Acta Scientific Microbiology (ISSN: 2581-3226)

Volume 8 Issue 5 May 2025

Research Article

Impact of « MenAfrivac» on Meningococcal Meningitis from 2010 to 2022 in Burkina Faso

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Received: March 27, 2025

Published: April 04, 2025

Abstract

Introduction: Meningococcal meningitis is a major public health issue in Burkina Faso due to its high morbidity and mortality. This work aims at studying meningococcal meningites thirteen years (13 years) after the nationwide introduction of" MenAfrivac" serogroup A meningococcal vaccine.

Methodology: This was a retrospective cross-sectional study of all epidemiological surveillance data on meningococcal meningitis following the introduction of conjugate A vaccine from 2010 to 2022. It involved all suspected cases of meningitis in Burkina Faso's 13 health regions, whose cerebrospinal fluid (CSF) samples were analyzed in the laboratory using the Polymerization Chain Reaction (PCR) technique.

Results: A total number of 27370 suspected cases of meningitis were recorded. Of these, 3125 were PCR-confirmed, including 1155 meningococcal cases, i.e. a frequency of 36.96%, and 76 fatal cases, of which 56 (73.68%) were due to serogroup W. Patients aged [4 - 15] were the most represented (74.12%). Nm serogroups accounted for 0.41% of NmA, 75.17% of NmW and 20.78% of NmX.

Conclusion: This work has highlighted the nearly total disappearance of NmA following the introduction of the A(MenAfrivac) conjugate vaccine, and the emergence and re-emergence of other serogroups. It is therefore imperative to strengthen surveillance, develop and make available a conjugate vaccine that takes into account these serogroups noticed in the country.

Keywords: Meningococcal Meningitis; Serogroups A; W and X; MenAfriVac

Introduction

Meningococcal meningitis is a real public health concern, particularly in sub-Saharan Africa in the so-called Lapeyssonnie meningitis belt [1] involving twenty-six (26) contiguous countries, stretching from Senegal in the west to Ethiopia in the east, caused largely by serogroup A meningococcus [2]. According to the WHO, the population in the zone is estimated at around 500 million [1], of whom 240 million live in the seven (07) countries most at risk: Burkina Faso, Mali, Niger, Chad, northern Nigeria, Sudan and Ethiopia.

In countries in this zone, an annual outbreak in meningitis cases is observed during the dry season, resulting in a high endemic background [3]. According to the World Health Organization (WHO), from 1998 to 2000, the number of cases of meningitis worldwide was estimated at over 700,000, with a letality rate of over 10% and a considerable after-effect proportion, sometimes reaching 20% [4]. The last large-scale meningitis epidemic in the African meningitis belt occurred in 2009, with a total of 88,199 suspected cases

and a mortality rate estimated at around 6.1% [5]. Over 85% of cases occurred in northern Nigeria and Niger, and were characterized by the predominance of Neisseria meningitidis (Nm) serogroup A [6]. A report from the Directorate of Protection and Public Health (DPPH) showed that over the period from 2003 to 2009, Burkina Faso reported 78,518 cases of meningitis, including 8,568 (11%) deaths. Of these deaths, 5,569 (65%) were due to Neisseria meningitidis group A (NmA) [7]. In 2010, NmX caused meningitis epidemics in Burkina Faso and in 2011 it accounted for 59% of confirmed cases of meningococcal meningitis in the country. The letality rates of meningitis related to this serogroup were as high as those reported for NmA, and children aged 1-9 years were the most affected group [8]. In 2012, the country experienced an epidemic mainly caused by Neisseria meningitidis (Nm) serogroup W [9]. In late 2013 until 2015, an epidemic occurred mainly affecting Niger and Nigeria with a predominance of serogroup C [10].

The environmental conditions in the African meningitis belt during the dry season, namely high temperature, very low humidity and harmatan (a dry, dusty, mucosa-weakening wind blowing from the Sahara) and respiratory co-infections linked to the degradation of mucosal defenses, are considered as factors contributing to increased susceptibility to meningococcal disease [11].

Indeed, in December 2010, the meningococcal vaccine named MenAfrivac was introduced in Burkina Faso as part of a mass vaccination program to reduce the occurrence of cases and epidemics linked to serogroup A, the usual epidemiogenic agent in the African cerebrospinal meningitis belt. Given the quality of the vaccine, and the hopes pinned on the "Eliminating Meningococcal Meningitis Epidemics in Africa" initiative, the question remains after thirteen (13) years of implementation: What influence have MenAfriVac vaccination campaigns had on the epidemiology of meningitis in Burkina Faso? Is the elimination or reduction of meningococcal A, the cause of an increase in the pathogenicity of other strains of meningococcus?

Case-by-case surveillance of meningitis is a strategy that has accompanied the introduction of the vaccine. It could provide the data needed for this purpose. This study was theefore initiated to assess the impact of MenAfrivac on Neisseria meningitidis serogroups 13 years after its introduction in Burkina Faso from 2010 to 2022.

Materials and Methods

Study framework

The study was carried out in Burkina Faso, located in the African meningitis belt. Its geographical position makes it one of the countries the most affected by meningitis epidemics in sub-Sahelian Africa. According to the health system organization in Burkina Faso, public health care departments have a pyramidal organization with three levels providing primary, secondary and tertiary care. The first level is represented by the health district with two levels: the first level of care is the Health and Social Promotion Center (HSPC), which is the basic health department of the health system; the second level of care in the district is the Medical Center with a Surgical Unit (MCSA); each MCSA has a laboratory with a known minimum package of activities; it serves as a reference for the HSPCs, the first level health centers of the district ; the second level is represented by the Regional Hospital (RH), which also has a laboratory and serves as a reference and referral center for the MCSAs. The third level is represented by the University Hospitals (UH): the highest level of referral for specialized care. The Bacteriology Virology laboratory at Charles De Gaulle University Hospital is the national reference laboratory for bacterial meningitis. Peripheral laboratories (MCSA and RH) forward the cerebrospinal fluid (CSF) of patients with suspected meningitis in their health centers to one of the higher-level laboratories for confirmation of the suspected case through cytobacteriological examination of the CSF. In addition, Burkina Faso has a large number of private centers also involved in meningitis surveillance.

Study type and period

This was a retrospective cross-sectional study of all epidemiological surveillance data on meningococcal meningitis following the introduction of conjugate A vaccine from 2010 to 2022.

Study population

All laboratory-confirmed suspected cases of cerebrospinal meningitis reported by health laboratories in Burkina Faso from 2010 to 2022.

Inclusion criteria

Any suspected case of meningitis whose CSF has been collected, sent and analyzed in the laboratory from the 13 health regions of Burkina Faso with PCR results available.

Sampling

An exhaustive sampling method covering all confirmed cases of MCS after the MenAfrivac vaccination campaign (2010 to 2022).

Data collection tools and techniques

A data collection form with the following variables: epidemiological and clinical data, disease progression and laboratory results. The data collected were those recorded in the Burkina Faso meningitis database from 2010 to 2022 at the Directorate of Protection and Population Health (DPPH).

Data source, processing and statistical analysis

Data were collected from the DPPH database. Data that could not be used were removed from the analysis. A description of the data was provided. They were entered and analyzed on a microcomputer equipped with EPI info and sphinx plus2 software, versions 7.2.2.6 and 5 respectively. Tables and figures were drawn up using Excel and Word version 2016. The parameter used to compare data was the P value, which, when less than 0.05, was considered significant. Each positive case of meningitis was calculated as a percentage with a 95% confidence interval.

Ethical and deontological considerations

Authorization to collect data was requested and obtained from the DPPH. Confidentiality and anonymity were ensured throughoutthe process.

Results

Socio-demographic characteristics of meningococcal meningitis cases (N = 1155).

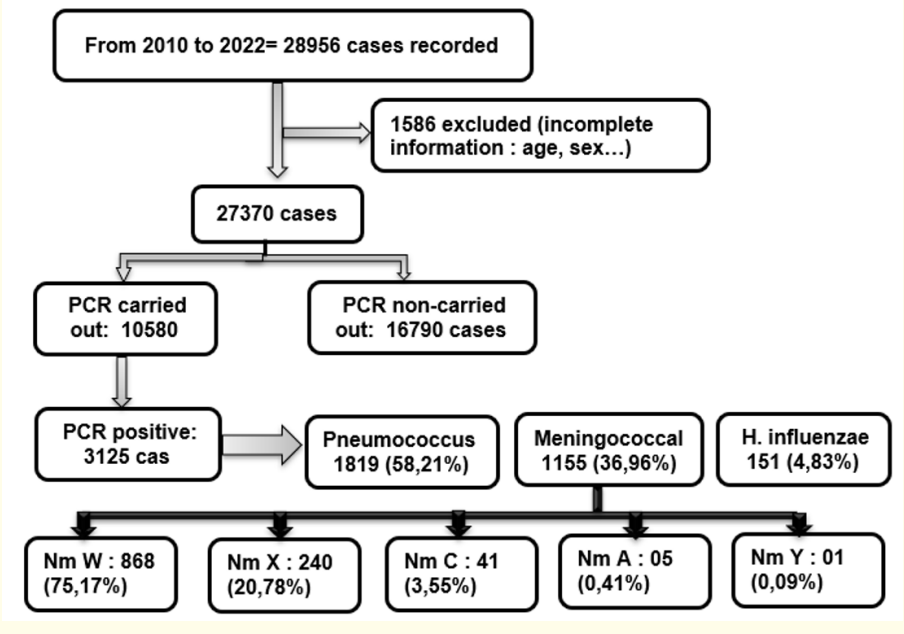

Figure 1: Flow chart showing number of patients included.

The average age was 9.58 ± 13.28 years, with extremes of 1 month and 82 years. The age range [4 - 15 years] accounted for 429 cases or 38.45%. Table I shows the age breakdown of confirmed cases of meningococcal meningitis.

Breakdown of confirmed cases of meningococcal meningitis by year.

In 2012, 398 cases were recorded, representing a frequency of 34.45%. Figure 2 shows the breakdown of confirmed cases of meningococcal meningitis by year.

Table I: Breakdown of confirmed cases of meningococcal meningitis by age group (N = 1155).

Socio-demographic characteristics	Nombre (%)
Age range in years	
[0 - 12 months [	195 (16,75)
[1 - 4 years [	308 (26,04)
[4 - 15 years [	429 (38,45)
[15 – 30 zyears [	127 (10,50)
[30 - 60 years [	78 (6,44)
60years and more	18 (1,81)
TOTAL	1155 (100)
Socio-professional situation	
Non-precised	1072 (92,81)
Pupils/students	70 (6,06)
Farmers/cattle breeders	10 (0,86)
Housewife	1 (0,08)
Informal sector	1 (0,08)
Civil servant	1 (0,08)
TOTAL	1155 100

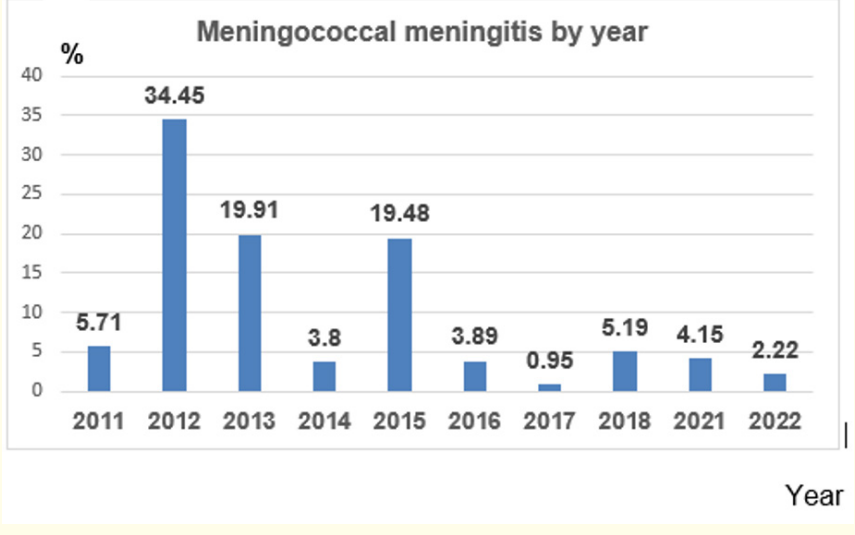

Figure 2: Breakdown of confirmed cases of meningococcal meningitis by year.

Breakdown of confirmed cases of meningococcal meningitis by region.

The Center-East region had 20.34% of confirmed meningitis cases, followed by the Center-South with 10.82%. Table II shows the breakdown of confirmed cases of meningococcal meningitis by health region.

Breakdown of confirmed cases of meningococcal meningitis by month (N = 1155).

Table II: Breakdown of confirmed cases of meningococcal meningitis by health region.

Regions	Confirmed cases (percentage)
Boucle du Mouhoun	65 (5,62)
Cascades	78 (6,75)
Center	38 (3,29)
Center-East	235 (20,34)
Center-North	70 (6,06)
Center-West	74 (6,40)
Center-South	125 (10,82)
East	101 (8,74)
Hauts bassins	104 (9,00)
North	65 (5,62)
Plateau central	82 (7,09)
Sahel	58 (5,02)
South-West	60 (5,19)
TOTAL	1155 (100)

In March, 411 cases were recorded, representing a frequency of 35.58%. Figure 3 shows the breakdown of confirmed cases of meningococcal meningitis by month.

Vaccination status

According to vaccination status, 477 cases (41.30%) suffering from meningococcal meningitis were vaccinated with MenAfrivac,

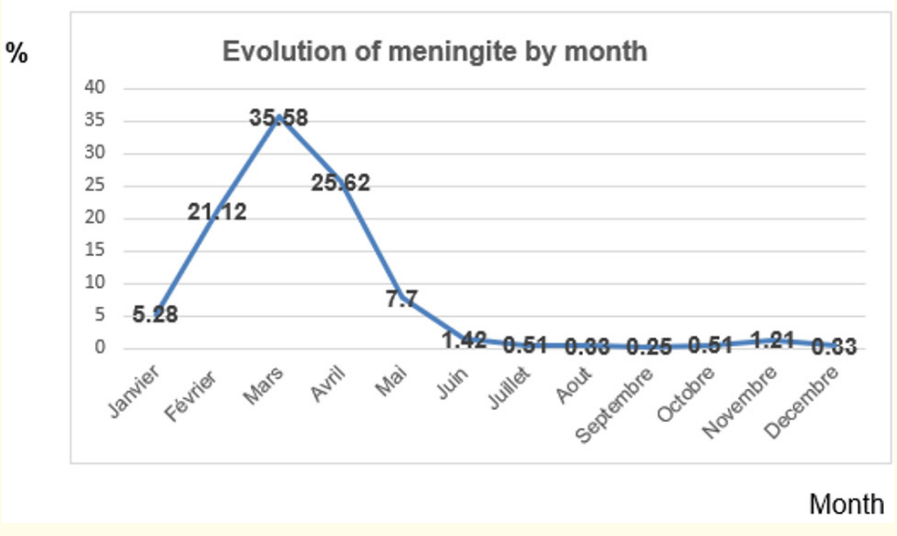

Figure 3: Breakdown of confirmed cases of meningococcal meningitis by month (N = 1155).

287 cases (24.85%) were not, and 391 cases (33.85%) had unknown vaccination status.

Age group by vaccination status

The [4 - 15] age group accounted for 354 cases (74.21%). Table III shows the breakdown by age group and vaccination status.

Table III: Breakdown of confirmed cases of meningococcal meningitis by age group and vaccination status (N = 477).

Age in years/MenAfrivac	Number (Percentage)
[0 – 12 months]	16(3,35)
[1 – 4 years]	54(11,32)
[4 – 15 years]	354(74,21)
[15 – 30 years]	43(9,01)
[30 – 60 years]	8(1,70)
60 years and more	2(0,41)
TOTAL	477(100)

Breakdown of confirmed cases of meningococcal meningitis by sex and vaccination status (N = 477).

282 cases (59.11%) were male, compared with 195 cases (40.89%) female, with a sex ratio of 1.40.

Frequency of PCR-confirmed meningococcal serogroups (N = 1155).

Serogroup W accounted for 868 cases i.e. (75.17%), followed by serogroup X with 240 cases (20.78%). Figure 4 shows the breakdown of PCR-confirmed meningococcal serogroups.

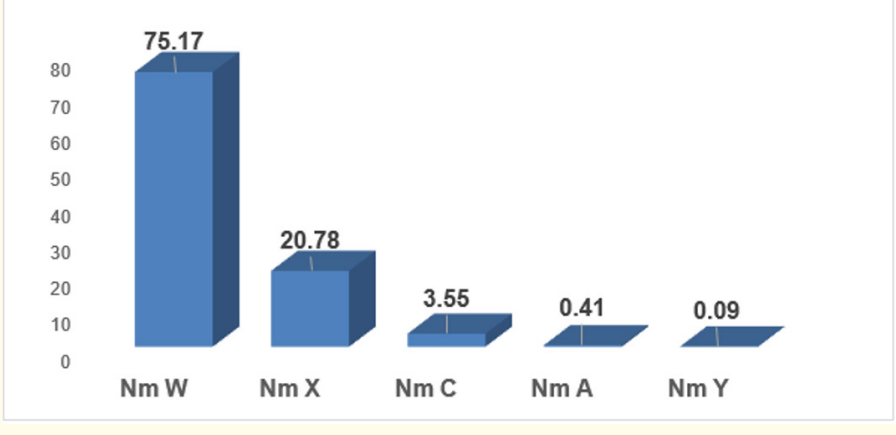

Figure 4: Breakdown of PCR-confirmed meningococcal serogroups (N = 1155).

Breakdown of PCR-confirmed meningococcal serogroups by year (N = 1155).

In 2012, serogroup W accounted for 285 cases, a frequency of 24.68%. Table IV shows the breakqown of meningococcal meningitis cases by serogroup, by year.

Breakdown of the different PCR-confirmed meningococcal serogroups by region (N = 1155).

Serogroup W in the Center Eastern region accounted for 183 cases i.e. (15.8%).

Table IV: Breakdown of meningococcal meningitis cases by serogroup, by year.

Years	NmA (%)	NmC (%)	NmW (%)	NmX (%)	NmY (%)	TOTAL
2010	0(0)	0(0)	0(0)	0(0)	0(0)	0
2011	1(0,09)	0(0)	6(0,52)	59(5,10)	0(0)	66
2012	0(0)	0(0)	285(24,68)	112(9,7)	1(0,09)	398
2013	0(0)	0(0)	215(18,61)	15(1,29)	0(0)	230
2014	1(0,09)	(0)	42(3,63)	1(0,09)	0(0)	44
2015	1(0,09)	3(0,26)	210(18,18)	11(0,95)	0(0)	225
2016	0(0)	2(0,17)	43(3,72)	0(0)	0(0)	45
2017	0(0)	2(0,17)	5(0,41)	4(0,34)	0(0)	11
2018	0(0)	15(1,30)	20(1,73)	25(2,16)	0(0)	60
2021	1(0,09)	13(1,12)	0(0)	34(2,94)	0(0)	48
2022	1(0,09)	26(2,25)	0(0)	1(0 ,09)	0(0)	28
TOTAL	5(0,41)	41(3,55)	868(75,17)	240(20,78)	1(0,09)	1155

Table V shows the breakdown of PCR-confirmed meningococcal serogroups by health region.

Breakdown of serogroup A according to MenAfrivac vaccination status (N = 5). The 5 confirmed serogroup A cases had not been vaccinated. According to origin, 1 came from Barsalogho, 3 from Sindou and 1 from Toma.

Breakdown of deaths by Neisseria meningitidis serogroup (N = 76).

Among the 1155 patients with PCR-confirmed meningococcal meningitis, 76 deaths (6.58%) were recorded, including 56 cases of death (73.68%) due to serogroup W. Table VI shows the breakdown

Table V: Breakdown of PCR-confirmed meningococcal serogroups by region (N = 1155).

Region/PCR	Nm Y	NmA	NmC	NmW	NmX	TOTAL
Boucle du Mouhoun	0(0)	1(0,09)	1(0,09)	49(4,24)	23(1,21)	73
Cascades	0(0)	1(0,09)	4(0,34)	60(5,2)	13(1,12)	78
Center	0(0)	0(0)	0(0)	66(5,71)	2(0,17)	68
Center West	0(0)	0(0)	0(0)	48(4,15)	26(2,25)	74
Center-East	0(0)	0(0)	0(0)	183(15,8)	52(4,5)	235
Center-North	0(0)	0(0)	6(0,52)	56(4,8)	8(0,69)	70
Center-South	1(0,09)	0(0)	2(0,17)	107(9,26)	16(1,38)	125
East	0(0)	0(0)	12(1,03)	77(6,66)	12(1,03)	101
Hauts Bassins	0(0)	0(0)	2(0,17)	27(2,33)	37(3,11)	66
North	0(0)	3(0,25)	7(0,6)	89(7,7)	14(1,21)	65
Plateau central	0(0)	0(0)	1(0,09)	77(6,66)	4(0,34)	82
Sahel	0(0)	0(0)	4(0,34)	40(3,46)	12(1,03)	58
South-Westt	0(0)	0(0)	2(0,17)	27(2,33)	31(2,68)	60
TOTAL	1(0,09)	5(0,41)	41(3,55)	868(75,17)	240(20,78)	1155

Table VI: Breakdown of number of deaths due to Neisseria meningitidis serogroup (N = 76).

PCR Serogroup	Deaths (%)	TOTAL
Nm Y	0 0	1
NmA	0 0	5
NmC	5 (6,60)	41
NmW	56 (73,68)	868
NmX	15 (19,72)	240
TOTAL	76 100	1155

of deaths according to Neisseria meningitidis serogroup. Meningitidis (N = 76).

Number of deaths due to Neisseria meningitidis serogroup by region (N = 76).

The Center-East region recorded the highest death rate, with 29 cases (38.15%), followed by the Hauts Bassins with 9 (12.84%) and the Boucle du Mouhoun with 8 (11.52%).

Risk factors associated with meningococcal meningitis

In multivariate analysis, being non-vaccinated and being a "housewife" multiplied the risk of being infected with meningococcal meningitis by 1.359 and 13.750 times respectively. Factors associated with meningococcal meningitis in multivariate analysis are presented in Table VII.

Table VII: Risk factors associated with meningococcal meningitis.

Variables	Meningitis Positive	OR	IC	P
Age				
[0 – 12 months [	93	1	11,58% < 12,74 <13,90 %	-
[1 – 4 years [	175	0,402	11,82%< 12,99< 14,16 %	0,0001
[4 – 15 years [	702	0,388	49,32% < 51,07 <52,82%	0,0001
[15 – 30 years [	125	0,746	12,59% < 13,79 <14,99%	0,0656
[30 – 60 years [	47	1,213	6,57% < 7,49 < 8,41%	0,3375
60year and more	13	1,102	1,44% < 1,92 < 2,40%	0,771
TOTAL	1155	-	-	-
MenAfrivac				
YES	477	1,359	35,08% < 36,77 <38,46%	0,0001
NO	678		61,54% < 63,23 < 4,92%	
TOTAL	1155			
Profession				
Farmer/cattle breeder	10	1	4,71% < 7,55 < 10,39%	-
Pupil/Student	70	0,917	89,61% < 92,45 < 95,29%	0,8290
Housewife	1	13,750	4,71% < 7,55 < 10,39%	0,003
Civil servant	1	0,417	4,71% < 7,55 < 10,39%	0,5390
Iinformal sector	1	4,167	89,61% < 92,45 < 95,29%	0,1728
TOTAL	83			

Discussion

In this study, the average age was 9.58 ± 13.28 years, with extremes of 1 month and 82 years. The age group [4 - 15[years] was the most affected by meningococcal meningitis, with a frequency of 38.45%. This finding corroborates those of Sacko [12] in 2016, Doumbia in 2013 in Mali [13] and Mac Neil., *et al*. in 2014 in Burkina Faso [14], who also found a predominance of cerebrospinal meningitis cases among young people and adolescents, accounting for 29.64%, 28.45% and 28% of cases respectively. Generally speaking, young people are more exposed to infections, particularly by cerebrospinal meningitis, because passive immunization is not well developed at this stage of life. And even if the vaccine's efficacy is proven in children, MenAfriVac only protects serogroup A. According to vaccination status, 41.30% of sufferers were vaccinated, in contrast to the study conducted by Ouédraogo., *et al*. in Sourô-Sanou University Hospital in Bobo Dioulasso, Burkina Faso, in 2013 [15], which found 24.68% of vaccinated cases among confirmed cases. The efficacy of the MenAfriVac vaccine has been proven, but it should be noted that several aspects contribute to this efficacy, notably the maintenance of the cold chain, the dose to be administered, the immune status of the subject and individual internal reactions to a chemical molecule, all of which can modify the immune response to a vaccine. Administering the vaccine aims at helping to reduce the occurrence of severe forms of the disease. The study also showed that vaccination coverage was satisfactory, especially in the 4-15 age group (74.41%), which is the most exposed to this infection and the most represented in the study.

Concerning the breakdown of meningococcal meningitis cases by month, this study showed that the first half of each year recorded more meningitis cases, with peaks noted in March 411 (35.58%) and April 296 (25.62%), in contrast to the second half during which the lowest frequencies were noted (November: 14 (1.21%); December: 4 (0.33%). These findings have been observed in other similar studies, such as those carried out by Dukic., *et al*. [16] in 2012 in Ghana, Garcia-Pando., *et al*. [17] in 2014 in Niger, and Umaru., *et al*. [18] in Nigeria in 2015, who confirmed in their work that the occurrence of cerebro-spinal meningitis was high during the first five months of the year. Neisseria meningitidis is a bacterial species that is highly sensitive to low temperatures (cold). Transmission is favored during the harmattan period, a hot, dry wind accompanied by dust that weakens the mucous membranes, associated with other factors such as pharyngeal carriage of meningococci, promiscuity and lack of immunity. The study also showed that the majority of cases of meningococcal meningitis after vaccination occurred in 2012 (398/1155 cases), i.e. a frequency of 34.45%. This result is confirmed by Kouyaté., *et al*. in Mali in 2016, who showed that the year 2012 recorded more than half the cases of meningococcal meningitis after vaccination, with 75% [19]. Generally speaking, in 2012, an epidemic occurred in the African meningitis belt involving 10 countries, with the majority of cases reported in Burkina Faso and in Chad. The epidemics were mainly caused by Neisseria meningitidis (Nm) serogroup W [20]. This study showed a high rate of NmW after vaccination from 2011, a progressive increase in the number of cases linked to this serogroup was observed with a peak in 2012 (285/1155) i.e. 24.68%. The number decreased in 2013 and 2015, but remained high at 215 and 210 cases respectively, before dropping in 2014. Studies carried out in Niger, Mali and Benin have shown a significant increase in the prevalence of serogroup W in the years following the MenAfriVac campaigns around 2010 [13,21-23]. This remarkable presence of serogroup W in the countries bordering Burkina could explain the increase in cases linked to this serogroup in the border regions of Burkina, such as the Center-East 183(15.8%), Center-South 107(9.26), East 77(6.66) and North 89(7.7). The study found an overall letality rate of 6.58%, 73.68% of which was due to serogroup W. Studies by Paul., *et al*. showed that the NmW observed in Burkina Faso after vaccination were part of the NmW ST-11 clone, which was last seen in the country in 2006 [24]. The ability of NmW to cause large epidemics with high letality rates to date is associated with this hypervirulent ST-11 clone [25]. In addition, the study showed an increase in Serogroup X in 2011 and 2012, respectively by 5.10% (59/1155) and 9.7% (112/1155). Studies carried out by Ouangraoua., *et al*. in 2014 in Burkina Faso [26] had found a predominance of cases linked to this serogroup from 2011 onwards. Also, work carried out concurrently in Bobo Dioulasso and Togo by Delrieux's team in 2011 [27] found that serogroup X had been reported in other countries in the meningitis belt since 2006, notably in Niger, Togo and Ghana. This could explain the predominance of this serogroup in health regions bordering these countries, such as the Center East with 52 cases (4,5%), the Hauts Bassins with 37 cases (3,11%) and the Center-West with 31 cases (2,68%). Population movements between countries and between cities are thought to be the reason for the spread of this serogroup within the country, especially as almost all health regions have been affected. The study

showed that NmC-related cases began to appear in 2015. It should be noted that in 2015, an epidemic caused by a new strain of serogroup C was recorded in Niger and Nigeria for the first time since 1975 [28], hence the high frequency of this serogroup in the East 12 (1.03%), North 7 (0.6%) and Center- North 6 (0.52%) health regions. As for cases of cerebro-spinal meningitis linked to serogroup A, against which the MenAfriVac vaccine has been manufactured, the study found a nearly total disappearance of the frequency of meningococcal A meningitis (0.41%) after the introduction of the MenAfriVac vaccine. This finding is similar to the results of several studies, notably those carried out by Dougla., *et al*. in 2013 [29], Gamougam., *et al*. in 2015 [30] in Chad, and Collard., *et al*. in Niger in 2013 [21], which showed that NmA strains disappeared in regions vaccinated with MenAfriVac. Similarly, those carried out by Novak., *et al*. in 2012 [31] and the study by Kristansen., *et al*. in 2014 [32] in Burkina Faso called the MenAfriCar consortium in 2015 [33] carried out in meningitis belt countries before and after the introduction of MenAfrivac also showed that cases of MCS due to NmA disappeared in most of these countries. After the introduction of MenAfriVac, the number of cases of meningitis A decreased dramatically, and no epidemics caused by this serogroup occurred in vaccinated areas [34]. The presence of NmA in the Barsalogho, Sindou and Toma health districts could be explained by the fact that these patients had not benefited from mass reactive vaccination. This nearly total disappearance is evidence of the effective action of the MenAfrivac conjugate vaccine to control serogroup A. It could therefore be concluded that the MenAfriVac vaccine had a positive impact on NmA and an important role in changing the epidemiology of meningococcal meningitis in the belt countries and particularly in Burkina Faso. It should be noted however that, even before the MenAfriVac campaigns, there was an increasing number of epidemics caused by serogroups W and X of N. meningitidis [35-39]. Therefore, the recent emergence of other non-A serogroups as an important cause of invasive disease could be the result of the expansion of these serogroups to fill the niche left by serogroup A, since the capsule change has not been documented. Regarding risk factors for exposure to the disease, the study showed that the non-vaccinated subjects had a 135.9% risk of developing meningococcal meningitis. Vaccination status was identified as a risk factor for carrying meningococcus [40] by Ba., *et al*. in Burkina Faso in 2014. Indeed, vaccinated individuals are able to develop active immunity against meningococcal meningitis. Also, being a housewife multiplied the risk of developing meningococcal meningitis infection by 13,750 times. The socioeconomic context of housewives in Africa and particularly in Burkina Faso could explain their high risk of exposure to the disease.

Conclusion

The introduction of MenAfriVac, an affordable, effective, and long-acting meningococcal group A conjugate vaccine, offers extraordinary hope for eradicating meningococcal group A meningitis epidemic, particularly in Burkina Faso. However, the emergence of new serogroups, combined with the presence of individuals at risk due to the lack of 100% vaccination coverage, is a serious challenge to achieving this goal. As long as the pathogenic serogroup circulates freely among unprotected individuals, the risk of major meningitis epidemics always remains. This highlights the need for an effective surveillance system and an affordable vaccine that provides protection against the main serogroups responsible for meningitis in Burkina Faso and potentially against emerging serogroups in the country. The success of MenAfriVac, which virtually eliminated group A meningococcal disease and its carriage in large areas of sub-Saharan Africa, has highlighted the need for a polyvalent vaccine for the same result for groups C, W, X and Y. The current effort to develop an affordable, heat-stable, pentavalent meningococcal conjugate vaccine targeting all strains of meningitis in Africa and particularly in Burkina Faso is the hope of making Africa free of miningitis one day.

Current knowledge on the subject

- The results of this study highlighted the nearly total disappearance of serogroup A meningococcal meningitis 13 years after the introduction of the MenAfriVac conjugate vaccine in Burkina Faso, but the emergence and persistence of other serogroups was noted.
- For better control of meningococcal meningitis, an effective surveillance system and a vaccine offering protection against the main serogroups causing meningitis in Burkina Faso must be put in place.

Our study's contribution to knowledge

- This study has shown the need to strengthen surveillance and develop a pentavalent vaccine against serogroups circulating in Burkina Faso.
- This surveillance will enable the rapid detection of a new serogroup, for appropriate action can be taken to avoid epidemics and the spread of the germ.

Conflicts of Interest

The authors declare no conflicts of interest.

Author Contributions

Yameogo Soulemane: provided data analysis and wrote the body of the article. Absatou BA/KY: did most of the survey work and proofread of the article. Tondé Issa: proofread the article. Arnaud Diendere: proofread the article. Traore Idriss: proofread the article. Andre Ky: translated the article into English, Diallo Salimata: participated in data collection. Ouedraogo Issoufou: participated in data collection. Sanou Idrissa: corrected the article

Acknowledgements

The authors would like to thank all the respondents who participated in this study. Thanks also to all those who provided with material essential to the study.

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