Review Article

Health Ramifications and Recovery Avenues for Sudan's April 2023 Armed Conflict: A Review

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Abstract

Background: Sudan's history is marred by ongoing sociopolitical challenges, with deep cultural divisions fueling numerous wars. A new conflict erupted on April 15, 2023, pushing the country closer to a full-scale civil war. This war has severely crippled Sudan's already fragile healthcare system, rendering 70% of hospitals in combat zones nonoperational, causing 12,000 deaths, thousands of injuries, and leaving 11 million in dire need of healthcare. More than seven million people are displaced, half of which are children, and are facing severe health challenges, especially vulnerable groups. Heath situation is threatening with unchecked spread of outbreaks of communicable diseases that were previously controlled and marked failure in meeting the health demands of patients with noncommunicable diseases, reproductive and child health issues, and people with serious conditions that require adequate follow-up. Moreover, the projections threaten with more catastrophic consequences including famine, environmental destruction, and further displacement of people. This review article highlights the urgency of the situation and explores potential solutions to enrich global understanding of crisis management.

Methods: To comprehensively assess the impact of the crisis and propose a way forward, we drew data by exploring search engines and databases such as Google, Humanitarian Agencies Websites, Google Scholer, and PubMed along with some relevant reports. The search terms included are "Sudan's war", "impact of war on healthcare systems", and "Sudan's armed conflicts".

Results: More than 19 publications on the impact of the war on health in addition to periodic reports from international organizations and governmental authorities were reviewed.

Conclusion: Although all publications point to the gravity of the situation and the need for prompt response, this crisis offers a unique opportunity to rebuild Sudan's struggling healthcare system with the principles of social accountability. Through domestic and international collaboration, this sector can become a model for similar nations, meeting the needs of its people and promoting sustainable development.

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1. Introduction

During humanitarian crisis, there is a substantial and pervasive hazard to a population's well-being, safety, and fundamental human rights. Crises frequently result from natural disasters, armed conflict, displacement, public health emergencies, or other occurrences that disrupt normal social functioning [1].

The ongoing conflict in Sudan between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF) – paramilitary forces – began on April 15, 2023. The conflict has significantly impacted civil life in all its facets, including the civil services. Initially, the impact was mainly pronounced in conflict-zones like Khartoum, the western region of the country, and recently Aj Jazirah state, however, with more than nine months in "war mode" and most services being centralized, the whole country is suffering. Health facilities have endured systematic damage, essential equipment has been looted, and the general security situation has forced a substantial portion of the population to abandon their homes and evacuate areas affected by the conflict.

1.1. The country

Sudan is distinguished by its rich and varied cultural, geographical, and historical legacy. It is the third-largest country in Africa—at the intersection of sub-Saharan Africa and the Middle East, Sudan's borders extend to the Red Sea, and it neighbors seven countries. Its population of around 48.1 million represents diverse ethnic, cultural, and linguistic backgrounds. Arabic is the official language, and English is commonly used by the educated population. Most of the population are Muslims, who live alongside Christians and indigenous religious communities [2, 3].

1.2. Overview of Sudan's history and its struggles

Archaeological evidence has shown Sudan to be the home of one of the oldest civilizations, the Ta-Seti kingdom, present here since 5900 BC [4].

Since then, Sudan has been home to mighty kingdoms and sultanates, until the era of colonization. In 1956, Sudan's independence was achieved, following a protracted struggle.

Following its independence, Sudan has seen a cyclic pattern of elected governments, military coups, and popular revolutions intended to reinstate democracy. This has greatly hampered the development and stability in the country.

There have been four main civil wars in post-colonial Sudan: two North–South wars (1955–1972 and 1983–2005), a third war in Darfur (2003), and a fourth in the Nuba Mountains and Southern Blue Nile following the independence of South Sudan (2011) [3, 5, 6].

The civil conflicts that Sudan has endured are fueled by ineffective governance, unequal distribution of wealth and authority, and cultural inequalities, primarily driven by cultural grievances. Widespread corruption has exacerbated mistrust and increased socioeconomic disparities, further inflaming public anger.

1.3. Context before the current war

In December 2018, Sudanese citizens, primarily youth, staged a revolution to end 30 years of dictatorship. The transitional government that was established thereafter faced immense challenges and had limited resources with which to act.

Supported by the international community, it sought to realize the ideals of the revolution. The experts involved in state rebuilding have actively engaged in crafting strategies to transform the healthcare system, aligning it with the revolutionary slogan of "freedom, peace, and justice."

Sudan's healthcare system is divided into three tiers: primary, secondary, and tertiary care. Neglect and insufficient corrective measures have led to critical issues: 74% of facilities lack vital services, 81% of the population has only limited healthcare availability within 2 hr, there are ongoing medication shortages, and over 75% of health expenses are out-of-pocket, surpassing the World Health Organization's (WHO) recommended 40% [7].

Unfortunately, the brief period of political optimism (2019–2021) gave way to turmoil. The transitional government was facing mounting pressure and was overthrown by a military coup in October 2021 [8].

By April 2023, the nation was plunged into a severe war, putting its existence into question, and raising the specter of a full-blown civil war.

2. Methodology

This is a narrative review that aims to provide an overview on the impact of April's war on health and possibilities for recovery by focusing on the historical context, current situation, and the desired principles for transformation. To portray the situation and chart a path forward in the absence of ample evidence on disaster management strategies in crisis-ridden countries like Sudan, we conducted a comprehensive review of the literature using search engines and databases such as Google, International Humanitarian websites, Google Scholar, and PubMed. Moreover, we analyzed reports from international humanitarian organizations, the Federal Ministry of Health, and other sources. The search terms included "Sudan's healthcare system", "April's war", "impact of war on healthcare", and "Sudan's armed conflict and health".

3. Findings

In addition to periodic reports and statements from humanitarian agencies and health authorities, the search yielded 19 insightful articles shedding light on the impact of this war on public health. These articles are informative and carry revealing titles that convey a sense of imminent danger. The content spans a wide spectrum, ranging from in-depth analyses of the overall public health situation to highlighting the specific needs of vulnerable groups such as children, cancer patients, and individuals with kidney failure. Furthermore, there are urgent calls to safeguard the well-being of healthcare workers and patients amidst the hostilities, along with a forewarning of the potential collapse of the health system.

These important articles are authored by a diverse group, including Sudanese and international health professionals, as well as a medical student. The publication dates range from as early as April 19th to the most recent findings on December 29th, 2023. The diverse array of journals featuring these articles adds credibility to the research, with notable publications including the WHO publications, Lancet, the British Medical Journal (BMJ), The New York Times, The Lancet Child & Adolescent Health, The Lancet Global Health, International Journal of Surgery (IJS) Global Health, Medicine, Conflict and Survival, Conflict and Health, Public Health Challenges, and Cureus [9–28] (Table 1).

The extensive body of publications in this relatively short time serves as a testament to the critical nature of the situation, emphasizing the imperative for prompt and decisive action. This direction is further underscored by numerous national and international meetings and periodic reports that consistently raise red flags and advocate for urgent intervention.

The findings will be discussed under the following titles: Overview of the Humanitarian Impact of War, Impact on Health and the Healthcare System, Impact on Specialized Facilities, and the Health Situation in Refugee Camps and Settlements. The paper also discusses views and ideas for recovery using the crisis management framework as a structuring tool.

3.1. Overview of the humanitarian impact of war on the country

According to Eastern Mediterranean Regional Office (EMRO), even before the conflict began,

The security situation is dire, and significant casualty numbers have been published. As of the second week of December 2023, the conflict has resulted in 12,501 deaths and 26,051 injuries [30].

A substantial portion of the population faces limited access to fundamental necessities such as food, water, shelter, electricity, and essential services including nutrition, healthcare, and education. Furthermore, in numerous conflict zones, the distressing scenario persists where numerous deceased individuals remain unattended, exposed to decay, or susceptible to scavenging by animals on the streets.

Moreover, tragic claims of ethnic cleansing are rising. On July 2023, a mass grave was discovered on the outskirts of El Geneina in Darfur region that contained the remains of at least 87 individuals belonging to the Masalit ethnic group and others,

there were 15.8 million people in Sudan needing humanitarian assistance. In the few weeks following the onset of the conflict, this number surged by 57% [29].

Since April 15, Sudan has experienced escalating conflict between SAF and RSF, with fighting originating in Khartoum and spreading to Darfur and other regions including the recent invasion of Aj Jazirah state – Sudan's breadbasket – by RSF in mid-December, adding to the eminent threat of famine. At the same time, the overtake of Madani city has devastating humanitarian and health impact since the city was transformed to a health and humanitarian hub hosting medical services and non-governmental organization (NGOs). Moreover, it represented a safe refuge to many people who has to abandon their homes in Khartoum after April 15th (Figure 1). who were allegedly killed by the RSF and their affiliated militia [31–33].

Civilian areas are under attack and occupation by militants, leading to severe challenges to health and human rights issues. The economy has collapsed, leading to food scarcity and soaring prices. According to the International Organization for Migration Displacement Tracking Matrix (IOM DTM), as of January 3rd, more than six million people have been displaced internally (IDPs). The majority of IDPs are from Khartoum (61%), followed by South Darfur state (15%), North Darfur state (8%), Aj Jazirah state (5%), Central Darfur (4%), West Darfur (3%), East Darfur (1%), South Kordofan (1%), North Kordofan (1%), West Kordofan (<1%), Sennar (<1%), and White Nile (<1%).

It is also reported that around 1.57 million more sought refuge in neighboring countries as follows,
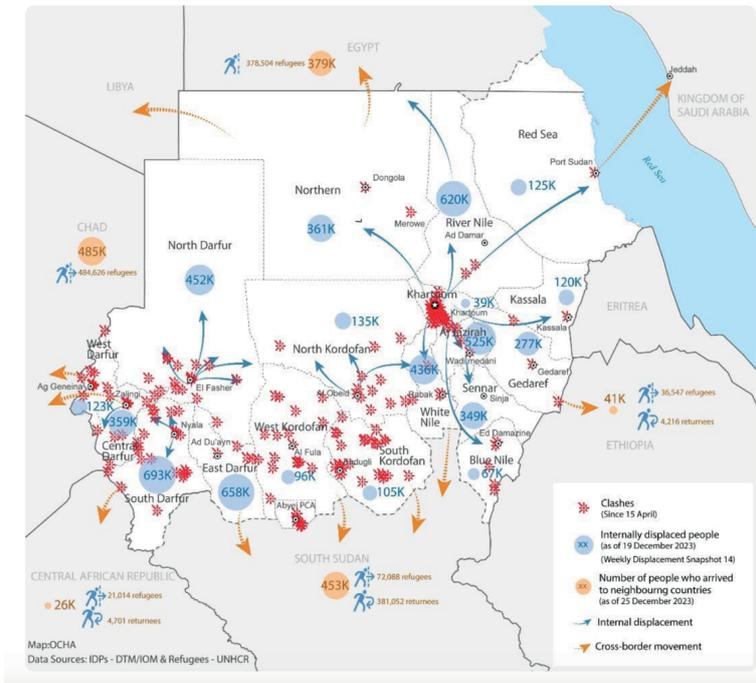
Figure 1: War affected areas in Sudan. Source: https://reports.unocha.org/en/country/sudan/card/4VM7zpu6Tl/ Sudan Humanitarian Update (January 4, 2024).
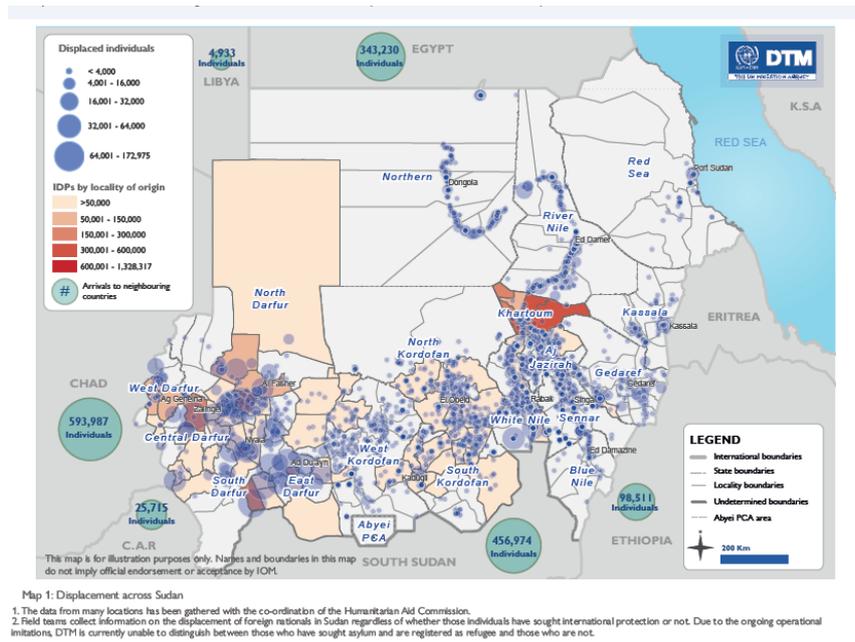
Figure 2: Displacement across Sudan and to neighboring countries since April 15, 2023. Source https://dtm.iom.int/reports/dtm-sudan-monthly-displacement-overview-04 By IOM UN Migration, Displacement Tracing Matrix, Snapshot: 25 December 2023.

Chad 39%, South Sudan 31%, Egypt 22%, Ethiopia 7%, Central African Republic 2%, and Libya <1% (Figure 2) [34].

Moreover, in the Eastern Mediterranean Public Health Network latest report on January 4th,

2024, Sudan was declared as the country with the most extensive displacement and protection crisis globally. With the conflict persisting for over nine months, this catastrophe has profoundly affected livelihoods, infrastructure, and human

rights, leading to the vast displacement of people reported previously. Unfortunately, Sudan currently holds the record of having the highest number of displaced children worldwide and almost 25 million people need assistance [35].

While this situation calls for urgent assistance, the ongoing hostilities and extreme security conditions obstruct humanitarian agencies from reaching areas of greatest need. ACAPS (the Assessment Capacities Project) rated the constrains on humanitarian access in Sudan as extreme as 5 out of 5 and predicts an escalation of the humanitarian crisis throughout 2024 with conflicts overspilling to the neighboring countries [36].

3.2. Impacts on health and the healthcare system

The conflict resulted in and is still causing dire health situation in the country. Healthcare system is greatly challenged by pressing health demands like escalating war-related injuries, increasing cases of noncommunicable diseases, and pressing need for maternal and child healthcare services. At the same time, it is unable to appropriately respond to them due to extensive damage to healthcare facilities and disrupted supply chains, shortage of healthcare professionals due to displacement and interrupted training, forced population displacement accompanied by limited healthcare access, and unhealthy sanitary conditions due to overcrowded displacement camps as well as civil service collapse. Similar damage to healthcare systems has been observed in other war affected countries, such as Syria and Ukraine [37, 38]. The situation is made worse due to the existing imbalance in Sudan's healthcare system, where approximately 70% of healthcare professionals are

concentrated in urban regions, notably in Khartoum [39].

Since September 2023, the Federal Ministry of Health reported the death of more than 6200 people across the country due to outbreaks of disease linked to the conflict and to the decline of the healthcare system – it is estimated that during armed conflicts, indirect causes of mortality are almost triple the direct causes; for example, United Nations International Children's Emergency Fund (UNICEF) recently reported a 30% surge in the rate of child malnourishment due to the war [26, 29].

3.2.1. Service provision

Within the first few months of violence, it became extremely challenging to provide healthcare services including Primary Health Care (PHC). With the continuing attacks on healthcare facilities (60 as verified by the WHO), over 70% of them are not working, and 65% of the population are deprived from healthcare services.

The influx of IDPs further strained the already fragile state-level healthcare system. Additionally, the recent assault on Madani locality in Aj Jazirah state has resulted in severe shortage of treatment centers for patients with cancer, cardiac problems, and renal failure [29, 35].

3.2.2. Disease burden

Prior to this tragic war, Sudan was suffering from a dual burden of disease, both communicable and noncommunicable. Diseases, including malaria, rubella, measles, dengue, and acute watery diarrhea were relatively under control, however, they have surged to cause threatening outbreaks due to the disruption of public healthcare services including immunization. These outbreaks are reported for Measles in 11 states and Dengue in 10 states.

Furthermore, the conflict has resulted in the outbreak of diseases of Poor Water, Sanitation, and Hygiene (WASH), such as cholera. The outbreak was declared by the Federal Ministry of Health on late September 2023 and currently it has spread to 18 states and has caused a total of 224 deaths.

Noncommunicable diseases on the other hand contributed to 51% of all deaths in Sudan before the recent crisis. The ensuing severe shortage in healthcare delivery, medications, and specialized facilities have further added to the burden of these diseases on the affected population.

Meanwhile, the situation of reproductive health is worrisome. Safe deliveries are currently a major concern. Moreover, it is estimated that 4.2 million women and children are at risk of gender-based violence [35].

3.2.3. Mental health

The trauma and sustained stress resulting during this conflict and the atrocities witnessed, such as killings, physical violence, home plundering and destruction, infrastructure devastation, and the shattering of dreams and aspirations, has necessarily had significant mental health and psychosocial impacts on both individuals and communities. The Sudanese population continued to suffer these violations under the previous regime, and international criminal charges are pending against many government officials. Sudanese youth witnessed and documented a wave of violence during the revolution. In this regard, it is essential to acknowledge that culture and context impacts health, in cases of conflict-related sexual violence as well as mental health disorders [40, 41]. Previously, these issues were largely overlooked, however, they could have severe and lasting consequences: previous work has observed cases

of post-traumatic stress disorder and other psychological disturbances among Sudanese civilians affected by war [26, 42, 43].

3.2.4. Attacks on health facilities and personnel

Furthermore, the Surveillance System on Attacks on Health Care (SSA), utilized by the WHO, has confirmed 60 incidents of attacks on healthcare facilities, resulting in 34 fatalities and 38 injuries, spanning from April 15 to December 15, 2023 [44]. It is expected from previous experience of war, that this will have a negative impact on retention among the current healthcare workforce, both at the present and in the future [37, 38].

3.2.5. Projected health impact

Based on the projections of the Integrated Food Security Phase Classification (IPC) for the period between October 2023 and April 2024, the ongoing hostilities will result in a dire situation in the country with >70% of the population suffering from various degrees of food insecurity – unfortunately, 3.4 million children under five years of age are already suffering from malnutrition [30].

Obviously, the long-term impact of this war on public health is huge, with estimates of around 700 million dollars financial loses of the healthcare system and a devastating burden on the country's most vulnerable population. Moreover, armed conflicts entrap communities in a vicious cycle that lead to poverty resulting in more conflicts and the cycle goes on. Examples of conflict consequences that fuel the vicious cycle are environmental destruction, loss of natural resources, and demolition of social fabric and other related issues like identity crisis [23, 45, 46].

3.3. Impact on specialized facilities

Specialized centers were established in Khartoum to meet Sudan's unique healthcare needs. Such centers include the National Public Health Laboratory (NPHL), the National Medical Supplies Fund, the Central Blood Bank, the Mycetoma Research Center, the Diabetic Children Hospital, the Diabetic Health Centers, the Tuberculosis Hospital, the Leprosy Centers, the Assistive Devices Centers, the National Oncology Centers in Khartoum and Madani. Before the war, these national bodies offered free services to the public. The ongoing conflict has disrupted the service and the international partnerships they rely upon, putting the future of these centers at risk. Moreover, NPHL contains some specimens that can result in serious biological hazard if the storage of these materials was not appropriately secured [23, 27].

Regarding the oncology centers, the situation is devastating for the cancer patients. After the forced shutdown of Khartoum center, cancer patients were left with only two institutions that provide comprehensive treatment – a governmental center in Madani, Aj Jazirah State and the other a private center in the city of Merowe in the Northern State. However, now, that the Madini center has ceased to exist and the drug supply chain has been interrupted, cancer patients are reporting horrific experiences with intense pains as their main complaints [25].

3.4. Health situation in refugee camps and settlements

Sudanese fleeing the conflict have sought sanctuary in neighboring nations, including Chad, South Sudan, Egypt, Ethiopia, the Central African Republic, and Libya. Many of these countries were already grappling with challenges in their healthcare systems. Refugee camps and settlements in these areas are densely populated and provide only limited services, making them vulnerable to the spread of infectious diseases, malnutrition, and human rights abuses. The substantial influx of displaced Sudanese into hosting countries is expected to place pressure on their healthcare and education systems as well [30].

UNHCR report from September 20, 2023 highlights the dire health conditions in Sudan's neighboring countries, where Sudanese war refugees have sought shelter, in particular Chad, Ethiopia, and South Sudan. One major concern is the continued arrival of refugees in border areas with inadequate health services, which is resulting in significant health challenges, primarily malnutrition and measles. There have been outbreaks of cholera and malaria in some camps, with a high risk for these diseases due to expected rains, flooding, and a lack of appropriate WASH facilities for the coming months.

Despite the dedicated efforts of humanitarian organizations and local healthcare professionals, the growth in demands on healthcare in the ongoing crisis continues to strain capacity [47].

4. Feedforward

The rising global crisis rate has been a topic of concern to the United Nations (UN) since the late 20th century, and it has been proactive in addressing it.

Disasters are categorized as human-made, natural, or mixed [48]. The disaster of war, one of the most devastating forms of human conflict, fall under the human-made category. It inflicts immediate harm through violence and displacement, and it leaves lasting destruction, hindering economic

and social development. Its aftermath involves infrastructure collapse, community displacement, and disruptions to essential services, making recovery difficult.

Since 2010, global conflict has significantly increased, leading to projections that by 2030, around 60% of the world's population in extreme poverty will reside in nations facing various disasters, including fragility, conflict, and violence [49].

The rising tide of disasters has prompted the emergence of the field of disaster management. This is a proactive approach focusing on preparedness and mitigation to reduce disaster impacts and enhance recovery resilience where complete prevention or restoration is often impossible.

Failure to create such plans can bring significant harm to lives, property, and finances [50]. Disaster managers recognize four separate stages in the life cycle of disaster management, each of which entails specific actions and activities. The stages are preparedness, response, recovery, and mitigation. This structured framework provides necessary guidance to emergency responders, government entities, and humanitarian organizations working to perform actions intended to address and minimize disaster impacts [51].

In the context of a developing country like Sudan - already constrained with various challenges – the repercussions of disasters can be overwhelming.

For many years, ineffective approaches to disaster management have compounded the suffering of vulnerable individuals. Flooding, a recurrent disaster in Sudan, repeatedly leads to dire health crisis. The Sudanese government often fails to provide timely aid to affected communities, so volunteer groups step in to aid. Volunteering during humanitarian crises is a well-documented global phenomenon, known as convergence. In Sudan,

the phenomenon is deeply ingrained in the cultural norm and referred to as nafeer [52].

As part of its state-building efforts during the Transitional Government (2019–2021), Sudanese professionals began to establish a comprehensive system for recovery and resilience. However, this system, which aimed to reduce vulnerability and boost community resilience in the face of future disasters, is not yet fully operational [53, 54]. Furthermore, given the unprecedented nature and scope of the current crisis in Sudan, the lessons of international experience and the local collective wisdom are essential for reference and guidance.

4.1. Planning the recovery of the healthcare system within the framework of disaster management phases

Using the disaster management framework as an organizing structure, this paper analyzes the situation and discusses prospects for recovery.

4.1.1. Preparedness

Considering Sudan's experience with historical crises, its healthcare system should collaborate proactively with specialized international disaster relief organizations. This would involve crafting emergency plans, conducting readiness assessments with training and drills, and ensuring that essential supplies and resources are available. Tsagkaris and colleagues have developed a comprehensive model for the prediction of war's consequences on health, encompassing physical injuries, the destruction of healthcare infrastructure, harm to critical non-health infrastructure, and impact on environmental warfare [55]. In contexts like Sudan, an important additional category is the long-term depletion of human resources, which

can significantly affect the country's ability to provide essential services during and after a crisis. The primary goal in this phase is enhancing preparedness and minimize the potential impact of disasters, emphasizing community involvement and engagement with relevant stakeholders.

4.1.2. Response

This phase is activated at the occurrence of a disaster. Sudan is currently in this phase, facing severe challenges that are straining the healthcare system. Khartoum, for example, has very few operational hospitals, and many areas remain inaccessible from the outside due to ongoing conflict, putting immense pressure on healthcare workers who are striving to save lives without proper support or preparation. International NGOs (INGOs), including the WHO, the Red Crescent, and Médecins Sans Frontières (MSF), are collaborating with the Federal Ministry of Health and are committed to providing healthcare support. However, their efforts are greatly hindered by the uncontrolled violence. It is worthy to note that professional organizations such as the Sudanese American Physicians Association (SAPA), which is a humanitarian, non-profit, nonpolitical organization registered in the United States and Sudan, has particularly played a remarkable role in the current crisis. As the largest medical organization aid, it supported the over-stretched healthcare system, providing lifesaving support to the whole country. According to its latest report in October 2023, covering six months of the conflict, SAPA has delivered critical humanitarian support contributing to direct healthcare service delivery, healthcare system resiliency, WASH, Food and Nutrition, and Protection [56].

An effective response strategy must be prioritized which can be implemented immediately

to safeguard lives, protect property, and address the basic needs of affected individuals and communities. Ideally, the first responders, including emergency services, medical teams, and disaster relief organizations, should rapidly mobilize to help and manage the initial emergency. In addition, leveraging the involvement of youth groups can be instrumental in supporting people who are fleeing conflict zones. Groups like "Nafeer" played a valuable role during the 2013 flood crisis, including the provision of healthcare, earning recognition from international NGOs [53]. Another significant youth organization, with widespread membership, the Resistance Committee is present across the country and considers itself to be guardian of the revolution and can quickly mobilize while prioritizing safety to provide essential services to IDPs during this phase.

During this stage, NGOs and humanitarian partners are vital for supporting the collapsing healthcare system. Although the WHO is coordinating the response to the current health crisis, this response is sluggish and unable to cover the healthcare needs of the country as experience in other counties like Syria, which underscores the need for community mobilization.

As patriots and responsible healthcare professionals, it is imperative to act swiftly to preserve the lives of Sudanese people and protect their healthcare facilities by engaging in relentless efforts to fulfil the following:

Call for an urgent cease fire and demand that military groups protect the lives of civilians.

Publicly condemn the attacks on healthcare facilities and healthcare personnel and remind the conflicting parties that such attacks are forbidden by the International Humanitarian Law.

Mobilize the community leaders and youth groups to take part in providing shelters and other humanitarian assistance to displaced citizens.

Collaborate with relevant humanitarian agencies to provide First Aid training to community groups.

Appeal for neighboring countries to kindly shelter refugees.

Appeal for the international community to pressure the conflicting parties to stop the war and to aid with re-building the country.

Demand the humanitarian organizations to provide more support in terms of food, sanitary requirements, etc. to improve health at civilian shelters such displacement camps [17,24].

4.1.3. Recovery

Following the phase of the initial response, the actions in the recovery stage seek to restore areas affected by disaster and bring them to a state of normality. This extensive process includes the reconstruction of infrastructure, ongoing medical care, psychological support for survivors, and providing support to communities as they resume their daily routines. The overarching goal is to facilitate the recovery and reconstruction of individuals' and communities' lives.

For Sudan to attain swift and comprehensive recovery, several critical steps must be taken. First, a viable resolution to the ongoing conflict is imperative, with broad anti-war support and international assistance. International support and global finance will play a crucial role in mitigating the impact of the crisis on Sudan's healthcare system. This will allow Sudan to rebuild its healthcare infrastructure, produce and retain qualified healthcare professionals, and enable the delivery of essential services to its population.

In parallel, reformation of the flawed healthcare system is essential, ensuring a more efficient and equitable healthcare system to meet the needs of Sudan. In a low-income country like ours, it is important to decentralize healthcare services, for example, the experience with decentralizing the oncology centers was quite successful and greatly helped cancer patients during this war [16]. The desired reform must encompass the restructuring of healthcare delivery, improving access to essential services, enhancing infrastructure, strengthening workforce capacity, prioritizing public health initiatives, and addressing healthcare system challenges to yield improved socially accountable healthcare system and a healthier population.

Community groups' active involvement, particularly those of youth organizations, is integral to the success of these recovery efforts. Their engagement ties into the deeply rooted culture of *nafeer*, or *fazaa*, in which the community comes together to assist in mutual aid, such as in rebuilding facilities and restoring the environment [52].

4.1.4. Mitigation

Mitigation is the ongoing effort to prevent or ameliorate the consequences of potential future disasters. The threat of entrapment in a vicious cycle of war, poverty, unrest is well documented; it is important to consider the fragile state of peace after conflicts as recurrence of peace violations is very common within the first five years [57, 58].

This framework can be used as a roadmap to assist countries and all relevant stakeholders to prepare for anticipated threats. When this endeavor is successful where the entire cycle, including preparation, response, recovery, and mitigation, is taken seriously, particularly in its final stages, the number of crises is expected to significantly decline.

In Sudan, present-day conflicts have deep historical roots, linked to issues such as inadequate governance, identity, injustice, exclusion, corruption, and underdevelopment. To prevent future crises, engagement in community consultations, which could be integrated into the process of constitution formulation, is vital. These efforts should incorporate multiple strategies, including peace-building initiatives, promoting inclusion, educating both combatants and the public at large on international human rights and humanitarian law, emphasizing the protection of civilians and healthcare facilities, and providing conflict resolution methods, including traditional wisdom. These mitigation measures are implemented to build a more resilient society that is capable of proactively preventing, withstanding, and adapting to crisis situations.

Although devastating, if properly managed, this conflict presents a great opportunity to rebuild the nation. As for the healthcare system, professionals were already engaged in serious discussions and planning during the transitional period. These efforts must continue with the collaboration between all internal and external stakeholders to bring out the most contextualized system that will be socially accountable, built on the pillars of quality, equity, relevance, and cost-effectiveness and by so doing, the values of the Mighty Sudanese Revolution of Freedom, Peace and Justice will be met.

5. Limitations

In this review, we opted for a bird's eye view of healthcare ramifications of this war. Although it gives a general idea about the situation, a more focused review to analyze the various areas is paramount. Moreover, the situation is still

unfolding, and information become irrelevant very quickly.

6. Recommendations for future studies

For more comprehensive review of the effects of April war on the country's health and for more strategic views for recovery, we recommend further research to cover the following areas:

1. Impact of displaced healthcare professionals on healthcare services at their new settlement area.

2. The feasibility of healthcare services decentralization: How can we improve practice for ensuring equitable service distribution post-crisis? The example of cancer services.

3. Role of Volunteering Organizations: Scrutinize the contributions of volunteering organizations in supporting and enhancing healthcare system during crises – SAPA experience.

4. Health of vulnerable populations amid the crisis: How can we collaborate to provide better protection and services?

5. Possible role of medical students in supporting the overburdened healthcare system.

6. War impact on the environment: Current and expected threats.

7. The features of the desirable healthcare system in Sudan: The quest for contextualized and socially accountable healthcare services.

7. Conclusion

The ongoing conflict in Sudan, which began on April 15, 2023, is a grave humanitarian crisis

with far-reaching consequences for Sudanese population and beyond. The escalating crisis has garnered global attention, as seen in the significant international discussions.

After more than nine months, the war has left about 12,000 dead, thousands injured, and millions, especially in Khartoum, Darfur, and Kordofan, and Aj Jazirah state lacking sufficient access to food, water, shelter, electricity, education, and healthcare services. Moreover, almost eight million people are currently displaced, internally, and externally to the neighboring countries. In their new settlements, these people are encountering numerous healthcare challenges.

The healthcare system of Sudan is teetering on the edge of collapse, confronted by extreme circumstances. More than 70% of hospitals in conflict zones are nonfunctional and healthcare facilities and personnel are repeatedly attacked by militants sharply violating the international humanitarian laws. Moreover, population health is greatly hampered by unchecked outbreaks of communicable diseases, inability to cater for patients with non-communicable diseases, lack of services to vulnerable groups, and disruption of medical supply chains. Environmental destruction is threating of famine and further waves of displacement, poverty, and conflicts.

To address both existing and anticipated health-related crises, a disaster management strategy is necessary. Such a strategy should encompass plans and measures to prepare for, respond to, and recover from the ongoing repercussions of the war.

Despite the grief, this catastrophe presents an opportunity to reassess our healthcare system and re-build it with the desired principles of social accountability.

Sudan, which has been marked by a long history of conflict and parallel efforts for conflict resolution,

can serve as a model, not only for its own recovery but also as a source of valuable guidance for other nations that are facing similar challenges. This potential is rooted in its well-established social structure, the wisdom of its professional community, the resilience of its revolutionary forces, and the global solidarity and assistance that have been marshaled in support of its pursuit of freedom and prosperity.

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Ethical Considerations

Not required. All images are taken from open access sources (mainly UN websites) and are appropriately cited.

Competing Interests

None declared.

Availability of Data and Material

All articles used for the review are available and referenced.

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