

# Meningitis in Benin (West-Africa)

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## Introduction

Meningitis is an inflammation of the membranes and lining of the brain and spinal cord. It is an airborne infectious disease which is spread by droplets and throat secretion from infected people and kills around 50% of those who are not treated and for children even up to 80-100% (1,2). Although the disease is also present in industrialized countries and added almost everywhere to the emergency notification system, the heaviest burden lies within the meningitis belt of the world: the semi-arid area of Sub-Sahara Africa(2,3). Especially from Senegal to Ethiopia where 300 million people are at risk. The meningococcal meningitis is responsible for the large epidemics in the Sahel areas during the dry seasons and starts mostly in February to end in late May. It is known that the outbreak of the disease is influenced by poor and crowded living circumstances and a low immune system. Especially when the nose and throat are harmed by infections or by certain weather circumstances, which dehydrate and weaken the nasopharyngeal mucosa and make those vulnerable for bacteria's and viruses. This happens particularly during the Harmattan, a very dry north to east wind, which carries a lot of dust, blowing from the Sahara towards the Gulf of Guinea. (2,3,4). However there's a notable association between this disease and the climate, it is not exactly clear yet which mechanisms are most likely responsible for the outbreaks of meningitis (2,3,5). Also the pilgrimage Hajj plays a role in spreading meningitis (2,4,6), in the past especially the N. meningitidis string A but since the vaccination programmes for pilgrims against the A and C string the niche for the W135 string is getting more favourable (4).

## Methods and findings

Information was obtained by published literature and institutional reports. Publications were cross-referenced. It has to be noticed that there're not many (scientific) paper published about facts and features of meningitis in Benin.

## History

Between 1905 and 1908 the epidemics in West Africa and the Sudan were the earliest documented in the former century and in the 50 years that followed it became clear that meningococcal meningitis was a severe and permanent problem. (6)

*"The 'Meningitis Belt' was first named by Lapeyssonnie in 1963 as the region south from the Sahara, the semi-arid sub-Sahara including the Sahel, in which there was an annual rainfall of 300-1100 mm and the area was concentrated between latitudes 4" and 16" north" (3,4). In 1968 this definition was extended by the World Health Organization (WHO) and included also parts of Benin, Cameroon, Ethiopia, Gambia, Ghana, Mali and Senegal. (6) Since 1980 there is an outset in reporting outbreaks and cases of meningitis to the surveillance systems of the WHO. Outbreaks are concentrated when absolute humidity is  $\leq 10 \text{ g.m}^{-3}$  (3), especially during the whole year (5). However it only predicts the onset, not the incidences which are described from 50- 70/100,000/y in endemic periods and 50-100-1,000/100,000/y in epidemic periods (4) (6). Yet the restrictions of the data available should not be forgotten, due to lack of laboratory facilities, standard case definition in the reporting, administrative limitations and occasional interest of parties. This incomplete data makes it hard to compare different countries or even years within the same country (3,6).*

## Medical aspects

There are several causes for getting meningitis, e.g. viral infections, pneumococcal, H. influenzae type b (Hib) (mostly in children from 2-36 month), tuberculosis, E. coli or even parasitical. Most cases of bacterial meningitis are caused by Streptococcus pneumoniae and Neisseria meningitidis. Of the 12 serotypes of the N. meningitidis, the types A, B, C, Y and W135 are the major cause of

human illness. (3,7,8). Pneumococcal meningitis is less correlated to the dry season and has a higher mortality rate (3). Due to the H. influenzae type b (Hib) conjugate vaccines, this type of meningitis is nowadays easier to control (9), just like the type C meningococcal meningitis after introduction of this vaccination to young people. However at the moment especially types Y and W135 are becoming more dominant (7). This paper will focus on meningococcal meningitis that is caused by the *Neisseria meningitidis*, which is known as the most frequent form in the meningitis belt (4) and the only cause of epidemics (9).

*“After an incubation period of 3-4 days the patient gets symptoms like a terrible headache, high fever, nausea, vomiting, stiffness of the neck and photophobia. Meningitis can have a rapid onset and death can follow within a few hours after the first symptoms. In severe cases the patient becomes comatose, convulsions and seldom purpura fulminans. Diagnostic symptoms in infant can be difficult to recognise. They refuse food, are apathetic, having convulsions and very specific is the bulging of the fontanel.”* (1) Early treatment with e.g. chloramphenicol or ceftriaxone (1) is necessary to save lives and prevent complications. . Still on average 5-15% of the patients die after early starting of treatment (1). However it became clear that there's an almost 100% fatality rate in neonatal and 5%-25% older groups after different studies were done all over the world. (3)

Prevention for three years can be taken medically by *“vaccination with Purified bacterial capsular polysaccharide (AC, AC/W135, Y) - one dose or Purified bacterial capsular polysaccharide conjugated to a protein (only serogroup C available) - three doses for infants, one dose for older children.”* (7) For the type B meningococcal disease there is still no vaccine available (1,7).

Further investigations of climate and seasonal circumstances which influences the pattern of outbreak are necessary so better warning systems and prevention measure can be provided in national and regional programs (5,13).

### **Situation in Benin and the surrounding countries.**

In the semi-arid area of Sub-Sahara Africa there is a movement of millions of metric tons of dust passing by wind and blowing even to other continents every year. Without any doubt there is a strong association between the location of outbreak of *N. meningitidis* in those areas and weather conditions like humidity, dust and rainfall. Also deforestation (related to the Harmattan) and population density plays a role (3,4,10,11,12).

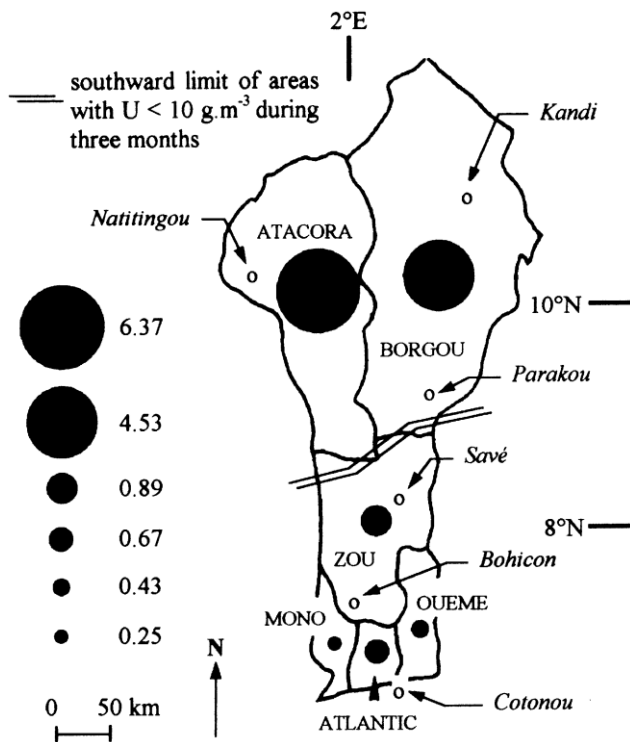
Dust storms move not only particles of sand and clay, but also bacteria, fungi, virus-like particles, pesticides and other toxins. An investigation of dust samples of storms in Mali resulted in 27% opportunistic human pathogens out of 94 different bacteria that were found, so dust storms do have their impact on human health. It is proven that there are many pathogens in dust storms which can affect the respiratory system and cause asthma and allergic reactions. Next to that, there're pathogens found in the Mali investigation (11) which most likely cause gastrointestinal problems, septicaemia and even noma lesions. Also water, crops and trees can be contaminated. (10,11).

The northern part of Benin is an endemic area of meningitis, contributory to the climate which has high humidity throughout the year as a result of the Harmattan. In the North, the dry season is from October to May and infections are especially found in February- March while large epidemics appear over the years in between longer periods of time (3). The last epidemic outbreak in Benin was in 2001, with 6147 cases of which 265 persons died between the 1<sup>st</sup> of January and the 18<sup>th</sup> of March in the Atacora and Borgou, two northern departments (13). In total 7532 cases were administrated in Benin in 2001 (4).

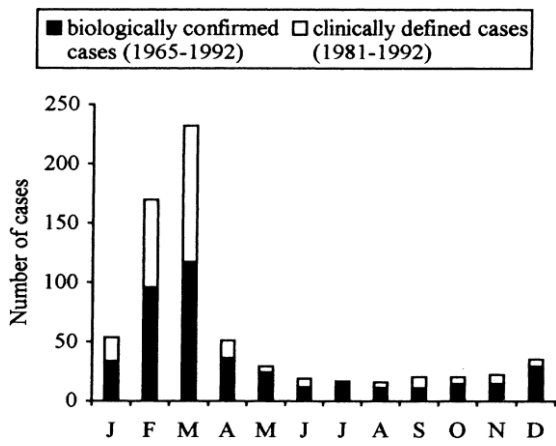
Unfortunately, meningitis is spreading, so cases do appear in the south, irrespective of the climate. The fatality rate is even higher in this area especially during the lowest incidence period when it

concerns infants. In the northern regions the morbidity rate is much higher. Between 1965 and 1992, incidences throughout the country varied on average from 63.7/100,000 in the Atacora, to 45.3/100,000 in Borgou, in the mid of Benin to 8.9/100,000 in Zou, 4.3/100,000 in Ouémé and 2,5/100,000 in Mono in the south (3) (figure 1).

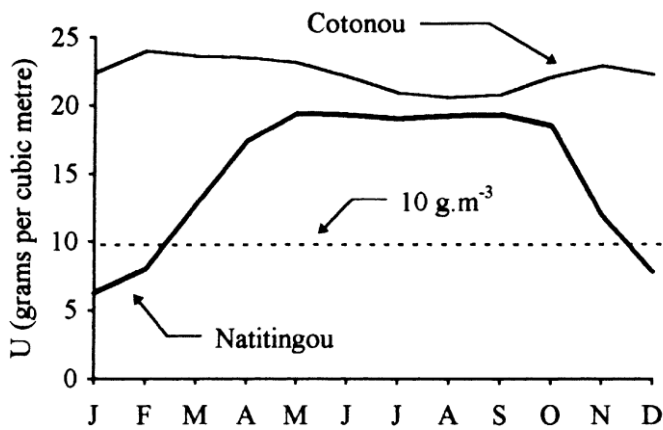
The absolute humidity is related to meningitis in the Atacora and Borgou, where humidity is below 10 g.m<sup>-3</sup> during December, January and February, while the incidence rate of meningitis shows a peak in March. It seems not causal to humidity that most incidences in the Southern part of Benin appear in September, after the dry period of July and August, with still a minimum humidity of 20.5 g.m<sup>-3</sup>. (3) (figures 2 and 3) So more investigation is needed.



**Figure 1.** Spatial distribution of cerebrospinal meningitis, Benin, 1965–1992 (incidence rate per 100,000).  
*Weather conditions and cerebrospinal meningitis in Benin (Gulf of Guinea, West Africa) J.P. Besancenot et al. (1997)*



**Figure 2.** Mean monthly occurrence of cerebrospinal meningitis, Benin. Biologically confirmed cases over the period 1965–1992, clinically defined cases over the period 1981–1992 only.  
*Weather conditions and cerebrospinal meningitis in Benin (Gulf of Guinea, West Africa) J.P. Besancenot et al. (1997)*



**Figure 3.** Mean absolute humidity (g.m<sup>-3</sup>) in two representative Beninese stations, 1965–1992. The location of Cotonou and Natitingou is indicated in Figure 1.

*Weather conditions and cerebrospinal meningitis in Benin (Gulf of Guinea, West Africa)*  
J.P. Besancenot et al. (1997)

It can be justified that the Southern part of Benin with its Guinean type subequatorial climate does not belong to the 'meningitis belt', contrary to the North with its low absolute humidity due to the Harmattan. One must consider that given numbers of morbidity and mortality are not reliable and even diagnostics often have to be done on medical criteria, due to the fact that culture facilities are not available in the endemic area in the northern part of Benin, e.g. Gram staining is still not possible in many health facilities in the North. Nevertheless the above mentioned findings reinforce the assumption that there is a relationship between weather and meningitis (3). Besides that, not everybody is seeking health care in a health centre or hospital. There is also a group which goes to the traditional healer and those cases are normally not counted in incidence and fatality rates.

However meningitis outbreak is not related to the Harmattan only. Also large vaccination programs which protect temporarily and even more important, new strains of the N. Meningitidis are influencing new cases or epidemics in addition to which incidence rates on regional level may differ on local or community level (3,4,6).

### Cultural and socio-political aspects and prevention

Meningitis should be considered as a serious public health problem, especially in the so-called westward-eastward pan-African Meningitis Belt, where large epidemical outbreaks alternate the seasonal endemic periods (3) and raise the existing burden of poverty and vice versa poverty contribute to the epidemics.

It is clear that poverty also plays an important role in spreading the disease, because without quick diagnose and treatment, the ill person is a source of infection to family and community. The poor are not able to search for medical help within the first hours when the signs of meningitis become clear. This is not only because of lack of knowledge how to interpret the symptoms, gender disparities and authorisation by family before leaving home, but also accessibility, affordability and acceptability of the health facilities are delaying factors in decision making choices when to look for help and where. Also traditional healing is an important factor in the culture of the people living in Benin and other parts of Africa.

Meningitis is responsible worldwide for an average of 170,000 deaths per year (9). About 10-20 % of the survivors develop permanent disabilities like epilepsy, sensorineurol deafness and mental retardation (7,9). These impediments have high impact on family life and that of the patient, because in general in Africa, and also in Benin, a lot of people with epilepsy and mental retardation are stigmatised. People believe that those persons are possessed by bad spirits or by their ancestors, because they themselves or someone of the family, has done something wrong and upset the spirits. When someone is deaf he or she is by definition idiot.

In Benin (and in general in Africa) fertility is very important. In the rural area there are still old traditions going on. When a man wants to marry a girl, who he didn't choose when she was still a

child, he has to pay money or cattle. However the girl's family doesn't collect the dowry until there's a proof the woman is fertile. It often happens that they even wait until the pregnancy of the second child before paying the dowry. Therefore, losing a child is an awful thing and believed as the will of God or a punishment for things you did wrong. Especially in the remote villages and hamlets, a woman will be abandoned by her husband and family in law when the first two children die at a young age. The mother is not a good care taker or people believe she must have done something which provokes the spirits. This tradition lays an extra burden on women when a child gets meningitis and isn't treated promptly, because this means it is a source of infection for the other children who are there, while often she is not capable to seek for help because of distance, financial or gender restrictions.

Understanding the necessity of having children and the cultural tradition which blames mostly mothers when things go wrong, next to the knowledge that disabled children will have difficulties to survive while also their families suffering by stigmatization, means an extra reason for national policy makers to provide good quality of health services. Besides this medication and set up and maintain a well working reporting system is needed, which all contributes to quick and adequate treatment of those who get ill and prevention for the rest of the community.

Considering those facts, it is clear that national policy makers have to protect their population for further spreading of the disease or even preventing them from getting ill in the first place. They have to play a role in educating not only of health care workers and medical staff to ensure quality, but also to inform the communities to search for help in an earlier stage of the disease. On international level it is important that an adequate reporting system quickly responding, initiating preventive measures like vaccination programs, which contribute to a well being population. However geographic influences can not be ruled out and preventive vaccines are limited, because they don't prevent all forms of meningitis and work for a period of an average three years only. Next to this, mutations of the surface components of the bacteria occurs in order to survive; so changing chains of the bacteria hamper the development of a vaccine which combats all types of meningitis.

### **Role of medical anthropology in controlling meningitis**

There are several cultural aspects challenging anthropology. Traditional beliefs about spirits and ancestors who take over the child or even take it into their world, the punishing part and blaming of the mother which is related to those beliefs, the stigmatization, the gender issues, the male dominated society, the role of traditional healers. All these issues need further guiding and comprehensibility when quick action has to be taken as someone gets ill.

For controlling meningitis, especially in Benin, the anthropologist can make a considerable contribution in order to understand the local beliefs and find a way to explain the importance of early action and creating adaptation of the population to insure quick treatment of the sick, protection of the other members of the family or community and finally also realising autonomy for the women in controlling their own health seeking behaviour by empowerment. Cooperation with the traditional healers and investigation and understanding of their methods could contribute to an early intervention on the process of the illness and the spreading of the disease.

Cooperation has to be found with the traditional healers, in order to achieve knowledge about their know-how and try to find a way in which the referral systems from community to health centres can be strengthened. You can imagine a vice versa referral system in which especially mental health care is referred to the traditional healers and physical problems, especially in cases of infectious diseases like meningitis, are quickly recognized and referred to the biomedical staff.

On the other hand the anthropologist can be of use explaining carefully to the western society and their policy makers, to adapt the beliefs in the will of the ancestors of the local population in

Africa and stop intervening in this particularly issue by just leaving the treatment and preventive measures for the developed world, in order to respect and accept old African traditions. In that case, looking at the globalisation, extra prevention is necessary at borders to protect the Western world from importing those kinds of diseases in to their society – as well with legal as illegal immigrants and travellers. To insure herd immunity it would be wise to immunise at least 90% of the total population regular in those countries which have a colonized past and/or are flooded with persons seeking asylum.

In the case of meningitis, this would mean an invert system in which people coming from the risk areas can prove they have been vaccinated e.g. one month before going abroad. But it will be difficult to control due to the illegal immigrations which take place all over the world.

Me myself, having an biomedical point of view, would prefer preventive vaccinations, quick biomedical diagnoses and adequate treatment in case of meningitis in the developing countries. It would be preferable more education is given to local health workers to raise their diagnostic skills, possibilities of Gram-staining most be implemented in all health centres and structural delivery of medication is necessary. Also expiration of medicines is preferred comparing to being out of stock and loosing not even a patient but also the trust of the relatives in the health care system for the future.

In my opinion the change of culture and adaptation of the western health care system in general can be a very positive development, in order to raise the medical care in this part of the world and by that purpose contributing to a more stable society, both on economic as on psychological level.

Of course controlling infectious diseases is not the solution for creating progress in the economy of a country, but at least a healthy population can stabilise the economic factors because healthy people contribute to a higher living standard in families and it opens possibilities for children to have a school life on regularly base because their parents are capable of taken care of farm work and homework by themselves.

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