted services in Khartoum and other areas. However, the extension of fighting into Gezira State transformed Wad Medani from a relative area of service concentration into a conflict-affected health environment. UNICEF reported that the escalation in Gezira displaced approximately half a million people in December 2023 and that insecurity, access constraints, and limited humanitarian personnel affected aid delivery [2].

This review synthesizes available evidence on how the war affected the health system in Wad Medani and the surrounding Gezira context. Because conflict conditions limit systematic data collection, the review combines peer-reviewed studies with reports from humanitarian organizations. The purpose is to identify the principal pathways through which war has weakened health-system capacity and to highlight priorities for recovery and resilience.

2. Review Approach

This narrative review draws on peer-reviewed publications indexed in PubMed and publicly available reports from UNICEF and other humanitarian sources. Literature was selected for relevance to Sudan's health-system disruption, the effects of the conflict on healthcare facilities and workers, and evidence specifically related to Wad Medani or Gezira State. The evidence was organized thematically around health-system infrastructure, workforce, medicines and supplies, service delivery, population health, and

recovery. Given the rapidly changing conflict environment, reported figures should be interpreted as time-specific estimates rather than complete measurements of the current situation.

3. Impact on Health Infrastructure

Health infrastructure in Wad Medani was affected through the broader collapse of health services in Sudan and the direct expansion of conflict into Gezira State. The national literature documents attacks on healthcare facilities, occupation or militarization of medical sites, looting, power interruptions, and shortages of essential resources [1,3]. These mechanisms are especially damaging in a referral city because the loss of a single tertiary or specialized facility can affect patients from a large surrounding population.

Humanitarian evidence demonstrates the scale of the challenge in Madani locality. In February 2024, UNICEF reported supporting 35 of 75 health facilities in Madani locality, reaching more than 150,000 people with lifesaving services [4]. The fact that external support was required across nearly half of the listed facilities illustrates the extent to which routine health-system capacity had been compromised. UNICEF had previously reported that, in conflict-affected Madani, it supported 11 primary healthcare centres and two hospitals to maintain essential services [5].

Infrastructure disruption also includes less visible systems that are essential for safe care. Electricity, water, sanitation, communications, laboratory capacity, oxygen, waste management, cold-chain systems, and transportation are all vulnerable during armed conflict. Even when a building remains physically intact, interruption of these supporting systems can make clinical services unsafe or impossible.

4. Health Workforce and Professional Capacity

The health workforce is one of the most important health-system assets lost during conflict. Sudanese clinicians and other health professionals have faced displacement, insecurity, interrupted salaries and working conditions, and the need to leave conflict-affected areas. A national review identified the exodus of health workers as a major contributor to health-system deterioration [1]. Another study of Sudanese surgical practitioners found that two-thirds of respondents had either left Sudan or been internally displaced, while 51% were no longer practising because they had fled conflict areas or because their hospitals were out of service [6].

For Wad Medani, workforce disruption has an additional effect because the city historically functioned as a major medical and educational centre. The loss or displacement of specialists affects not only direct patient care but also teaching, supervision, referral coordination, research, and the ability to maintain complex services. Workforce shortages can increase workload for remaining staff, contribute to burnout, reduce service hours, and weaken infection prevention and clinical governance.

Protecting health workers is therefore not simply an ethical obligation; it is a central health-system intervention. Maintaining safe working environments, regular remuneration, psychosocial support, and mechanisms for displaced professionals to contribute remotely or return safely can help preserve institutional capacity.

5. Medicines, Equipment, and Supply Chains

War has disrupted the movement and availability of medicines, laboratory materials, surgical supplies, vaccines, blood products, and other essential commodities. The national health-system literature describes shortages, looting of facilities and humanitarian supplies, destruction of infrastructure, and disruption of supply chains [3]. In a referral centre such as Wad Medani, interruptions in supply chains can quickly affect both emergency care and chronic disease management.

The problem is not limited to the quantity of medicines. Conflict can also interrupt procurement, warehousing, transportation, cold-chain maintenance, quality control, and distribution. Consequently, patients may experience repeated stock-outs or be forced to travel to alternative facilities. Such fragmentation is particularly dangerous for patients requiring uninterrupted treatment, including people with kidney disease, diabetes, hypertension, cancer, epilepsy, and other chronic conditions.

Humanitarian partners helped mitigate shortages in 2023 and 2024 through delivery of health commodities, vaccines, nutrition supplies, and support to functioning facilities [2,4,5]. However, humanitarian supply mechanisms cannot fully substitute for a stable national and state health-supply system. Recovery should therefore include restoration of routine procurement and distribution networks alongside emergency assistance.

6. Disruption of Essential Health Services

The consequences of conflict are most visible in interrupted access to essential health services. Emergency and surgical care depend on functioning hospitals, trained personnel, electricity, blood supplies, medicines, operating theatres, imaging, laboratories, and referral transport. When several of these components fail simultaneously, conditions that would normally be treatable can become life-threatening.

Maternal and newborn health are particularly vulnerable. National evidence shows that obstetric services were among the essential services disrupted by the war [1]. Delays in reaching facilities can increase the risk of complications from haemorrhage, hypertensive disorders, obstructed labour, sepsis, and neonatal emergencies. In Wad Medani, the concentration of displaced populations also increased demand for reproductive, maternal, newborn, and child health services at the same time that resources were constrained.

Primary healthcare has an important protective role during conflict because it can provide vaccination, antenatal care, treatment of common illnesses, nutrition screening, chronic disease follow-up, and early detection of outbreaks closer to communities. UNICEF's support to dozens of facilities in Madani locality demonstrates the importance of sustaining primary-level services even when referral hospitals are under severe pressure [4].

7. Infectious Diseases, Nutrition, and Public Health

Conflict increases infectious-disease risk through displacement, overcrowding, inadequate water and sanitation, interrupted vaccination, reduced surveillance, and limited access to treatment. UNICEF reported that Gezira State had more than 1,800 suspected cholera cases during the late-2023 escalation and highlighted the wider deterioration of health services and severe shortages of health personnel [2]. Later humanitarian reporting documented continuing cholera transmission across Sudan and emphasized that surveillance was limited in conflict-affected areas [7].

Displacement also increases the risk of malnutrition. In Gezira, UNICEF documented increased malnutrition among children at health facilities, including a report from Al-Dabbaghah Health Centre where monthly cases rose substantially and most identified cases were among displaced people [8]. This demonstrates how conflict affects health indirectly through food insecurity, loss of livelihoods, displacement, and reduced access to routine preventive services.

The public-health consequences extend beyond outbreaks. Interrupted vaccination programs can increase susceptibility to measles and polio, while weakened surveillance delays recognition and response. Maintaining laboratory services, vaccination, water and sanitation interventions, nutrition programs, and community health education is therefore as important as maintaining hospital beds.

8. Chronic Disease and Specialized Care

Patients with chronic and specialized conditions face some of the greatest risks when health systems fragment. Dialysis requires repeated visits, reliable water and electricity, functioning machines, trained personnel, consumables, and timely referral. A multicentre study of hemodialysis patients in Sudan included a centre in Gezira State and found substantial displacement and employment disruption among patients after the war, illustrating how conflict affects both healthcare access and the socioeconomic conditions needed to sustain treatment [9].

Cancer care provides another important example. The National Cancer Institute in Wad Medani was one of Sudan's major oncology centres. A 2024 analysis reported that the institute became nonfunctional after the conflict spread to Gezira State, interrupting diagnostics and treatment and forcing patients and oncology professionals to experience repeated displacement and discontinuity of care [10]. For cancer patients, interruption of chemotherapy, radiotherapy, surgery, pathology, or supportive treatment can result in disease progression and loss of previously achieved treatment gains.

These examples show why health-system recovery should not focus exclusively on trauma and emergency medicine. A resilient conflict-affected health system must maintain continuity of care for chronic and specialized conditions alongside emergency response.

9. Mental Health and Psychosocial Consequences

The war has produced widespread psychological distress among patients, health workers, displaced families, and communities. Repeated exposure to violence, bereavement, displacement, loss of livelihoods, uncertainty, and interruption of education and employment can contribute to anxiety, depression, post-traumatic stress symptoms, and other mental-health problems.

Mental-health services are often among the first services to be deprioritized during humanitarian emergencies, despite increasing need. The health-system response in Wad Medani should therefore integrate basic psychosocial support into primary healthcare, maternal and child services, chronic disease care, and community programs. Health workers themselves also require confidential psychological support and safe referral options.

10. Effects on Health Equity and Vulnerable Populations

The war has not affected all residents equally. Displaced people, children, pregnant women, older adults, people with disabilities, patients with chronic disease, and those living far from functioning facilities face greater barriers to care. Displacement can also increase the cost of transport and medicines while reducing household income. UNICEF estimated that the December 2023 escalation in Gezira displaced around half a million people, placing additional pressure on host communities and health facilities [2].

The result is a cycle in which the people with the greatest health needs may have the least ability to reach care. Effective recovery must therefore use equity as a core planning principle. Outreach services, mobile clinics where appropriate, community health workers, subsidized transport, medication distribution closer to patients, and targeted nutrition and maternal-child programs can help reduce these disparities.

11. Health-System Resilience and Humanitarian Response

Despite severe disruption, healthcare workers, communities, government structures, universities, and humanitarian organizations have continued to provide services. UNICEF and partners supported health facilities, vaccination, nutrition, water, and psychosocial interventions during the crisis [4,5,7]. These efforts demonstrate that local capacity has not disappeared; rather, it has been operating under extreme constraints.

A resilient recovery strategy for Wad Medani should include five linked priorities. First, healthcare facilities and personnel must be protected in accordance with international humanitarian law. Second, essential supply chains should be restored with reliable procurement, warehousing, transportation, and cold-chain capacity. Third, primary healthcare should be strengthened to provide accessible preventive and basic curative services while referral hospitals are rehabilitated. Fourth, continuity mechanisms should be established for dialysis, cancer treatment, maternal care, vaccination, mental health, and other essential services. Fifth, health information and surveillance systems should be rebuilt so that decisions are based on timely local data.

Reconstruction should also involve the University of Gezira and local professional leadership. Local institutions understand the service geography, workforce constraints, disease patterns, and community priorities of the region. International partners can provide financing, technical expertise, commodities, and emergency support, but long-term recovery is more likely to be sustainable when local institutions lead planning and implementation.

12. Discussion

The experience of Wad Medani illustrates how armed conflict damages health systems through interconnected pathways rather than through facility destruction alone. A hospital can remain standing but become nonfunctional if staff flee, medicines run out, electricity fails, referral roads become unsafe, or patients cannot afford transportation. Conversely, a partially functioning facility can remain lifesaving when supported by health workers, humanitarian supplies, reliable referral pathways, and community trust.

The evidence also indicates that the war has shifted the role of Wad Medani's health system. Before the conflict, the city served its resident population and surrounding communities. During the war, it became part of a wider humanitarian network supporting displaced people and patients whose original services had collapsed. This increased demand occurred simultaneously with the deterioration of the local health-system infrastructure. The resulting mismatch between population need and system capacity is a central determinant of health outcomes.

A further lesson is that emergency health response and health-system recovery cannot be separated. Humanitarian agencies may keep facilities functioning in the short term, but dependence on temporary financing and parallel supply systems can become unsustainable. Recovery planning should begin during the emergency phase, with attention to governance, workforce retention, financing, infrastructure rehabilitation, data systems, and continuity of care.

The available evidence has limitations. Many reports are produced during rapidly changing conditions, and security constraints prevent complete facility assessments. National studies may not provide Wad Medani-specific estimates, while humanitarian reports often cover defined periods rather than the entire conflict. Future research should therefore prioritize longitudinal facility

assessments, health-worker retention studies, patient-access surveys, mortality and morbidity surveillance, and evaluations of humanitarian interventions in Gezira State.

13. Recommendations

- Protect healthcare workers, patients, ambulances, hospitals, primary healthcare centres, pharmacies, laboratories, and medical warehouses from attack, occupation, and interference.
- Restore and maintain essential infrastructure, especially electricity, water, sanitation, oxygen, laboratory services, communications, and cold-chain capacity.
- Strengthen primary healthcare in Wad Medani and surrounding communities through stable financing, essential medicines, vaccination, maternal-child health, nutrition, and community-based services.
- Re-establish reliable referral and emergency transport networks connecting primary facilities with functioning hospitals and specialized centres.
- Create continuity-of-care programs for dialysis, cancer, diabetes, hypertension, epilepsy, and other chronic conditions, including medication refill mechanisms for displaced patients.
- Support retention and return of health professionals through safe working conditions, regular payment, accommodation where needed, continuing professional development, and psychosocial support.
- Strengthen disease surveillance and rapid response for cholera, measles, malaria, polio, and other epidemic-prone diseases, with particular attention to displaced populations.
- Integrate mental-health and psychosocial support into primary healthcare and humanitarian services for both communities and health workers.
- Use coordinated humanitarian financing to avoid prolonged interruptions in essential services and gradually transition emergency support into sustainable state and community health-system financing.
- Establish a locally led health-system recovery plan involving the Gezira State Ministry of Health, University of Gezira, health professionals, communities, humanitarian organizations, and international partners.

14. Conclusion

The war in Sudan has had a profound effect on the health system in Wad Medani and Gezira State. The consequences extend from damage and disruption of health facilities to workforce displacement, shortages of medicines and supplies, interruption of referral systems, increased infectious-disease and malnutrition risks, and loss of continuity for patients requiring specialized and chronic care. The disruption is particularly significant because Wad Medani has functioned as a major health and referral centre for Gezira and surrounding populations.

Evidence from humanitarian reports and peer-reviewed studies shows that maintaining even basic healthcare has required substantial external support. Yet the persistence of local health workers, institutions, and humanitarian partnerships provides a foundation for recovery. The priority should be to protect healthcare, restore essential services, rebuild supply and referral systems, retain and support the health workforce, and strengthen primary healthcare and public-health surveillance. Ultimately, sustainable recovery in Wad Medani will depend on an end to violence, respect for the protection of healthcare under international humanitarian law, adequate financing, and locally led reconstruction of a resilient health system.

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