University of Dongola

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RESEARCH PROPOSAL

Prevalence of Meningoencephalitis among Pediatric Patients at Dongola Specialized Hospital, Northern State, Sudan, 2026.

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1.1 Introduction

Meningoencephalitis is an inflammatory condition involving the meninges and brain parenchyma. It may result from infectious or non-infectious causes and can present with fever, seizures, altered level of consciousness, headache, vomiting, and focal neurological abnormalities. In children, meningoencephalitis is an important clinical condition because it may lead to severe neurological complications and death, particularly when diagnosis and treatment are delayed (1,2).

Meningitis remains an important global health problem, with a considerable burden among children and populations living in the African meningitis belt. The Global Burden of Disease Study 2016 estimated approximately 2.82 million incident meningitis cases worldwide in 2016, highlighting the continuing need for effective surveillance, timely diagnosis, and appropriate treatment (3). Surveillance studies in the WHO African Region have also documented a substantial burden of pediatric bacterial meningitis, including infections caused by Streptococcus pneumoniae, Neisseria meningitidis, and Haemophilus influenzae (4,5).

In Sudan, hospital-based research among febrile children in Khartoum has demonstrated the importance of applying standardized clinical and laboratory criteria when diagnosing and estimating the burden of bacterial meningitis (6). However, the available evidence does not adequately describe the hospital-based prevalence of pediatric meningoencephalitis at Dongola Specialized Hospital in Northern State, Sudan.

Determining the hospital-based prevalence and describing the demographic, clinical, vaccination, and laboratory characteristics of affected children may provide locally relevant information about the condition. Therefore, this study will determine the hospital-based prevalence of meningoencephalitis among pediatric admissions at Dongola Specialized Hospital during the period from July to November 2026.

1.2 Problem Statement

Meningoencephalitis is a potentially serious condition in children that may cause severe neurological complications and death. Although global and regional studies have documented the burden of meningitis, and research from Khartoum has examined bacterial meningitis among Sudanese children, the available evidence does not adequately establish the hospital-based prevalence of pediatric meningoencephalitis at Dongola Specialized Hospital (3–6).

The absence of locally documented data makes it difficult to quantify the proportion of pediatric admissions affected by meningoencephalitis during a defined period. Furthermore, information describing the demographic and clinical characteristics of affected children, their documented vaccination status, and available laboratory findings is limited in the local setting.

Consequently, the hospital-based prevalence of pediatric meningoencephalitis at Dongola Specialized Hospital during the study period remains insufficiently documented. This study will address this information gap by determining the hospital-based prevalence and describing the

characteristics of pediatric patients diagnosed with the condition between July and November 2026.

1.3 Justification

Previous global and regional studies have demonstrated that meningitis continues to represent an important health problem, particularly among children in the African region (3–5). Research conducted in Sudan has also highlighted the importance of standardized clinical assessment and laboratory investigations in identifying bacterial meningitis among children (6).

These findings support the need for locally relevant epidemiological information to complement the existing evidence. However, the available studies do not adequately describe the hospital-based prevalence of pediatric meningoencephalitis at Dongola Specialized Hospital. The absence of such information represents a gap in the published evidence concerning this condition in Northern State.

The present study is therefore justified by the need to establish a local hospital-based estimate of the prevalence of pediatric meningoencephalitis and to describe the demographic, clinical, vaccination, and laboratory characteristics documented among affected children. The findings may provide baseline information for future research, support comparisons with findings from other settings, and help identify areas where further clinical or epidemiological investigation may be needed.

1.4 Research Hypothesis

Because the study is descriptive in nature, a formal hypothesis-testing framework may not be necessary. The study will focus on estimating hospital-based prevalence and describing the characteristics of pediatric patients with meningoencephalitis.

1.5 Objectives

1.5.1 General Objective

To determine the hospital-based prevalence of meningoencephalitis among pediatric admissions at Dongola Specialized Hospital, Northern State, Sudan, from July to November 2026.

1.5.2 Specific Objectives

1. To determine the hospital-based prevalence of meningoencephalitis among pediatric admissions at Dongola Specialized Hospital during the study period.
2. To describe the demographic and clinical characteristics of pediatric patients diagnosed with meningoencephalitis.
3. To describe the documented vaccination status and available laboratory findings, including complete blood count, cerebrospinal fluid analysis, Gram stain, blood culture, and cerebrospinal fluid culture, among pediatric patients diagnosed with meningoencephalitis.
4. To identify and describe microorganisms isolated from blood and cerebrospinal fluid cultures among culture-positive cases.

1.6 Research Questions

1. What is the hospital-based prevalence of meningoencephalitis among pediatric admissions at Dongola Specialized Hospital from July to November 2026?
2. What are the demographic and clinical characteristics of pediatric patients diagnosed with meningoencephalitis during the study period?
3. What is the documented vaccination status of pediatric patients with meningoencephalitis, and what laboratory findings are available among these patients?
4. Which microorganisms are isolated from blood and cerebrospinal fluid cultures among culture-positive cases?

2. LITERATURE REVIEW

2.1 Global, regional, and national burden of meningitis, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016.

Murray et al. conducted a systematic analysis for the Global Burden of Disease Study 2016 to estimate the global, regional, and national burden of meningitis. The analysis estimated 2.82 million incident meningitis cases globally in 2016 and found that the highest incidence rates were concentrated in the peri-Sahelian countries forming the African meningitis belt. The study highlighted the continuing burden of meningitis and the importance of surveillance, prevention, diagnosis, and treatment (4).

2.2 Pediatric bacterial meningitis surveillance in the World Health Organization African Region using the invasive bacterial vaccine-preventable disease surveillance network, 2011–2016.

Bardají and colleagues analyzed pediatric bacterial meningitis surveillance data from the WHO African Region covering 2011–2016. Data from 26 countries included 49,844 reported meningitis cases in children younger than five years, with laboratory-confirmed cases involving Streptococcus pneumoniae, Neisseria meningitidis, and Haemophilus influenzae. The study demonstrated the value of standardized surveillance for describing the epidemiology of pediatric bacterial meningitis across Africa (5).

2.3 Bacterial meningitis in Sudanese children; critical evaluation of the clinical decision using clinical prediction rules.

Abdelrahim, Fadl-Elmula, and Ali conducted a hospital-based study among 503 febrile children provisionally diagnosed with meningitis in Khartoum, Sudan. The study found that 55.9% received a final clinical confirmation, while only 1.5% of children with available clinical and laboratory information met criteria for proven bacterial meningitis. Neisseria meningitidis and Streptococcus pneumoniae were identified as bacterial causes in the confirmed cases. The findings demonstrate the importance of standardized diagnostic criteria when estimating the burden of meningitis in Sudanese children (7).

The reviewed literature shows that meningitis remains an important pediatric health problem globally and in Africa, while Sudan has published evidence mainly from Khartoum and from

studies focused on bacterial meningitis or specific etiologies. There is a local evidence gap concerning the hospital-based prevalence of pediatric meningoencephalitis at Dongola Specialized Hospital, which the present study aims to address (4-7).

3. MATERIALS AND METHODS

3.1 Study Design

A hospital-based observational descriptive study with retrospective and prospective components (ambispective) will be conducted. The study will determine the hospital-based prevalence of pediatric meningoencephalitis during the defined period from July 2026 to November 2026. Eligible cases admitted from July 2026 until the beginning of approved data collection will be identified through retrospective review of medical records. Eligible cases presenting thereafter will be identified prospectively until the end of November 2026.

3.2 Study Area

The study will be conducted in Dongola, the capital city of Northern State, Sudan. Dongola is located in northern Sudan along the Nile River and is characterized by a hot, dry desert climate, with very high temperatures during the summer months. The hot environmental conditions and the seasonal variation in temperature are relevant contextual features when describing pediatric illnesses observed in the area. The study will focus on pediatric patients receiving hospital care within Dongola [10].

3.3 Study Setting

The study setting will be Dongola Specialized Hospital, a major healthcare facility serving Dongola and surrounding communities in Northern State. The hospital provides pediatric clinical services and has access to routine laboratory investigations relevant to the study, including complete blood count, CSF analysis, Gram staining, blood culture, and CSF culture where clinically indicated and available.

3.4 Study Population

Study Population

All pediatric patients younger than 18 years admitted during the study period who meet the approved study case definition for meningoencephalitis.

3.5 Case Definition

A study case will be a child younger than 18 years with an acute febrile or clinically compatible illness and neurological dysfunction, such as seizure, altered level of consciousness, or focal neurological abnormality, together with clinical evidence of meningeal involvement or a treating-physician diagnosis of meningoencephalitis. A case may be microbiologically confirmed when an etiological organism is demonstrated by an appropriate laboratory investigation. Patients with a subsequently established alternative diagnosis excluding meningoencephalitis will not be counted (2,8).

3.6 Inclusion Criteria

- Pediatric patients aged less than 18 years.
- Patients admitted during the defined study period.
- Patients who meet the approved clinical case definition for suspected/probable or confirmed meningoencephalitis.
- Medical records containing sufficient information to establish eligibility.

3.7 Exclusion Criteria

- Patients aged 18 years or older.
- Patients whose final clinical assessment establishes an alternative diagnosis and excludes meningoencephalitis.
- Records with insufficient information to establish eligibility after reasonable attempts to retrieve the required information.

3.8 Sampling Technique and Sample Size

Consecutive sampling will be used to include all eligible newly diagnosed pediatric cases of meningoencephalitis identified during the study period. Every eligible case will be included consecutively without selective sampling.

The minimum sample size is estimated to be **50 cases**. This estimate is based on the observed frequency of meningoencephalitis cases per week and per month, as well as the number of cases recorded during the previous year.

All eligible cases identified during the study period will be included consecutively, with a minimum target of 50 cases.

3.9 Data Collection

Data will be collected from the selected hospitals in Dongola using a structured data collection questionnaire. Retrospective data will be obtained from medical records of eligible pediatric patients diagnosed with meningoencephalitis between July and September 2026. Prospective data will be collected from newly diagnosed eligible pediatric patients between September and November 2026. Only newly diagnosed cases during the defined study period will be considered for the prevalence calculation, using the total number of pediatric admissions as the denominator.

Demographic Data

- Study identification number
- Age
- Sex
- Residence
- Date of admission

Clinical Data

- Presenting symptoms

- Fever
- Seizures
- Altered level of consciousness
- Meningeal signs
- Focal neurological signs
- Duration of illness
- Relevant documented medical history
- Final clinical diagnosis
- Hospital outcome where available

Vaccination Data

- Documented vaccination status
- Relevant vaccine history according to available records and the applicable national immunization schedule

Laboratory Data

- Complete blood count
- CSF analysis
- CSF culture
- Blood culture
- Microorganism isolated, where available

Only investigations performed as part of routine clinical care, or investigations separately approved for research, will be recorded. No invasive procedure will be performed solely for research unless specifically approved by the relevant ethics committee (8).

3.10 Study Variables

Dependent Variable: Meningoencephalitis case status (positive or negative).

Independent Variables: Sociodemographic characteristics, including age, sex, residence, and socioeconomic status; clinical characteristics, including presenting symptoms, signs, and relevant medical history; relevant laboratory and investigation findings; vaccination history; and relevant environmental or surrounding factors available in the study data.

3.11 Data Analysis

Data will be entered, cleaned, coded, and analyzed using appropriate statistical software such as SPSS.

Categorical variables will be summarized using frequencies and percentages. Continuous variables will be summarized using means and standard deviations when approximately normally distributed, or medians and interquartile ranges when appropriate.
Hospital-based prevalence for the study period will be calculated as:

Hospital-based prevalence (%) = (Number of eligible meningoencephalitis cases ÷ Total pediatric admissions) × 100

The prevalence will be interpreted as a hospital-based frequency/proportion of pediatric admissions during the defined period and will not be presented as community population prevalence.

3.12 Ethical Considerations

Ethical approval will be obtained from the Research Ethics Committee of the Faculty of Medicine, University of Dongola, and the Ministry of Health, Northern State, Sudan. Administrative permission will also be obtained from Dongola Specialized Hospital.

Confidentiality and privacy of patients' information will be maintained throughout the study. Data will be collected and used solely for research purposes, and no personal identifiers will be included in the final report.

3.13 Research Plan

5. Finalization of the proposal and approval by the supervisor.
6. Submission for ethical and administrative approval.
7. Preparation and pilot review of the data collection form.
8. Retrospective identification and extraction of eligible records after approval.
9. Prospective identification and documentation of eligible cases.
10. Data entry, cleaning, coding, and quality control.
11. Statistical analysis and interpretation.
12. Preparation, revision, and submission of the final research report.

3.14 Time Schedule

The study activities will be implemented according to the following schedule:

Activity	Sep 2026	Oct 2026	Nov 2026	Dec 2026	Jan 2027
Proposal finalization and supervisor approval	✓				
Ethical and administrative clearance	✓	✓			
Preparation and pilot review of data collection form		✓			
Retrospective data collection		✓	✓		
Prospective data collection		✓	✓		
Data cleaning and coding			✓	✓	
Data analysis and interpretation				✓	

Final report writing and revision				✓	✓
Final submission					✓

3.15 Budget

Item	Estimated cost (SDG)
Printing and photocopying	20,000
Stationery and data collection forms	80,000
Transportation	100,000
Communication and coordination	50,000
Data entry/analysis	200,000
Others	50,000
Total	500,000

4. REFERENCES

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5. ANNEXES

Annex I: Data Collection Form

Study title: Hospital-Based Prevalence of Meningoencephalitis among Pediatric Patients at Dongola Specialized Hospital, Northern State, Sudan (July–November 2026).

Section	Information
Study identification	Study ID; hospital record number kept separately and securely; date of admission
Demographic data	Age; sex; residence
Clinical presentation	Fever; seizures; altered consciousness; meningeal signs; focal neurological signs; duration of illness; other relevant symptoms
Medical history	Relevant previous illnesses and documented history
Vaccination	Documented vaccination status and relevant vaccine history
Investigations	CBC; CSF analysis; CSF culture; blood culture; microorganism identified; susceptibility result if routinely available
Management	Plan of management
Outcome	Discharged; died; referred; other documented outcome
Eligibility	Meets approved study criteria: Yes / No

Annex II: Administrative and Ethical Documents

- Ethical clearance application and approval.
- Hospital administrative permission letter.
- Final data collection form.
- Participant information and consent/waiver documents as required.
- Data confidentiality and management plan.