



# ***Neisseria meningitidis* Meningitis in Burkina Faso: Review of the Literature**

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## **Authors' contributions**

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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## **ABSTRACT**

**Introduction:** *Neisseria meningitidis* meningitis is a permanent threat in Burkina Faso due to its epidemic potential.

**Objective:** To study the epidemiological aspects of meningitis caused by *Neisseria meningitidis* and to identify the main current trends.

**Patients and Methods:** This was a descriptive cross-sectional study with retrospective collection of data from the literature on *Neisseria meningitidis* epidemics in Burkina Faso.

**Results:** Burkina Faso has experienced several epidemics of meningitis caused by *Neisseria meningitidis* serogroup A. Indeed, the country was hit by epidemics due to this serogroup in 1957, 1985, 1994, 1995, 1996, 1997, 2004, 2005, 2006, 2007, 2008 and 2009. The 1996 epidemic was particularly deadly with 4363 deaths recorded. *Neisseria meningitidis* serogroup W has also been responsible for several epidemics including those of 1992, 2001, 2002, 2003, and 2012. While *Neisseria meningitidis* serogroup X was responsible for the first major epidemic in 2010. As for *Neisseria meningitidis* serogroup C, after a first outbreak in 1979, it was in 2019 that this serogroup was again responsible for an outbreak in eastern Burkina Faso. In all these outbreaks, children

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were the most affected and case fatality was high (more than 14%). In addition to the therapeutic management of cases, a vaccine response was used to contain these epidemics. The vaccines used were initially polysaccharide vaccines (meningococcal A+C vaccine, tetravalent A+C+Y+W vaccine), and since 2010, the MenAfriVac® conjugate vaccine, which has eliminated epidemics due to meningococcus (Nm) A. However, it is noted that other *Neisseria meningitidis* serogroups (X,C,W) continue to circulate. Epidemiological surveillance data showed a clear decline in *Neisseria meningitidis* in week 48 of 2022, behind *Streptococcus pneumoniae* which has become the leading cause of bacterial meningitis in Burkina Faso. The same trend has been observed since the mass vaccination campaign with the MenAfriVac® conjugate vaccine.

**Conclusion:** The persistent circulation of *Neisseria meningitidis* serogroups W, X, and C raises concerns about further meningitis epidemics. It is important to maintain a high level of epidemiological surveillance of *Neisseria meningitidis* in Burkina Faso.

**Keywords:** Epidemic; meningitis; *Neisseria meningitidis*; serogroups; Burkina Faso.

## 1. INTRODUCTION

Meningitis is an inflammatory process in the meninges most often caused by microorganisms. *Neisseria meningitidis* meningitis, commonly referred to as cerebrospinal meningitis, is the only bacterial meningitis that can cause epidemics [1]. It is characterized by an infectious syndrome with evidence of *Neisseria meningitidis* or strongly suggestive biological abnormalities on examination of cerebrospinal fluid [2]. Meningitis occurs in the sub-Saharan region of the continent, known as the "African meningitis belt", which extends from Senegal in the west to Ethiopia in the east [3,4]. Since 1980 there has been an expansion of these epidemics to the south of the Lapeyssonnia belt [4-6]. This area has paid a heavy price for this disease. The incidence of meningitis was higher there, and young children, adolescents, and immunocompromised youth were most affected. These epidemics used to be caused mainly by *Neisseria meningitidis* serogroup A. They constitute a public health problem for the countries of the African meningitis belt [7]. Of the twelve serogroups of *Neisseria meningitidis*, six (A, B, C, W, X, and Y) cause the majority of epidemics and five (A, B, C, W, and Y) have vaccines. The objective of this review of the literature was to study the epidemiological aspects of *Neisseria meningitidis* meningitis and to identify the main current trends.

## 2. PATIENTS AND METHODS

This was a descriptive cross-sectional study with retrospective collection of data from the literature on *Neisseria meningitidis* meningitis in Burkina Faso.

The data were collected from the Directorate of Health Protection of the Population (Direction de

la Protection de la Santé de la Population (DPSP) of the Ministry of Health of Burkina Faso and from published scientific articles.

## 3. RESULTS AND DISCUSSION

### 3.1 Results

#### 3.1.1 Epidemiological aspects

Burkina Faso, located in the heart of the African meningitis belt, has suffered several epidemics due to *Neisseria meningitidis* serogroup A. In fact, the first epidemic due to this serogroup dates back to 1957, with 16,000 cases. Subsequently, the years 1985, 1994, 1995, 1996, 1997, 2004, 2005, 2006, 2007, 2008 and 2009 have also seen epidemics due to *Neisseria meningitidis* serogroup A.

Regarding epidemics due to *Neisseria meningitidis* serogroup W, data from the literature indicate that Burkina Faso experienced the first large-scale epidemic in 1992. Subsequently, other epidemics occurred in 2001, 2002, 2003, and 2012, while *Neisseria meningitidis* serogroup X was responsible for the first large epidemic in 2010 [1,6-15].

As for serogroup C of *Neisseria meningitidis*, after a first outbreak in 1979, it was in 2019 that this serogroup was again responsible for an outbreak in eastern Burkina Faso.

Although serogroup Y was isolated alongside serogroup A in previous epidemics, notably those of 1994 and 1995, it has not yet been able to express its epidemiogenic potential in Burkina Faso. Although children between 5 and 10 years of age are the most affected during epidemics, the disease also affects adolescents and young adults. The case fatality rate during epidemics was high (over 14%) [1,16-19].

### 3.1.2 Clinical aspects

Clinically, acute meningitis is characterized by an abrupt onset, severe headache, fever, nausea, vomiting, photophobia, and neck stiffness. Other neurological signs, such as prostration, delirium, coma and/or convulsions may be observed. The clinical examination will note meningeal stiffness with Kernig or Brudzinski signs; the presence of purpura is characteristic of meningococemia.

A lumbar puncture is necessary to detect the meningococcus. Analysis of cerebrospinal fluid in the laboratory allows isolation of the bacteria by culture and PCR. The antibiogram specifies the sensitivity of the bacteria. Cerebrospinal fluid cytology shows hyperleukocytosis and biochemistry shows moderate hyperproteinorrachia [3,11].

### 3.1.3 Strategies for responding to epidemics

In Burkina Faso, several strategies are implemented to fight epidemics of meningitis caused by *Neisseria meningitidis*. Therapeutic management of cases during epidemics involves Ceftriaxone 2 g/day once daily IM or IV for 5 days in adults, and Ceftriaxone 100 mg/kg/day once daily IM or IV for 5 days in children. Outside of epidemics, the duration of treatment is 7-10 days for all ages with ceftriaxone or cefotaxime and at the same dosage as during an epidemic. Adjuvant treatment is always instituted; it involves 3 days of corticosteroid therapy with dexamethasone 10 mg every 6 hours or hydrocortisone 500mg/d in a single injection in adults; and in children, dexamethasone 0.5 to 1mg/kg/d in two injections or hydrocortisone 10 mg/kg/d in two injections, Hydration and correction of electrolyte disorders in case of dehydration; antipyretic treatment in case of

fever; and treatment of seizures and prevention of recurrence [20].

In addition to the free therapeutic management of cases, a mass reactive vaccination campaign was used to control these epidemics. The vaccines used were initially polysaccharide vaccines (meningococcal A+C vaccine, tetravalent A+C+Y+W vaccine), and since 2010, the MenAfriVac® conjugate vaccine, which has eliminated epidemics due to meningococcus (Nm) A. Also, a change in the vaccination schedule has allowed the introduction of this vaccine (MenAfriVac) into the expanded program of vaccination in Burkina Faso. All epidemics due to *Neisseria meningitidis* serogroup W have been met with a lack of vaccine for the response.

### 3.1.4 Epidemiological surveillance

This surveillance is case-based. It allows the transmission of national data on meningitis in real time. Thus, in 2022, there was a clear decline in *Neisseria meningitidis*, behind *Streptococcus pneumoniae*, which has become the leading cause of bacterial meningitis in Burkina Faso. In 2022, a cumulative total of 1564 cases, including 78 deaths, have been recorded as of week 48 of the year 2022. Most cases were due to *Streptococcus pneumoniae* which accounted for 66% of cases, while *Neisseria meningitidis* X accounted for 15%, and *Neisseria meningitidis* C for 5%. No cases of meningitis due to *Neisseria meningitidis* serogroup A were detected in 2022(10). The same trend had been observed since the mass campaign with the new MenAfriVac conjugate vaccine in 2010. Tables 1 and 2 present respectively the cases and deaths of meningitis from 2011 to 2021 and the evolution of *Neisseria meningitidis* cases isolated by PCR at the laboratory of the Centre hospitalier universitaire yalgado Ouédraogo.

**Table 1. Status of meningitis cases, deaths and case fatality from 2011 to 2021 [10]**

Years	Cases	Deaths	Lethality
2011	3878	588	15,2
2012	6793	720	10,6
2013	2919	339	11,6
2014	3475	357	10,3
2015	2877	287	10,1
2016	721	80	11,1
2017	488	43	8,8
2018	440	20	4,5
2019	1794	130	7,2%
2020	1579	107	6,8%
2021	1559	91	5,8%

**Table 2. Evolution of *Neisseria meningitidis* cases isolated by PCR of cerebrospinal fluid in a meningitis reference laboratory (Yalgado Ouédraogo University Hospital of Ouagadougou) from 2011 to 2021 [21]**

Years	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Samples received	486	1341	676	970	838	785	715	754	582	406	456
Samples positive	226	611	222	293	336	274	210	118	152	98	103
<i>N. meningitidis</i> isolated	51	387	79	89	122	64	26	17	66	34	25

An oropharyngeal carriage study conducted in 2016 found a carriage rate ranging from 3% for *Neisseria meningitidis* X to 5% for *Neisseria meningitidis* W in the general population in Burkina Faso. This oropharyngeal carriage could reach 10% of the population in some countries of the African meningitis belt. During the 2002 epidemic, the carriage rate was 25% in epidemic health districts during the W epidemic in Burkina Faso, compared to a carriage of 3.4% in non-epidemic districts [8,9,10].

### 3.2 Discussion

In Burkina Faso, since mass vaccination with MenAfrivac in 2010 and its introduction in the expanded program of immunization, there has been a marked decline in *Neisseria meningitidis* meningitis, behind *Streptococcus pneumoniae* which has become the leading cause of bacterial meningitis in Burkina Faso. All epidemics due to *Neisseria meningitidis* serogroup W have been hampered by a lack of vaccines for the response. For this reason, the Ministry of Health of Burkina Faso has based its response to epidemics due to NmW and X on case management, using antibiotics (ceftriaxone) that are provided free of charge. Regardless of management, death is possible if there are poor prognostic factors such as coma, seizures, shock and leukopenia [3,11]. Case fatality during *Neisseria meningitidis* epidemics remains high in Burkina Faso (over 14%), comparable to the Soumaré series in Dakar [5]. However, higher mortality rates have been reported in French series reaching 20% in adults and 10% in children [2]. The prognosis of *Neisseria meningitidis* meningitis depends on early diagnosis and appropriate management [2].

### 4. CONCLUSION

Burkina Faso has paid a heavy price for cerebrospinal meningitis epidemics. Nm A,C,W,X have been the most incriminated serogroups.

The current trend is a decline in *Neisseria meningitidis* serogroups A and W, while there is an increase in serogroups X and C. Since the 2010 mass vaccination with the MenAfrivac conjugate vaccine, *Streptococcus pneumoniae* has overtaken *Neisseria meningitidis* as the leading cause of purulent meningitis in Burkina Faso.

The persistent circulation of *Neisseria meningitidis* X, *Neisseria meningitidis* C, and oropharyngeal carriage of *Neisseria meningitidis* W raise concerns about further epidemics of cerebrospinal meningitis. The best prospect for controlling meningococcal meningitis epidemics in Africa is the development of a conjugate vaccine that includes A C X and W serogroups, which will be introduced in the expanded program on immunization. It is important to maintain a high level of surveillance of *Neisseria meningitidis* meningitis including genome sequencing.

### CONSENT AND ETHICAL APPROVAL

It is not applicable.

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### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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