Research Article

# Epidemiological profile of meningitis cases in the state of Alagoas, Brazil (2007-2018)

## Abstract

**Objective**: To explore the epidemiological incidence of meningitis cases in one of the poorest Brazilian states, Alagoas, between 2007 and 2018.

**Methodology:** The research design employs descriptive statistics to examine secondary data from the Information System on Diseases of Compulsory Declaration (SINAN).

**Results:** In total, there were 1,683 cases of meningitis registered in Alagoas during the analyzed period. 2013 was the year with the highest number of records (221 cases). The most affected age group is between 20-39 years (438 cases). Bacterial meningitis is the most recurrent modality (416 cases), followed by viral meningitis (336 cases) and unspecified meningitis (278 cases). In general, men (994 cases) are more affected than women (686 cases).

**Conclusions:** This information contributes to the expansion of the epidemiological panorama, allowing the formulation of public health policies that are up-to-date in poor locations in the face of biological problems.

**Keywords:** meningitis, public health, immunization programs, public policy

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## Abbreviations:

SINAN, system on diseases of compulsory declaration; WHO, world health organization; MB, bacterial meningitis; MH, Haemophilus influenza; HR, health regions; HDI, human development index

## Introduction

Meningitis is characterized by the inflammation of the meninges and cerebrospinal fluid. It has a rapid clinical evolution and diverse etiology - viruses and bacteria being the most common agents.[1] The classic symptoms are fever, vomiting, headache, altered mental status, and a stiff neck.[1] Diagnostic procedures may include lumbar puncture, blood testing and computed tomography scan. The prevalence is higher among children under five and people over 60.[2] Each year, 380,000 people die from meningitis Worldwide.[3] In addition to fatalities, the disease often causes irreversible neuropsychological sequelae to survivors such as significant motor impairment and serious deafness.[4,5] Economically, direct hospitalization costs to treat meningitis can reach up to R$ 20,000 (approximately U$$ 4,000 at current prices).[7] In 2018, the World Health Organization (WHO) started the project "*Defeating meningitis by 2030*". The policy aims to globally eradicate meningitis epidemic by expanding medical coverage and developing new vaccines.[3] In addition, the initiative also seeks to improve the quality of life of the population affected by the disease.[3] In Brazil, meningitis is considered an mandatory notifiable disease.[8] Despite of government efforts to offer vaccines through the Unified Health System on a regular basis calendar, many states continue to record meningitis cases, including novel outbreaks and sporadic epidemics.[8]

According to the Brazilian Information System on Diseases of Compulsory Declaration (SINAN), the average number of cases per year grew from 20 (1975-2006) to 20,000 (2007-2018). In particular, the State of Alagoas, one of the poorest in the federation, recorded, in 2018, the 2nd largest increase (36.59%) in the number of cases across the country. In this paper, we explore epidemiological profile of meningitis cases in Alagoas (2007-2018).

## Methodology

The research design employs descriptive statistics to examine secondary data from Brazilian Notifiable Diseases Information System from 2007 to 2018. The geographical coverage selected was only the State of Alagoas.[9] On the original dataset, the information from 2007 to 2013 is consolidated. Data from 2014 to 2017 and 2018 were updated in August 2019 and are subject to review. The distribution of meningitis cases is examined by: a) time; b) age group; c) gender; etiological agent; and d) health administrative region. All analyzes were performed using the software R Statistical 3.6. Replication materials, including data and computational scripts, are available at <https://osf.io/dm69v/>.

## Results

Figure 1 illustrates the distribution of meningitis cases in Alagoas during the analyzed series. In all, 1,683 cases of meningitis were recorded in the State. The year 2013 concentrated the highest number of cases during the period, while 2016 and 2017 concentrated the lowest number. There is an average of 140 cases per year during the series. Figure 2 illustrates the number of cases by age group (2a) and sex (2b). The age group that concentrates the most cases is 20-39 years, followed by children aged 5-9 years. The elderly, over 60 years old, form the group with the lowest number of registered cases. In general, men are more affected than women. Table 1 outlines the distribution of cases by the etiologic agent. *Bacterial meningitis* (MB) tops the list, followed by viral meningitis. In turn, meningitis caused by *Haemophilus influenzae* (MH) has the least number of cases. It is worth noting that 276 cases failed to have a specified etiologic agent (MNE). In addition, 104 cases had the etiological category ignored (missing). Geographically, the capital, Maceió, concentrates 95% of meningitis cases across the State (1,598). About 82 municipalities did not present any case during the analyzed period. From an administrative point of view, the State is divided into ten health regions (HR). The 1st HR was the one with the largest number of cases, followed by the 7th

HR, 9th HR, 3rd HR, 4th and 6th HR, and 5th and 10th HR. The 2nd and 8th HR did not register cases. Figure 3 illustrates the distribution of cases in Alagoas according to the Health Regions.
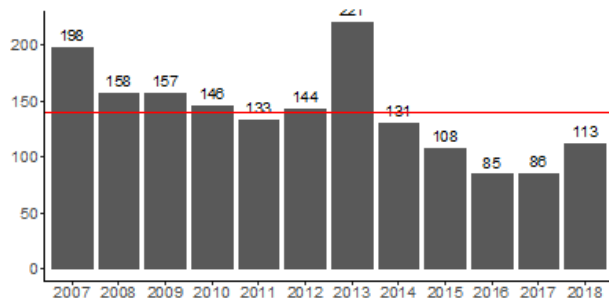


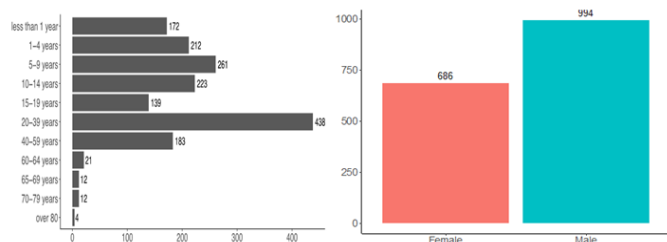**Figure 1** Meningitis cases over time (2007-2018).



**Figure 2** Distribution of cases by (a) age group and (b) gender.
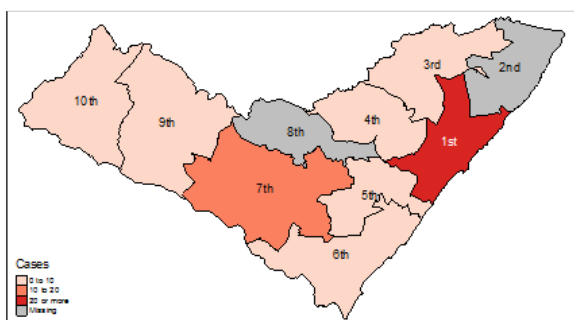


**Figure 3** Distribution of cases by Health Region.

## Discussion

The dynamics of meningitis cases in the State of Alagoas reflects a set of actions that occur at the national level, which is vaccination coverage. According to the Ministry of Health, the country has found it difficult to achieve vaccination coverage goals for some diseases, including meningitis.[11] Only 44.6% of the country's municipalities manage to reach the target set by the Federal Government.[11] The increase in the number of cases in the year 2018, illustrated in Figure 1, is closely linked to the previous year's vaccination coverage, 2017. In that year, Alagoas, despite having reached the BCG coverage goal (100%), was below in the other vaccines against meningitis: Meningococcus C (88.92%), Pentavalent (81.06%), and Pneumococcal (91.68%). The immunization target is 90% for BCG and 95% for Meningococcus C, Pentavalent, and Pneumococcal.[12] In 2012, the coverage pattern was repeated. However, the magnitude of the values was different. The BCG goal was reached (100%) and the others were below: Meningococcus C (92.87%), Pentavalent (29%), and Pneumococcal (82.50%). What calls attention is Pentavalent's low level of coverage. This reduction was seen in all other states as well. This factor may have contributed to the increase in the number of cases in the following year, 2013. From the moment that adult individuals (20-39 years old), as shown in Figure 2, are the most affected by the disease, this may be an indication of some failure in vaccination coverage, since these individuals, supposedly, should be immune to the disease because they have already been vaccinated in childhood.

Currently, vaccination coverage rates are not the same as those of past decades.[13,14] The literature points to some factors that explain this fall: a) the false feeling that it is not necessary to be vaccinated because the disease is not in circulation; b) ignorance about the importance of vaccines; c) the role of anti-vaccine movements in spreading false news on social networks.[11,14] Several studies in the national literature show the reducing role of vaccines in meningitis cases in the country.[15–18] Besides, the performance of the health epidemiological surveillance systems at the state or municipal levels has a significant role in reducing cases through instruction and inspection.[19,20] Given the State's whole vaccination and bureaucratic framework to fight infectious diseases, it is paradoxical to find such a number of cases, not only at the state level but at the national level. After the increase in the number of cases between 2017 and 2018, shown in Figure 1, one of the measures taken by the Department of Health has been the investment in epidemiological surveillance services, in the transmission of information about the disease and reinforcing the importance of the vaccine.[21]

**Table 1** Distribution of cases by etiology

| SIGLA | Description | Quantity |
|---|---|---|
| MB | Meningitis due to other bacteria and unspecified bacterial meningitis | 416 |
| MV | Viral meningitis | 336 |
| MNE | Unspecified meningitis | 278 |
| MP | Pneumococcal meningitis | 124 |
| MM+MCC | Meningococcemia with meningococcal meningitis | 118 |
| MTBC | Tuberculous meningitis | 117 |
| MCC | Meningococcemia | 107 |
| MM | Meningococcal meningitis | 84 |
| MOE | Meningitis due to another etiology | 81 |
| MH | Haemophilic meningitis | 16 |
| IGN | Missing cases | 5 |
| Total | | 1,683 |

The higher prevalence of bacterial meningitis, shown in Table 1, is also data that draws attention from the social perspective. The literature points out that this etiological agent has the highest morbidity and mortality in populations with socioeconomic vulnerability.[22] According to the Atlas of Human Development in Brazil, Alagoas occupies the last position in the ranking of the Human Development Index (HDI) among the federation states, with 0.631.[23] The limitation of this study lies in the data. The information present in large information systems ends up being underreported, either due to problems with feeding by the users and updating the information. Information at SINAN takes at least two years to consolidate. Even the disease's rapid evolution would prevent proper registration in the system, as it could disguise some clinical signs. The data would still need to go through a correction process, which would minimize the effects of underreporting.[24] The findings found in the study reinforce the importance of vaccination campaigns in the control of meningitis cases not only in Alagoas but also across the country. The data analysis contributes to the expansion of the epidemiological panorama of the Alagoas territory, providing a more accurate knowledge of the reality. With this, it allows the formulation of public health policies that are heated to face biological problems.

## Acknowledgments

## Conflicts of interest

The author declares there is no conflict of interest.

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