# Literature Review: Disease Epidemiology in Sudan

## Regional Disease Distribution, Outbreaks, and Chronic Disease Burden

## Introduction

Sudan's tropical climate, compounded by ongoing conflict and humanitarian crises, has led to a significant burden of both infectious and chronic diseases. The displacement of populations into refugee camps and isolated areas has exacerbated the spread of diseases such as malaria, cholera, kala-azar, tuberculosis (TB), and dengue fever. Additionally, chronic diseases are becoming increasingly prevalent in these vulnerable populations (WHO, 2024). This review provides an updated overview of the epidemiology, regional distribution, and outbreak dynamics of these diseases in the context of Sudan's current war conditions (UNHCR, 2024).

## 2.0 Malaria

### 2.1 Epidemiology and Regional Distribution

Malaria remains a leading cause of morbidity and mortality in Sudan, with Plasmodium falciparum being the predominant species (WHO, 2024). The highest transmission rates are observed in tropical and subtropical regions like Blue Nile, South Kordofan, and Darfur, where environmental conditions favor mosquito breeding (Sudan Ministry of Health, 2024). Conflict-induced displacement has led to overcrowded camps with inadequate sanitation, further facilitating malaria transmission (MSF, 2024). Seasonal rains and flooding exacerbate the situation by creating ideal breeding conditions for Anopheles mosquitoes (UNHCR, 2024). Seasonal rains and flooding create ideal breeding conditions for Anopheles mosquitoes.

### 2.2 Outbreaks

The ongoing conflict has disrupted malaria control programs, leading to increased incidence rates. In 2024, malaria cases surged among host communities and refugees in Blue Nile and Darfur, with over 3,456 confirmed cases reported in Kurmuk by July (WHO, 2024). Many patients lacked timely access to artemisinin-based combination therapies (ACTs), resulting in higher mortality rates (MSF, 2024). The rainy season exacerbates the situation by creating additional breeding sites for mosquitoes. The conflict has led to large-scale displacement, increasing malaria transmission in overcrowded camps lacking insecticide-treated nets (ITNs).

### 2.3 Challenges and Control Efforts

Conflict disrupts malaria prevention programs and healthcare delivery. Limited access to ITNs and vector control measures, compounded by the destruction of health facilities, undermines malaria management efforts (Sudan Ministry of Health, 2024). Efforts to control malaria are further hampered by the displacement of healthcare workers and logistical challenges in delivering essential supplies (WHO, 2024).

## 3.0 Cholera

### 3.1 Epidemiology and Regional Distribution

Cholera outbreaks have become increasingly frequent in flood-prone areas, particularly in Kassala and Al-Qadarif, and refugee camps in Darfur. Overcrowding, lack of clean water, and poor sanitation in these areas create conditions conducive to the spread of Vibrio cholerae (MSF, 2024).

### 3.2 Outbreaks

A significant cholera outbreak occurred in mid-2024, resulting in at least 388 deaths and approximately 13,000 infections over two months (WHO, 2024). Refugee camps reported high transmission rates due to contaminated water sources and inadequate sanitation facilities (UNHCR, 2024).

### 3.3 Challenges and Control Efforts

The war has severely impacted water, sanitation, and hygiene (WASH) infrastructure, essential for cholera control (WHO, 2024). Emergency vaccination campaigns have been deployed, but logistical challenges and insecurity limit their reach (Sudan Ministry of Health, 2024). The destruction of infrastructure and healthcare facilities has further complicated response efforts.

## 4.0 Kala-Azar (Visceral Leishmaniasis)

### 4.1 Epidemiology and Regional Distribution

Kala-azar, endemic in regions like Gedaref and Blue Nile, is caused by Leishmania donovani and transmitted by sandflies. Malnutrition and weak immune systems among displaced populations increase susceptibility (MSF, 2024). The displacement of populations into these areas has increased exposure to sandfly vectors, leading to a rise in cases.

### 4.2 Outbreaks

In 2023–2024, Gedaref reported over 2,000 cases, disproportionately affecting refugees and IDPs (WHO, 2024). Overcrowded living conditions and delayed treatment contributed to high fatality rates (Sudan Ministry of Health, 2024). High fatality rates were linked to delayed diagnosis and limited access to antileishmanial drugs. Conflict and displacement have disrupted control programs, resulting in increased incidence of kala-azar.

### 4.3 Challenges and Control Efforts

War conditions disrupt vector control programs and limit access to diagnostic and treatment resources. Co-infections with HIV further complicate kala-azar management (MSF, 2024). Diagnostic and treatment resources are scarce, and co-infections with HIV further complicate management of health conditions.

## 5.0 Tuberculosis (TB)

### 5.1 Epidemiology and Regional Distribution

TB remains a significant public health issue, particularly in urban centers and conflict-affected regions. Malnutrition and overcrowding in camps exacerbate TB spread (UNHCR, 2024). The displacement of populations into overcrowded camps has facilitated TB transmission.

### 5.2 Outbreaks

Rising multidrug-resistant TB (MDR-TB) cases are linked to disrupted healthcare services and limited treatment adherence in displaced populations (WHO, 2024). Overcrowded environment, displaced populations, and unsanitary conditions in refugee camps have further contributed to the spread of TB and serve as reservoirs for transmission.

### 5.3 Challenges and Control Efforts

The war has disrupted TB control programs, including diagnostics and treatment. Refugees and displaced individuals face stigma, inconsistent access to medication, and inadequate healthcare infrastructure, contributing to treatment resistance (MSF, 2024). Efforts to control TB are hampered by the destruction of healthcare infrastructure and the displacement of healthcare workers.

## 6.0 Dengue Fever

### 6.1 Epidemiology and Regional Distribution

Dengue fever, caused by Aedes aegypti mosquitoes, is increasingly prevalent in Kassala and Red Sea regions, driven by poor waste management and urbanization (Sudan Ministry of Health, 2024). The displacement of populations into these areas has increased exposure to Aedes aegypti mosquitoes, the primary vectors of dengue virus.

### 6.2 Outbreaks

Recent outbreaks reported over 1,500 cases in Kassala in 2024, particularly in peri-urban and refugee camp areas (WHO, 2024). Seasonal rains and inadequate vector control measures have led to increased dengue transmission.

### 6.3 Challenges and Control Efforts

The conflict has disrupted vector control and disease surveillance systems, undermining effective management efforts (UNHCR, 2024). Limited diagnostic capabilities and weak disease surveillance systems further impede response efforts and hinder effective dengue management.War conditions disrupt vector programs and public health awareness campaigns.

## 7.0 Chronic Diseases in Refugee Camps and Isolated Areas

### 7.1 Epidemiology and Challenges

Chronic diseases, including hypertension, diabetes, and cardiovascular conditions, are rising in refugee camps and isolated areas. Displaced populations face limited access to essential medications and regular care (MSF, 2024). The ongoing conflict has disrupted healthcare services, limiting access to essential medications and routine care. Psychological stress, poor nutrition, and unhealthy living conditions worsen these conditions.

### 7.2 Impact of War

The destruction of healthcare facilities and displacement of workers have disrupted chronic disease management. Psychological stress and poor nutrition worsen these conditions (UNHCR, 2024). The war has led to the displacement of millions, with over 600,000 seeking refuge in neighboring countries. The resulting humanitarian crisis has overwhelmed healthcare systems, making it challenging to manage chronic diseases effectively.

### 7.3 Recommendations

Strengthening healthcare systems through mobile clinics, telemedicine, and integrating chronic disease care into emergency response is critical (WHO, 2024). Mental health support and nutritional interventions should also be prioritized.

## 8.0 Conclusion

The epidemiology of diseases in Sudan reflects the devastating impact of conflict and displacement. Addressing these challenges requires enhanced coordination among humanitarian organizations, improved disease surveillance, and strengthened healthcare systems (WHO, 2024).

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## References

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