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Disease outbreaks during wartime and lack of health services in Sudan 2023

Épidémies de maladies en temps de guerre et manque de services de santé au Soudan en 2023

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Résumé

Objectifs : Les flambées de maladies en temps de guerre et l'absence de services de santé au Soudan en 2023.

Méthodologie : Cette étude de surveillance (étude observationnelle et analytique) analyse la littérature publiée sur le niveau des flambées de maladies dans les zones de conflit et sur l'ampleur de l'impact subi par les établissements de santé durant la période de guerre actuelle, qui a commencé au huitième mois de l'année 2023.

Résultats : Au moins 1 618 cas suspects de choléra ont été signalés dans 22 localités des États de Gedaref, du Kordofan du Sud, de Khartoum et d'Al Jazirah au 22 octobre, dont 67 décès associés.

Le ministère fédéral de la Santé (FMoH) a recensé plus de 4 000 cas de rougeole et 107 décès associés, principalement dans les États du Nil Blanc et d'Al Jazirah.

À El Gezira, au sud de Khartoum, le rapport cumulatif du département des urgences sanitaires concernant la dengue, couvrant la période du 13 septembre au 18 octobre, a enregistré 148 cas suspects, dont 126 cas confirmés par test rapide et deux décès.

De nombreux établissements de santé ont été détruits ou délibérément ciblés, ce qui a conduit à leur mise hors service.

Conclusion : Le conflit armé au Soudan a de graves répercussions sur la santé et le bien-être de la population, en particulier des enfants et des femmes. Le conflit a perturbé les systèmes alimentaires, entraîné des déplacements, et provoqué une instabilité économique, contribuant à une augmentation des taux de malnutrition et à de potentiels problèmes de santé futurs.

Recommandations : Premièrement, il est nécessaire que la communauté internationale investisse dans le développement et la mise en œuvre de systèmes de santé durables capables de résister aux défis liés au conflit.

Deuxièmement, il est essentiel de garantir la fourniture de services de santé essentiels à la population affectée, notamment les soins de santé mentale, les services de santé maternelle et infantile, ainsi que les soins pour les personnes souffrant de maladies chroniques.

Troisièmement, il est nécessaire de s'attaquer aux causes profondes du conflit, telles que la pauvreté, l'inégalité et l'instabilité politique, afin d'établir une paix et une stabilité durables.

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Mots clés : Conflit armé, Soudan 2023, Flambées épidémiques, Choléra, Rougeole, Dengue, Services de santé, Infrastructures sanitaires, Crise humanitaire, Déplacement de population, Malnutrition, Systèmes de santé durables.

Abstract

Objectives: Disease outbreaks during wartime and lack of health services in Sudan 2023

Methodology: This monitoring study (observational and analytic study) analyzes published literature on the level of disease outbreaks in conflict areas and the extent to which health facilities have been affected during the current war period, which began in the eighth month of the year 2023.

Results: At least 1,618 suspected cases of cholera have been reported from 22 localities in Gedaref, South Kordofan, Khartoum and Aj Jazirah states as of 22 October, including 67 associated deaths.

the Federal Ministry of Health (FMoH) identified over 4,000 measles cases and 107 associated deaths, most from White Nile and Aj Jazirah states.

In El Gezira, south of Khartoum, the state Health Emergencies department's cumulative report for dengue fever, covering the period from September 13 to October 18, recorded 148 suspected cases, with 126 confirmed positive cases through rapid examination and two fatalities.

Many health facilities were subjected to destruction and unjustified targeting, which led to them being out of service.

Conclusion: The outfitted clash in Sudan has critical ramifications for the wellbeing and prosperity of its populace, especially youngsters and ladies. The contention has disturbed food frameworks, prompted relocation, and caused financial shakiness, adding to expanded hunger rates and potential future medical conditions

Recommendations: First, there is a need for the international community to invest in the development and implementation of sustainable health systems that can withstand the challenges of conflict.

Second, it is crucial to ensure the provision of essential health services to the affected population, including mental health care, maternal and child health services, and care for those with chronic diseases.

Third, there is a need to address the root causes of conflict, such as poverty, inequality, and political instability, to create sustainable peace and stability.

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keywords: Armed conflict,Sudan 2023, Disease outbreaks,Cholera,Measles, Dengue fever, Health services,Health infrastructure,Humanitarian crisis,Population displacement.

Introduction

Armed conflicts have long been considered one of the most significant factors affecting the underdevelopment of public health systems, particularly in low- and middle-income countries with fragile infrastructure. Wars and internal conflicts often lead to the collapse of healthcare services, shortages of essential medical supplies, and mass population displacement, creating ideal conditions for the spread of infectious diseases.

Before the war, Sudan's healthcare infrastructure was largely nonexistent, particularly in rural areas, and was under pressure due to factors such as political and economic difficulties and a lack of funding. With the outbreak of violence between the Rapid Support Forces and the Sudanese Armed Forces, the current situation has become significantly more dire. Hospitals and healthcare infrastructure have been deliberately destroyed, health workers are unable to work safely, and displaced populations are increasingly affected by food insecurity and lack of access to safe drinking water, especially with the repeated displacements.

This study aims to examine and illustrate the extent to which the challenges and deterioration of public health infrastructure in Sudan have been exacerbated by the war, with a particular focus on the outbreak and spread of infectious diseases. By analyzing current data and comparing them with pre-conflict health indicators, the research seeks to understand the prolonged effects of war on Sudan's public health infrastructure.

The scientific problem

The main scientific problem of this study is the extent to which the Sudanese health system has been affected and is vulnerable to collapse in light of the current armed conflict, and the resulting increase in the prevalence of infectious diseases in a country that was already facing major challenges in its health infrastructure.

Research Question

What has been the impact of the armed conflict in Sudan since the outbreak of the latest war in 2023 on the performance of the national health system and the spread of infectious diseases? How are health institutions and their staff responding to the deteriorating health conditions?

Hypothesis

The ongoing war in Sudan has negatively impacted the health system, leading to increased incidences and outbreaks of preventable diseases and overwhelming existing healthcare facilities. Without coordinated international support, national efforts alone may not be sufficient to contain the health crisis.

Background

Sudan, located in North-eastern Africa, has an estimated population of 50million at the time of writing. it is the third largest country in Africa by land mass (1.886 million km²). The country is sparsely populated with

Poor infrastructure (roads, water, sanitation, and electricity) and a wide variety of ecological

Conditions ranging from arid desert to tropical rainforest (About Sudan, UNDP in Sudan, 2022.)

❖ **The economic and social situation of Sudan before the war:**

"Since its independence in 1956, Sudan's road to economic and human development has been hampered by internal conflicts that have undermined security and governance. Most recently in 2011, an armed conflict between Northern and Southern Sudan has led to a division of the country, after which South Sudan has become a country that is independent from (North) Sudan. South [1] "

❖ **Sudan has also been plunged since December 2013 in a political power struggle**

Persistent insecurity and political unrest have undermined efforts to reduce poverty and improve human development indicators. For many years, the absence of reliable socioeconomic data hampered effective policymaking. The first nationally representative household survey since 1978 was only conducted in 2009, revealing widespread poverty and inequality. These conditions, combined with the absence of stable governance, have significantly strained the country's ability to deliver essential public services, including healthcare.

❖ **Sudan's Health System Before the War:**

Sudan's health system had a comprehensive set of long- and short-term strategic objectives, supported by carefully designed health policies. However, a weak health information system, coupled with poor organization and implementation, was its most significant weakness. [2]

Economic instability is a major external factor undermining the health system, leading to reduced government spending on health services. Despite these challenges, Sudan has significant potential to develop its health system, including its rich natural resources, large population, and qualified health workers. [2]

Overcoming these challenges requires strengthening collaboration with international health financing institutions, leveraging local capacity, and implementing existing health policies. Had these imbalances been addressed before the war, the current health impact could have been significantly reduced. However, the deteriorating conditions caused by the war now require a greater focus on finding sustainable solutions to address the growing challenges.

❖ **The Sudanese Civil War (2023) and its Impact on Public Health:**

On April 15, 2023, the Sudanese capital, Khartoum, witnessed the outbreak of an armed conflict between the two wings of the military authority, represented by the Rapid Support Forces (RSF), led by Lieutenant General Mohamed Hamdan Dagalo "Hemedti," and the

Sudanese Armed Forces (SAF), led by Lieutenant General Abdel Fattah al-Burhan. This conflict erupted following a dispute over the integration of the RSF into the official army, amid uncertainty over the leadership of the military institution. Although the two sides had previously cooperated in the 2019 overthrow of former President Omar al-Bashir, and then in the 2021 coup, the conflict escalated into a bloody confrontation that led to a rapid deterioration in the humanitarian and health conditions. [3] [4] [5]

The clashes resulted in the bombing of military installations near residential neighborhoods, schools, and hospitals, posing a direct threat to civilian lives. [6] According to official reports, the death toll exceeded 3,000, with more than 6,000 wounded, and nearly 50% of the capital's hospitals closed due to destruction or lack of resources [8].

The war has exacerbated violence against the health system, with attacks targeting health infrastructure such as hospitals, health centers, laboratories, and pharmacies. Health workers have been killed, arrested, and kidnapped while carrying out their duties. Ambulances and medical supply vehicles have come under direct attack, while some health facilities have been used as weapons depots or shields during clashes, in flagrant violation of international humanitarian law. [7] [9] [10]

❖ Health and Humanitarian Consequences of the War:

The war has led to the near-total collapse of the health system in large areas of Sudan, contributing to an increased spread of

infectious diseases due to the destruction of infrastructure, disruption of water and sanitation networks, and mass displacement of populations. Increased health risks include outbreaks of diseases such as cholera, typhoid, measles, and polio, particularly given the disruption of vaccination campaigns and shortages of medical supplies.

In addition, some health facilities have become hotspots for infectious diseases due to poor infection control practices and poor hygiene. Health workers are also under severe pressure amid scarce resources and insecurity. [9]

❖ Conclusion:

The health situation in Sudan before the war demonstrated solid and scalable foundations despite economic and political challenges. However, the civil war has led to a sharp deterioration in all aspects of health. As the conflict continues, the need for emergency and coordinated interventions from the international community and humanitarian organizations increases, as does the need to formulate a national vision to rebuild the health system on more robust and resilient foundations. [10]

Problem statement:

Albeit not a critical gamble in this contention, natural fighting can worsen the spread of irresistible sicknesses. Natural specialists, like *Bacillus anthracis*, can cause sickness flare-ups in both regular citizen and military populaces, while synthetic weapons, for example, chlorine gas, can cause respiratory harm, making people more powerless to respiratory contaminations.

Besides, furnished clashes can prompt food frailty, unhealthiness, and starvation, which debilitate the safe framework and increment the gamble of contaminations. Utilizing savagery and torment can likewise cause actual wounds that taint and lead to foundational contaminations. [10]

With all this evidence showing that the level of the public health system in Sudan has declined recently, that is, before the war in 2023 , and with the increase in infection cases, especially in areas with a high population density, and despite the strenuous attempts to combat its spread by health organizations and bodies, it has become impossible to control it, and because of the events of the recent war and the large number of displacements to safe camps, and the concentration of residents and displaced people in governmental and non- governmental places such as schools, mosques and homes, in numbers with a high population density and the resulting direct and indirect contact between people, and with the decline in health services due to the restrictions that Imposed by the war on health facilities and bodies, and with their crowding, the transmission of diseases and infections has become very easy, as it is not possible to determine what the health status of those areas is or to limit the number of infections in them. Indeed, some sources have shown that the infection has spread to neighboring countries as well. Which constitutes a real threat to health security in all those areas.

Rationale/Justification:

Despite the limited information received about the real numbers of infection transmission rates among the population and the extent of their relationship to what is happening in areas in the conflict zones in the State of Sudan, and the extent of the destruction to which health facilities have been exposed, in this study we are trying to convey what can be conveyed regarding the low extent of the level.

Health care for civilians in places of gathering and displacement, which in turn poses a threat to the health security of the State of Sudan.

Objectives:

❖ General aim:

The main goal of this research is to shed light on the general health system for individuals and society in the State of Sudan, and to explore what the recent war can do in dismantling what remains of the relatively old health system, and how the war has a prominent role in weakening it.

❖ Specific aim:

Emphasizing the ability of infection to spread through the population easily and quickly.

Emphasizing the complete weakness of the health system and the loss of its foundation.

Considering the role of war and its impact on the shortage of medical supplies to health facilities.

Literature review:

❖ Disease outbreak:

"A disease outbreak is the occurrence of cases of disease in excess of what would normally be expected in a defined community, geographical area or season.

Outbreaks are maintained by infectious agents that spread directly from person to person, from exposure to an animal reservoir or other environmental source, or via an insect or animal vector. Human behaviors nearly always contribute to such spread. Early detection and reporting of such events is crucial in minimizing their negative social and economic impact.

Epidemic-prone diseases, including emerging and re-emerging diseases constitute the greatest threat to public health security and the disruption of social and economic developments of the countries of the Eastern Mediterranean Region.

In the past 20 years, the Region has witnessed a marked increase in the number of outbreaks and pandemics caused by emerging and re-emerging diseases, such as Alkhurma haemorrhagic fever, chikungunya, cholera, dengue, A/H5N1 influenza, pandemic A/H1N1 (2009) and Rift Valley fever, among others. This situation has been exacerbated by acute and chronic humanitarian crisis in many countries of the Region. [11]"

❖ The extent of the devastation caused by health violations in Sudan:

According to Insecurity Insight, there were at least 192 attacks on Sudan's healthcare sector between January 1 and September 6. At least 42 health institutions have been damaged and 28 medical personnel have died as a result of these accidents. Essential medical supplies have been pilfered, and patients have purposefully blocked their access to medical assistance. The effectiveness of healthcare professionals in meeting patient requirements, ensuring safe staffing levels, and influencing the public's access to healthcare are all compromised by these attacks. [12]

Documented incidents:

On September 6, 2023, three doctors and five other people were detained close to the Teiba Camp in Jebel Aulia village, Khartoum state, when they were traveling to volunteer at the only operable hospital in the area, Al Ban Jadeed Hospital/El

Ban Jedid Hospital, which is located in the East Nile neighborhood of Khartoum. Al Taghyeer and Dabanga Sudan, as sources. [12]. According to information released on September 12, 2023, a shell of unknown origin struck the upper floor of the Weapon Medical Hospital in Nyala, South Darfur State. Source: Akhbar of Sudan. [12]

❖ Data availability statement:

Since struggle emitted April 15, a bigger number of than 4.6 million individuals have become recently uprooted inside Sudan. The

number, added to the multiple million what already identity was uprooted inside the country before the ongoing struggle, makes Sudan home to the worlds biggest inside dislodged emergency. "The health system in Sudan is stretched to breaking point as capacities decline in the face of mounting needs," said Ni'ma Saeed Abid, WHO representative in Sudan, speaking Tuesday in Port Sudan. [11]

"Access to health care continues to be limited due to insecurity, displacement, and shortages of medicines and medical supplies, placing millions of Sudanese at risk of severe illness or death from preventable and treatable causes," he said.

Since September 26, Sudan has declared outbreaks of cholera in Gedaref, Khartoum and South Kordofan states, with suspected cases reported from Al Jazirah and Kassal states. [11]

As of last week, the WHO reports 1,962 suspected cholera cases with 30 lab- confirmed cases and 72 associated deaths. It estimates more than 3.1 million people are at risk of cholera until the end of December. [11]

On 26 September 2023, Sudan pronounced a cholera flare-up in Gedaref State, following affirmation of 4 stool tests from thought cases to contain *Vibrio cholerae*, the microbes that causes cholera. Starting around 29 September, there were 307 cases and 19 passings from Gedaref (CFR 6.18%), 400 cases and 8 passings from South Kordofan (CFR 2%), and 110 cases and 8 passings from Khartoum (CFR 7.27%). Examinations are progressing to decide if cholera has likewise spread to

Khartoum and South Kordofan states, where expanded instances of intense watery the runs have been revealed. [12]

❖ Disease outbreaks by number:

" Sudan has declared a cholera outbreak in Gedaref State. As of 29 September, there were 307 cholera cases and 19 deaths from Gedaref (CFR 6.18%), and 510 suspected cases and 16 deaths from South Kordofan and Khartoum: 400 cases and 8 deaths from South Kordofan (CFR 2%), and 110 cases and 8 deaths from Khartoum (CFR 7.27%).

- Reports of measles, malaria, dengue and other diseases are also being Received from several states. As of 29 September:

4,123 suspected measles/rubella cases with 107 associated deaths (CFR 2.6%) have been reported from 12 states: Blue Nile,

River Nile, White Nile, Red Sea, North Darfur, Kassala, Gedaref, Gezira, West Kordofan, Khartoum, East Darfur, and Sennar. The Largest number of measles cases is reported from White Nile (with 3,117 cases and 98 deaths as per reports received as of 22 September.)

736,507 clinical malaria cases and 22 deaths (0.003%) from 12 states.

4,097 suspected cases of dengue and 13 deaths (0.317%) from 6 States.

18 whooping cough (suspected pertussis).

- 65 heatstroke cases and 19 deaths were reported from Red Sea and Northern states.

- Confirmation of cases is challenging in the absence of functional public Health laboratories in most states. Measles samples are being Transported to Port Sudan for confirmation using the pathway for Transportation of samples from acute flaccid paralysis cases. Out of 108 Samples tested at the Public Health Laboratory in Port Sudan, 29 tested Positive for measles, 1 tested positive for rubella and 12 tested positive For both measles and rubella.
- Outbreak control efforts are ongoing including measles vaccination Campaigns in the southern part of the country with the support of UNICEF, WHO and other immunization partners."[12]

❖ Disease outbreaks by figures:

بسم الله الرحمن الرحيم وزارة الصحة الاتحادية تقرير الرصد الوبائي بتاريخ: الجمعة ٢٧ / ١٠ / ٢٠٢٣ م جدول يوضح حالات حتى الضحك بالولايات في الفترة من ١٥ يوليو حتى ٢٧ أكتوبر ٢٠٢٣ م:				
الولاية	حالات الإشتباه	وفيات	المعدات الموجبة بالفحص السريع	تاريخ
الضخارف	2516	٣٣	2152	١٧ أغسطس 27 أكتوبر
شمال دارفور	448	٢	307	٢٥ أغسطس 27 أكتوبر
كسلا	٢٨٦	٢	٢٢٥	٦ سبتمبر ٢٦ أكتوبر
جنوب كردفان	٤٢	٩	٩	١٥ سبتمبر ٢٢ أكتوبر
شمال كردفان	٦٢٤	١	498	١٥ سبتمبر 27 أكتوبر
الجزيرة	١٥٠	٢	١٢٥	٢٠ سبتمبر ٢٦ أكتوبر
البحر الأحمر	١٧	٠	١	١٧ أكتوبر ١٨ أكتوبر
الفيصل الأزرق	١	٠	٠	١٢ أكتوبر ١٢ أكتوبر
غرب كردفان	٤	٠	٠	٤ أكتوبر ١٦ أكتوبر
المجموع	٤.٠٨٨	٤٩	٣٣١٦	

جدول يوضح توزيع حالات الكوليرا / الإسهال المائي الحاد حسب الولايات في الفترة من ٢٩ يونيو حتى ٢٧ أكتوبر ٢٠٢٣ م:

الولاية	حالات الإشتباه	وفيات	المعدات الموجبة بالفحص السريع	تاريخ
جنوب كردفان	٤٠٠	٨	٢	١ يوليو ٢٤ أغسطس
الضخارف	985	٣٤	797	٢٨ أغسطس 27 أكتوبر
الخرطوم	٣٠٩	٢٢	11	٢٤ سبتمبر ٢٦ أكتوبر
الجزيرة	٣٨٣	٩	٢٤٩	٩ أكتوبر ٢٧ أكتوبر
المجموع	٢.٠٧٧	٧٣	١.٠٥٩	

Figure 01 : This table shows the prevalence of dengue fever and cholera in the period between July 15 and October 27, 2023. [13]

Characteristic		Cholera (N = 344)	Chikungunya (N = 308)	Dengue (N = 4236)	Diphtheria (N = 105)	Rift Valley fever (N = 567)
		Number (%)	Number (%)	Number (%)	Number (%)	Number (%)
Sex	Male	134 (39)	114 (37)	1991 (47)	42 (40)	317 (56)
	Female	210 (61)	194 (63)	2245 (53)	63 (60)	250 (44)
Age group	≤5	32 (9)	25 (8)	296 (7)	11 (10)	17 (3)
	6 - 14	48 (14)	83 (27)	932 (22)	11 (11)	85 (15)
	15 - 29	92 (27)	107 (35)	1270 (30)	14 (13)	181 (32)
	30 - 44	69 (20)	68 (22)	847 (20)	32 (31)	142 (25)
	≥45	103 (30)	25 (8)	891 (21)	27 (35)	142 (25)
	South Darfur	-	23	8	96	-
Residence	West Darfur	-	237	235	-	-
	East Darfur	-	24	-	2	-
	Red Sea	-	-	17	-	332
	Blue Nile	204	-	-	-	-
	North Darfur	-	1	-	1	-
	North Kordofan	-	3	77	-	-
	South Kordofan	-	2	-	-	-
	West Kordofan	-	1	1	-	-
	River Nile	-	-	-	1	238
	Khartoum	2	-	-	1	1
	North Darfur	-	-	-	-	-
	Algazira	9	1	1	1	1
	Kasala	-	2	3961	1	1
	Sinnar	128	-	2	1	-
	Gadarif	-	-	5	-	1
	White Nile	-	3	-	-	1

Figure 02: This table shows the prevalence of dengue fever and cholera and other disease according to prevalence in 2019.[14]

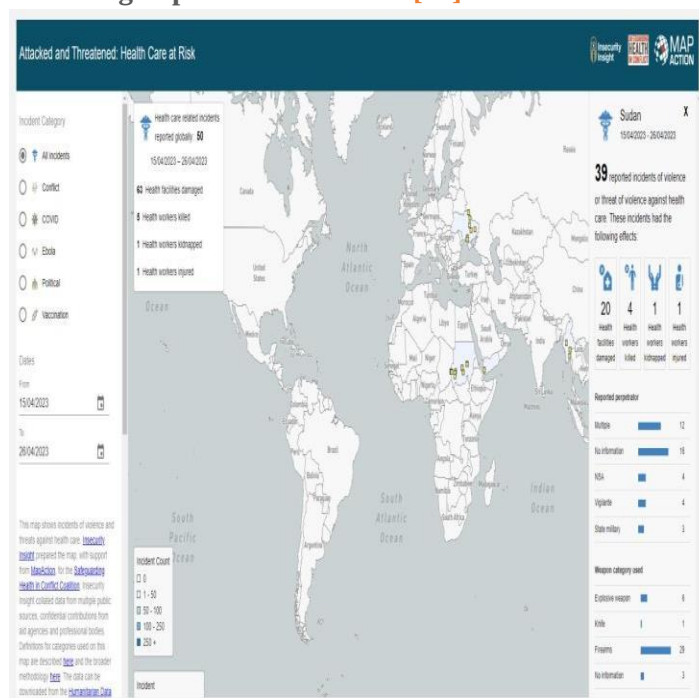


Figure 03: This map showing the scale of attacks on health care in Sudan. [16]



Figure 04 : Sudan's health crisis spreads to neighboring countries.[20]

Sudan states (n=18 states)	Number of public hospitals operating in Sudan before 15 April 2023 (before the war)	Number of public hospitals operating in Sudan from 15 April 2023 ¹ to 18 December 2023 ²	Change status	Reduction (%) in operating public hospitals since the start of the war compared with before the war	Number of public hospitals operating in Sudan after 18 December 2023 ²	Change status	Reduction (%) in operating public hospitals after 18 December 2023, compared with before the war
Blue Nile	18	18	●	0.0%	18	●	0.0%
White Nile	41	41	●	0.0%	30	●	26.80%
Sennar	37	37	●	0.0%	37	●	0.0%
South Kordofan	14	13	●	7.10%	13	●	7.10%
West Kordofan	20	20	●	0.0%	19	●	5%
North Kordofan	37	31	●	16.20%	31	●	16.20%
South Darfur	21	19	●	9.50%	19	●	9.50%
North Darfur	24	16	●	33.3	16	●	33.3
West Darfur	10	10	●	0.0%	10	●	0.0%
East Darfur	5	5	●	0.0%	5	●	0.0%
Central Darfur	10	10	●	0.0%	6	●	40%
Gezira	89	89	●	0.0%	39	●	56.20%
Nile River	42	42	●	0.0%	42	●	19%
Northern State	34	34	●	0.0%	34	●	0.0%
Al Qadafif	30	30	●	0.0%	30	●	0.0%
Kassala	29	27	●	6.90%	27	●	6.90%
Khartoum	53	22	●	58.50%	22	●	58.50%
Red Sea	26	26	●	0.0%	26	●	0.0%
Total ³	540	480	●	11.10%	377	●	30.20%

Figure 05: Number of operating public hospitals and reduction percentage (%) in 18 states of Sudan from 15 April 2023 to 15 April 2024.[21]

“The cells marked with a green dot indicates states with no change in the numbers of operating public hospitals. Cells marked with yellow dots indicate states with <10% reduction; orange dots indicate a reduction of 10%–40%, red dots indicate a reduction of >40% in the numbers of operating public hospitals, respectively.

15 April, 2023 marks the start of the war, beginning in Khartoum State, where the capital Khartoum is located.** December , marks the date the RSF seized control of Wad Madani, Sudans second largest and a strategic city, located in Gezira State, where thousands of internally displaced Sudanese and referred sought refuge following the outbreak of war.

18 December 2023 marks the date the Rapid Support Forces seized control of Wad Madani, Sudan's second largest and a strategic city, located in Gezira State, where thousands of internally displaced Sudanese and referred patients sought refuge following the outbreak of war.

Table data is provided by the Sudan Federal Ministry of Health which only pertains to public hospitals. Private hospitals are not included in the data.”

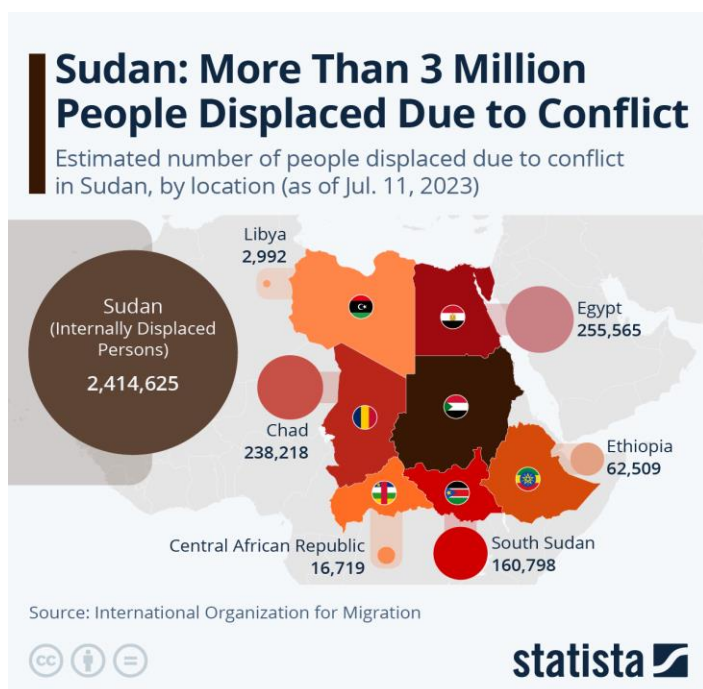


Figure 06: Sudan: More Than 03 million People Displaced Due to Conflict. [22]

CHAPTER TWO

Recommendations:

Health Challenges in Sudan Amidst Armed Conflict:

The ongoing armed conflict in Sudan has had a profound impact on public health, particularly among vulnerable groups such as children, women, and those with chronic diseases. The collapse of health infrastructure, coupled with disruptions in services and shortages of supplies, has led to the spread of preventable diseases. These diseases, while of limited risk under normal circumstances, can lead to premature death, permanent disabilities, and ongoing suffering due to the lack of care and medical interventions during conflict.

To address these escalating health challenges, a dual approach must be adopted,

encompassing both the local and international levels:

First: Recommendations at the Local Level:

Activate a Rapid Epidemiological Response:

The Sudanese Ministry of Health should cooperate with international organizations to establish health emergency rooms in affected areas, with mobile teams supported by staff and equipment.

Rehabilitate Health Facilities:

Damaged facilities, especially in Khartoum and Al-Jazeera, must be repaired and protected as neutral civilian facilities.

Launching urgent vaccination campaigns:

Mass vaccination campaigns against measles, cholera, and diphtheria must be implemented, especially in displacement areas and camps.

Improving water and sanitation:

Providing clean drinking water and adequate sanitation facilities, along with awareness programs on personal hygiene.

Strengthening epidemiological surveillance:

Establishing a database for immediate disease monitoring and training staff on early reporting.

Psychological and professional support for health workers:

Establishing psychological support and protection programs for health workers to encourage them to continue working amidst challenges.

Ensuring the neutrality of the health sector:

Preventing the politicization or targeting of health facilities, in compliance with international humanitarian law and the Geneva Conventions.

Second: Recommendations at the international level:

Supporting resilient health systems:

The international community must fund and build resilient health systems during times of conflict, including primary care, surveillance, and rapid response.

Ensuring the continuity of essential services:

Supporting mental health services, maternal and child health services, and treatment of chronic diseases, in cooperation with local authorities and humanitarian organizations.

Addressing the Root Causes of the Health Crisis:

The health crisis cannot be overcome without addressing the underlying causes of conflict, such as poverty, marginalization, and political instability, by promoting human rights and supporting communities.

Coordinating International Efforts:

Establish a national emergency committee in collaboration with the United Nations and health partners to coordinate the response and ensure unhindered access to aid.

This includes promoting human rights, supporting local communities, and addressing the underlying social determinants of health."[\[10\]](#).

Methods:

This study examined the availability of health services during the war in Sudan. It relied primarily on secondary data collected from official health authorities, such as the Federal Ministry of Health of Sudan, and published reports from humanitarian and health organizations, including the World Health Organization and the United Nations Office for the Coordination of Humanitarian Affairs

❖ Data sources:

Reports issued by the Sudanese Federal Ministry of Health for 2023.

Situation updates and health bulletins from international NGOs and UN agencies operating in Sudan.

Peer-reviewed articles and media monitoring of incidents related to attacks on healthcare infrastructure.

❖ Selection criteria:

Data focused on areas directly affected by armed conflict (such as Khartoum, Al-Jazirah, White Nile, Gedaref, and South Kordofan).

Incidents specifically related to cholera, measles, and dengue outbreaks, as these were the most common during the study period.

Only the number of officially confirmed or strongly suspected cases was included.

❖ Potential Limitations and Biases:

Due to ongoing conflict and limited access to some areas, disease incidence and damage to health facilities are highly likely to be underreported.

Data quality and completeness may vary between sources, particularly from non-state actors.

There is a risk of reporting bias, as more visible or urban areas are more likely to be underreported than remote rural areas.

Some sources may have political biases that influence the portrayal of access to health care and infrastructure damage.

This approach summarizes the most important research and resources for current situational monitoring from global and local sources that are accessible regardless of what they are.

The concentrate additionally utilizes content examination to concentrate on undeniably included articles, zeroing in on similitudes and contrasts in the discoveries to introduce the conditional outcomes [14]

Several reliable sources were used to analyze the events and risks to the Sudanese health system in the current civil war. We also relied on many websites related to international organizations concerned with public health, which also produce the necessary statistics to determine the level of risks to which you are exposed. The population of Sudan in the last war, noting that statistics may be incomplete due to the difficulty of reaching conflict areas and the lack of official competent authorities to investigate the health status of residents and displaced people in all conflict areas.

Results:

1. Cholera:

Cholera outbreaks continue to occur in endemic areas of Sudan in recurring patterns, often delayed due to limited surveillance capacity. While the disease affects all age groups, children under five are most vulnerable, particularly in endemic settings.

As of October 22, 2023, at least 1,618 suspected cholera cases were reported in 22 localities in Gedaref, South Kordofan, Khartoum, and Gezira states, including 67 associated deaths.

Data for the same period showed that Gedaref state alone recorded 985 suspected cholera cases and 34 deaths, representing the highest cholera incidence rate in the country.

Compared to 2019, when only 344 cases (134 males and 210 females) were reported nationwide, the current figures reflect an increase of over 500%, indicating a significant deterioration

in water, sanitation, and public health infrastructure.

2. Dengue Fever:

Dengue fever is a viral infection transmitted by mosquitoes. Between September 13 and October 18, 2023, the Gezira State Health Emergency Department reported 148 suspected cases, including 126 positive cases, and two confirmed deaths.

Furthermore, the October 2023 Epidemiological Surveillance Report revealed alarming figures in Gedaref State, with 2,516 suspected cases, including 2,152 positive cases, and 33 deaths documented between August 17 and October 27. The total number of dengue fever cases across all affected states reached 4,088.

In comparison, 2019 data reported a total of 4,236 cases (1,991 males and 2,245 females) nationwide, with no deaths. This indicates that, despite similar overall case numbers, the 2023 figures show a significantly higher mortality rate, particularly in densely populated areas, highlighting the increased severity of the disease and the strain on healthcare services.

3. Measles:

According to the World Health Organization, measles is a highly contagious viral disease that can cause serious complications and even death. From April 15 to September 15, 2023, the Federal Ministry of Health recorded more than 4,000 measles cases and 107 associated deaths, mostly in White Nile and Gezira states.

4. Other Diseases (2019 Baseline):

Table 2 (Figure 2) of the Reference Report provides data for 2019 that reflect the pre-conflict epidemiological baseline:

Cholera: 344 cases (134 males, 210 females)

Dengue Fever: 4,236 cases (1,991 males, 2,245 females)

Rift Valley Fever: 564 cases (314 males, 250 females)

These figures provide a baseline for understanding the escalation of disease outbreaks during the current conflict.

5. Impact on the Health System:

Figure 3 highlights the direct impact of the conflict on the health care infrastructure from April 15 to 26, 2023:

20 health facilities damaged

4 healthcare workers killed

1 person abducted

1 person injured

In addition, 58.5% of hospitals in Khartoum and 56.2% in Gezira State were reported non-functional during this period.

6. Population Displacement and Regional Threat:

Conflict-related migration has also contributed to the deterioration of the overall health situation. As of July 2023, regular migration figures include:

Egypt: 255,565

Ethiopia: 62,509

Chad: 328,218

These figures do not include irregular migration, which is difficult to track and poses a regional risk for disease transmission.

7. General Observations:

Sudan is facing a complex epidemiological and humanitarian crisis due to the collapse of health systems due to the conflict. Shortages of essential medical supplies have prevented the treatment of diseases that could have been controlled. Displacement, military targeting of health infrastructure, and lack of access to safe water have exacerbated disease transmission.

Current surveillance data likely do not reflect the full extent of disease outbreaks, as war hinders data collection and reporting.

Comparisons with pre-conflict data (2019) confirm that morbidity and mortality rates have increased significantly, reflecting the negative impact of war on public health.

CHAPTER THREE

DISCUSSION

- **SURVEILLANCE** Cholera outbreaks continue to occur frequently in endemic areas of Sudan, and their reports are often delayed due to limited surveillance capacity. The disease affects all age groups, with children under five at greatest risk, particularly in endemic areas.
- Compared to 2019, when only 344 cases were reported nationwide, the current figures reflect an increase of over 500%, demonstrating a significant deterioration in water, sanitation, and health infrastructure.
- Dengue fever is a viral infection transmitted by mosquitoes. Between September 13 and October 18, 2023, the Gezira State Health Emergency Department recorded 148 suspected cases, including 126 confirmed cases, and two confirmed deaths.
- The total number of dengue cases across all affected states is 4,088. Compared to 2019, which recorded 4,236 cases and no deaths, current figures show a significantly higher mortality rate, especially in densely populated areas, highlighting the severity of

the disease and the pressure on healthcare services.

➤ **WHO :**

According to the World Health Organization, measles is a highly contagious viral disease that can cause serious complications and even death.

From April 15 to September 15, 2023, the Federal Ministry of Health recorded more than 4,000 measles cases and 107 deaths, mostly in White Nile and Gezira states.

These figures provide a basis for understanding the escalation of disease outbreaks during the current conflict.

➤ **The impact of the conflict on the health system:**

The impact of the conflict on the health system is significant and must be protected and a safe environment provided to maintain the health system.

In addition, 58.5% of hospitals in Khartoum and 56.2% in Gezira state were non-functional during this period.

➤ **health situation:**

Conflict-related displacement has contributed to the overall deterioration of the health situation. The numbers are large and cannot be counted solely through regular ports.

These figures do not include irregular migration,

which is difficult to track and poses a regional risk of disease transmission.

➤ **epidemiological and humanitarian crisis:**

Sudan is facing a complex epidemiological and humanitarian crisis resulting from the collapse of the health system due to the conflict.

The shortage of essential medical supplies has led to an inability to treat diseases that could have been controlled.

Displacement, the military targeting of health facilities, and the lack of access to safe drinking water have also increased the spread of diseases.

Current epidemiological surveillance data may underrepresent the true extent of the outbreak due to the difficulty of collecting data during wartime.

Comparisons with pre-conflict data (2019) indicate a significant increase in morbidity and mortality rates, reflecting the negative impact of war on public health.

Limitations of the review:

Although this review provides information of high importance in determining the general state of the health system in Sudan and the extent of the spread of infectious diseases among the population, the restrictions imposed have limited full access to information.

For example, studies and statistics did not reach all health facilities, or at least did not reach a large segment of the population and the displaced, so the numbers, health status, and extent of destruction all remain questions whose answers are unknown.

Moreover, non-communicable diseases cannot be limited to their intersection with infectious diseases and their impact on the complete data of the general condition of health facilities.

Also, this study did not address any disease that could have been transmitted through sex or any other means that contribute to the spread of infectious diseases such as AIDS or other diseases, which result from mixing of the population in one way or another or their exposure to the conditions of the ongoing war.

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Conclusion:

The outfitted clash in Sudan has critical ramifications for the wellbeing and prosperity of its populace, especially youngsters and ladies. The contention has disturbed food frameworks, prompted relocation, and caused financial shakiness, adding to expanded hunger rates and potential future medical conditions. The effect on emotional wellness is likewise imperative, with direct inclusion prompting PTSD, discouragement, and tension, and backhanded impacts, for example, dislodging and the breakdown of informal communities adding to sensations of detachment, sadness, and uneasiness. To address these wellbeing worries in struggle zones, it is essential to focus on admittance to medical care, emotional well-being administrations, and local area based help. It is additionally critical to address the main drivers of contention and elevate peace building to forestall future struggles and their related wellbeing influences. Giving guide and backing to those impacted by furnished clashes by the global local area is fundamental, yet it is significant to guarantee that this help is powerful and supportable.

The ramifications of the equipped clash in Sudan stretch out past the actual nation, featuring the more extensive difficulties and ramifications of furnished clashes for worldwide wellbeing and compromise endeavors. Focusing on wellbeing and prosperity in struggle zones is fundamental for advancing harmony and soundness, as wellbeing and struggle are interlinked.

In general, this research indicates the extent of the impact of political events on the stability of the health system in the country, and all previous readings and analyzes indicate the extent of the development of infection transmission and deaths resulting from the lack of provision of necessary health care for civilians and displaced persons, and despite all that information, there is a lack of sources and statistics. The process of determining the true numbers of the disaster that will occur during the Sudanese war in 2023 is hampered for several reasons, including the destruction of the infrastructure of health facilities, which were specifically concentrated in the capital, Khartoum, where all residents of other states come to obtain treatment and health supplies, and if the war continues for more than Things may get worse and increase the suffering of defenseless civilians. Therefore, it is necessary to put conflicts aside and pay attention to the general health of civilians.

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