

Epidemiological Survey of Meningitis During Pregnancy Between 2014 and 2023

Levantamento Epidemiológico da Meningite Durante a Gestação Entre 2014 e 2023

Encuesta Epidemiológica de Meningitis Durante el Embarazo Entre 2014 y 2023

RESUMO

Objetivo: Traçar o perfil epidemiológico da meningite gestacional, no estado de Rondônia. **Método:** O presente trabalho consiste em estudo quantitativo descritivo cujos dados foram obtidos através do banco de dados do Departamento de Informática do Sistema Único de Saúde. Foram utilizados dados de notificação de meningite em gestantes entre 2014 e 2023 em Rondônia. **Resultados:** Foram registrados 3 casos de meningite em gestantes entre 2014 e 2023 em Rondônia, sendo 1 caso no 1º trimestre de gravidez, 1 caso no 2º trimestre da gestação e 1 caso em que o tempo gestacional não foi notificado. A faixa etária mais acometida foi entre 15 e 19 anos ($n = 2$). Em relação ao agente etiológico observou-se 1 caso de meningococemia. **Conclusão:** A presença de casos em adolescentes e a ausência de dados completos reforçam a necessidade de aprimorar os sistemas de informação e de implementar ações específicas voltadas a populações vulneráveis.

DESCRIPTORES: Meningite; Gestação; Epidemiologia.

ABSTRACT

Objective: To outline the epidemiological profile of gestational meningitis in the state of Rondônia. **Method:** This descriptive quantitative study was conducted using data from the database of the Department of Information Technology of the Unified Health System. Data on notifications of meningitis in pregnant women between 2014 and 2023 in Rondônia were used. **Results:** Three cases of meningitis were recorded in pregnant women between 2014 and 2023 in Rondônia: one case in the first trimester of pregnancy, one in the second trimester, and one case in which the gestational age was not reported. The most affected age group was between 15 and 19 years ($n = 2$). Regarding the etiological agent, one case of meningococemia was observed. **Conclusion:** The presence of cases among adolescents and the lack of complete data reinforce the need to improve information systems and implement specific actions aimed at vulnerable populations.

DESCRIPTORS: Meningitis; Pregnancy; Epidemiology.

RESUMEN

Objetivo: Describir el perfil epidemiológico de la meningitis gestacional en el estado de Rondônia. **Método:** Estudio cuantitativo descriptivo realizado con datos de la base de datos del Departamento de Informática del Sistema Único de Salud. Se utilizaron datos sobre las notificaciones de meningitis en embarazadas entre 2014 y 2023 en Rondônia. **Resultados:** Se registraron tres casos de meningitis en embarazadas entre 2014 y 2023 en Rondônia: un caso en el primer trimestre del embarazo, uno en el segundo trimestre y un caso en el que no se informó la edad gestacional. El grupo de edad más afectado fue el de 15 a 19 años ($n = 2$). En cuanto al agente etiológico, se observó un caso de meningococemia. **Conclusión:** La presencia de casos en adolescentes y la falta de datos completos refuerzan la necesidad de mejorar los sistemas de información e implementar acciones específicas dirigidas a las poblaciones vulnerables.

DESCRIPTORES: Meningitis; Embarazo; Epidemiología.

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INTRODUCTION

The human nervous system is protected by three meninges: the dura mater (outer and resistant), the arachnoid mater (intermediate), and the pia mater (inner and delicate). Between them is the cerebrospinal fluid (CSF), which protects against impacts. Meningitis, inflammation of the meninges, can be caused by infectious (viral, bacterial, fungal) or non-infectious agents. Bacterial meningitis is the most serious due to the rapid spread of infection between the arachnoid and pia mater, and can be fatal⁽¹⁾.

Meningitis is a disease that can be prevented by vaccination, but it remains a significant public health problem, with 1.2 million cases and approximately 135,000 deaths annually worldwide. It is important to note that half of those without adequate treatment die. In Brazil, immediate notification is mandatory and must occur within 24 hours after confirmation or suspicion of diagnosis, with the involvement of the State and Municipal Health Secretariats⁽²⁾.

During pregnancy, the maternal immune system undergoes changes in order to prevent rejection of the developing fetus, whose genetic material consists of half of the mother's genes and half of the father's genes. The process of immune change includes a reduction in the cytotoxic adaptive immune response and an increase in the regulatory adaptive immune response⁽³⁾.

After delivery, these changes are quickly reversed, leading to instant immune reconstitution that increases maternal vulnerability. In other words, immune changes during pregnancy and immediately after delivery contribute to the risk of infectious processes. In addition, the predominant Th2 immune responses are favorable to the development of tuberculosis, which can lead to a more severe and specific case of tuberculous meningitis⁽⁴⁾.

Studies on cases of bacterial meningitis during pregnancy reported six cases of meningitis in pregnant women, which resulted in two maternal deaths due to septic shock and cerebral hernia. This result highlights the severity of the disease and the importance of reporting cases so that effective public measures can be developed, especially in more vulnerable regions. The study also conducted a literature review on cases of bacterial meningitis during pregnancy in English, French, and German, which showed a total of 42 cases of the disease, with the most common etiological agents found being *S. pneumoniae* (25 cases, 60%) and *L. monocytogenes* (7 cases, 17%)⁽⁵⁾.

Thus, the epidemiological study of gestational meningitis is of paramount importance to guide public policies, especially in primary health care, through the identification of the most affected gestational age, the types of prevalent etiological agents, as well as the verification of the completion of compulsory

notification forms, since underreporting of data delays the diagnosis of the disease and can culminate in premature maternal-fetal death. Thus, the objective of this study was to analyze the epidemiological profile of cases of meningitis during pregnancy in Rondônia, from 2014 to 2023.

METHOD

This is a descriptive, retrospective, time series study of cases of meningitis in pregnant women in the state of Rondônia, located in the northern region of the country, between 2014 and 2023.

Rondônia has 52 municipalities, covers an area of 237,576 km², has a population of 1,581,196 inhabitants, and 26,198 pregnant women in 2023⁽²⁾. The study population consisted of people aged 15 years or older residing in Rondônia who had a record of meningitis in the Department of Informatics of the Unified Health System (DATA-SUS), which provides the data tabulator (TABNET).

The sociodemographic variables used were: gestational age, age group, confirmatory criteria, clinical evolution, and macro health region of the state of Rondônia. The etiological agents were: meningococcal meningitis (MM), meningococcal meningitis + meningococemia (MM+MCC), tuberculous meningitis (MTBC), meningitis caused by other bacteria (MB),

unspecified meningitis (MNE), viral meningitis (MV), meningitis caused by other etiologies (MOE), *Haemophilus influenzae* meningitis (MH), and pneumococcal meningitis (MP). The results obtained will be tabulated in Microsoft Excel in order to create graphs and tables.

According to Resolutions No. 466/12 and No. 510/2016 of the National Health Council, this study does not require review by a Research Ethics Committee (CEP), since it uses only

secondary data, which is in the public domain and freely accessible, made available by the DATASUS information bank.

RESULTS

According to Table 1, one case of meningitis was observed in pregnant women in both the first and second trimesters, both between the ages of 15 and 19. In addition, there was one case in which the gestational age is unknown

to the mother, who is between the ages of 20 and 39. Thus, cases of meningitis in pregnant women were infrequent ($n=3$), representing only 1.8% of the total records ($n=167$). However, the occurrence of two cases in adolescents in the first two trimesters of pregnancy deserves mention because it involves a group with greater biological and social vulnerability, which can increase the risk of infectious complications.

Table 1 – Confirmed cases of meningitis in Rondônia, Brazil, between 2014 and 2023, according to age group

Age Group	15-19	20-39	40-59
Ignored/Blank	-	4	-
1st Trimester	1	-	-
2nd Trimester	1	-	-
Gestational age not specified	-	1	-
No	4	26	26
Not applicable	10	51	43

Legend: Ign/Blank – Information ignored or not obtained; No – The patient is not pregnant; Not applicable – For example, in cases of men or children; Gestational age not specified – It is known that the patient is pregnant, but there is no information on the number of weeks. Source: DataSUS (2025). Organized by the authors.

According to Table 2, it was not possible to obtain information on the clinical evolution of the two pregnant women, both in the second trimester (1 case) and with unknown gestational age

(1 case). This lack of data in two-thirds of the records compromises the characterization of maternal-fetal outcomes, a particularly relevant aspect in a known vulnerable group. The only patient in the first trimester was discharged from the hospital. In addition, there were 289 cases among the “No” (74) and “Not applicable” (215) populations, whose clinical evolution indicated that 175 patients were discharged from the hospital (60.6%) and 47 resulted in deaths from

meningitis (16.3%), suggesting a positive evolution, but still high in terms of the number of deaths. Considering only cases with known evolution, the lethality rate was 21.2%, a significant value given the potential for serious complications already described for the disease. In the “Unknown or blank” category ($n=5$), there were 3 discharges and 2 records without information, reinforcing the pattern of incomplete information also identified in other variables.

Table 2 – Confirmed cases of meningitis in Rondônia, Brazil, between 2014 and 2023, according to clinical evolution

Outcome	Ignored/Blank	Discharge	Death due to meningitis	Death due to another cause
Ignored/Blank	2	3	-	-
1st Trimester	-	1	-	-
2nd Trimester	1	-	-	-
Gestational age not specified	1	-	-	-
No	8	43	15	8
Not applicable	35	132	32	16

Legend: Ign/Blank – Information ignored or not obtained; No – The patient is not pregnant; Not applicable – For example, in cases of men or children; Gestational age not specified – It is known that the patient is pregnant, but there is no information on the number of weeks. Source: DataSUS (2025). Organized by the authors.

In the analysis of Table 3, it was observed that most confirmed cases of meningitis in Rondônia occurred in the “Not applicable” category (n=215) and among non-pregnant women (n=74). In these groups, records for other bacteria (25 cases), cases in which the etiologi-

cal agent was not specified (25), and meningitis due to other etiologies (15) stood out. To a lesser extent, meningococcal meningitis (1 case), tuberculous meningitis (3 cases), aseptic meningitis (3 cases), and pneumococcal meningitis (2 cases) were identified. This pattern of

concentration in nonspecific agents or grouped in residual categories suggests that a significant portion of the diagnoses did not reach a laboratory etiological definition.

Table 3 – Confirmed cases of meningitis in Rondônia, Brazil, between 2014 and 2023, according to the etiological agent

Etiology	MCC	MM	MM+MCC	MTBC	MB	MNE	MV	MOE	MP
Ignored/Blank	-	-	-	-	2	3	-	-	-
1st Trimester	-	-	-	-	-	1	-	-	-
2nd Trimester	-	-	-	-	1	-	-	-	-
Gestational age not specified	1	-	-	-	-	-	-	-	-
No	-	1	-	3	25	25	3	15	2
Not applicable	-	6	1	21	62	63	21	35	6

Legend: Ign/White – Information ignored or not obtained; No – The patient is not pregnant; Not applicable – For example, in cases of men or children; Gestational age ignored – It is known that the patient is pregnant, but there is no information on how many weeks.

MCC (Meningococemia), MM (Meningococcal Meningitis), MM+MCC (Meningococcal Meningitis with Meningococemia), MTBC (Tuberculous Meningitis), MB (Other Bacterial Meningitis), MNE (Unspecified Meningitis), MV (Aseptic Meningitis), MOE (Meningitis of Other Etiology), MH (Haemophilus Meningitis), MP (Pneumococcal Meningitis).

Source: DataSUS (2025). Organized by the authors.

In the group of pregnant women (n=3), there was one case of meningitis

caused by other bacteria in the second trimester, one case of unspecified meningitis in the first trimester, and one case of meningococemia in the unknown gestational age category. Although numerically reduced, the etiological profile identified in pregnant women remained similar to that of the general population, with a predominance of nonspecific agents and grouped categories, with occasional reports of meningococemia—a condition of high clinical severity. Finally, the category “Unknown or blank” accounted for 5 cases without etiological definition.

As shown in Table 4, most confirmed

cases of meningitis occurred in individuals who were not pregnant (n=215), predominantly men and children. Among these, the most commonly used confirmatory criteria were culture (93 cases), followed by clinical criteria (68) and chemocytological criteria (60). For pregnant women, three cases were recorded: two confirmed by chemocytological criteria (2nd trimester and gestational age unknown) and one by clinical criteria (1st trimester). In the “Unknown or blank” category (n=5), confirmation occurred by culture (2) and clinical criteria (3).

Table 4 – Confirmed cases of meningitis in Rondônia, Brazil, between 2014 and 2023, according to confirmatory criteria

Confirmation criterion	Culture	Clinical	Bacterioscopy	Chemocytological	Clinical-epidemiological	Viral PCR	Other technique
Ignored/Blank	2	3	-	-	-	-	-
1st Trimester	-	-	-	1	-	-	-
2nd Trimester	-	-	-	1	-	-	-
Gestational age not specified	-	1	-	-	-	-	-
No	28	19	4	13	-	1	9
Not applicable	65	49	21	47	4	8	21

Legend: Ign/White – Information ignored or not obtained; No – The patient is not pregnant; Not applicable – For example, in the case of men or children; Gestational age ignored – It is known that the patient is pregnant, but there is no information on how many weeks. Source: DataSUS (2025). Organized by the authors.

De acordo com a Tabela 5, observa-se que em Rondônia a maioria dos casos confirmados de meningite ocorreu em indivíduos em que a gestação não se aplicava (72,4%) ou em mulheres não ges-

tantes (24,8%), somando 97,2% dos registros. Apenas 1,0% dos casos foram em gestantes (n=3), distribuídos entre Porto Velho (1º trimestre) e Cacoal (2º trimestre e idade gestacional ignorada), além de

1,7% classificados como ignorados ou em branco. Esse perfil confirma que a ocorrência em gestantes é rara, mas não irrelevante, especialmente quando comparado a outros cenários do país.

Tabela 5 – Casos confirmados de meningite em Rondônia, Brasil, entre 2014 – 2023, conforme macro região de saúde de Rondônia

Health Macroregion of Residence	Eastern Region	Central Region	Western Macroregion	Northern Macroregion	Macroregion II (Cacoal)	Macroregion I - Porto Velho
Ignored/Blank	-	1	-	-	1	3
1st Trimester	-	-	-	-	-	1
2nd Trimester	-	-	-	-	1	-
Gestational age not specified	-	-	-	-	1	-
No	3	-	1	-	25	44
Not applicable	5	2	4	1	78	123

Legend: Ign/Blank – Information ignored or not obtained; No – The patient is not pregnant; Not applicable – For example, in cases of men or children; Gestational age unknown – It is known that the patient is pregnant, but there is no information on the number of weeks.

Source: DataSUS (2025). Organized by the authors.

DISCUSSION

An epidemiological study of confirmed cases of meningitis in Brazil between 2016 and 2023⁽⁶⁾ shows that Brazil recorded 109,572 cases of meningitis, with the southeast region being the most affected (n=58,860). The main age group affected in Brazil was between 20 and 59 years old (n=38,620), followed by the age group between 1 and 4 years old (36,868) and 5 to 19 years old (23,608). When comparing the proportion of meningitis cases according to age group in the general population versus pregnant women, a distinct distribution pattern is observed, given that the proportion of pregnant adolescents affected by meningitis was higher than that of young adults. Also in relation to the population aged 20-39, it is observed that the only reported case did not have a defined gestational age. This, in turn, highlights weaknesses in the reporting system, which compromise a more accurate characterization of gestational risk.

This finding is consistent with the results of another study conducted in

Vitória da Conquista (BA)⁽⁷⁾, in which the authors also identified limitations related to the availability of complete data, a factor that can compromise analyses stratified by sex and age. These findings, although not very significant numerically, point to the need for qualified surveillance and prevention strategies aimed at pregnant women, especially adolescents, given the potential maternal-fetal repercussions of meningitis.

Similarly, at the regional level, the same study also found a higher prevalence of pneumococcal meningitis cases among men (66.7%) and in the 30-59 age group (83.3%), reinforcing the importance of gender and productive age in the epidemiology of the disease. Furthermore, four cases (2.4%) had blank or unknown information, which reflects flaws in the completion of the forms and may lead to distortions in the epidemiological analysis⁽⁷⁾.

Therefore, although the occurrence in pregnant women was rare, the presence of cases in adolescents and the absence of complete data reinforce the need to improve information systems and implement specific actions aimed at vulnerable populations.

From a clinical point of view, the favorable overall evolution of most non-pregnant cases (with a predominance of discharges) must be weighed against the

absolute number of deaths (n=47), which represents a significant mortality burden. In pregnant women, although the available data are limited, it is plausible to consider that the early implementation of safe antibiotics during pregnancy may have contributed to the positive outcome observed in the first trimester⁽⁸⁾.

The literature highlights that these regimens, especially with the inclusion of ampicillin for coverage against *Listeria monocytogenes*, constitute the recommended therapeutic basis⁽⁹⁾. In this sense, the lack of greater detail in the records does not prevent recognition of the importance of adequate therapy, but reinforces the need to improve information systems to better understand the clinical and maternal-fetal impacts of meningitis in pregnant women.

Regarding the results found according to the etiological agent, there is convergence with the national panorama described by other authors, who identified a predominance of viral meningitis (52.7%) and cases classified as unspecified (19.5%), followed by non-meningococcal bacterial meningitis (18.7%), while cases of classic etiologies such as meningococcal (3.0%) and pneumococcal were in the minority⁽⁶⁾. As in Rondônia, it is observed that a considerable proportion remains without etiological definition, a fact that may

reflect diagnostic limitations and compromise the accuracy of epidemiological surveillance.

From another perspective, it can be deduced that the low numbers of cases of meningococcal, pneumococcal, tuberculous, and *Haemophilus influenzae* type b meningitis in Rondônia may be associated with the consolidated adoption of prevention strategies in the country. Recent studies⁽¹⁰⁾ show significant reductions in pneumococcal meningitis after the introduction of the PCV10 and PCV13 conjugate vaccines, as well as a significant decline in invasive meningococcal disease after MenC and MenACWY vaccination⁽¹¹⁾. Similarly, the Hib vaccine has led to consistent declines in cases of *Haemophilus influenzae* meningitis⁽¹²⁾, and BCG continues to play a protective role against severe forms of tuberculosis, such as tuberculous meningitis. Thus, the low occurrence of cases due to these etiologies in the present study may reflect the positive impact of immunization policies and complementary preventive measures, such as chemoprophylaxis of contacts in the case of meningococcus.

Therefore, even though the numbers in pregnant women are small, the similarity in etiological distribution in relation to the general population suggests that the weaknesses in identifying the agent are structural and affect all groups. However, in pregnant women, this gap is more relevant, as it hinders the safe and effective selection of antimicrobial treatment, in addition to limiting the understanding of maternal-fetal risk⁽¹³⁾.

The presence of preventable agents among the few cases observed reinforces the importance of maintaining high vaccination coverage and qualified epidemiological surveillance, ensuring collective protection and minimizing clinical impacts on vulnerable populations⁽¹⁴⁾.

The predominance of culture as a confirmatory method, although less frequent in other settings, can be considered a positive aspect, as in addition to confirming clinical suspicion, it allows the identification of the etiological agent and the

definition of the antimicrobial sensitivity profile, even though its processing time should not delay the start of treatment⁽¹⁵⁾.

In Rondônia, therefore, the greater use of culture suggests an effort to improve laboratory confirmation, which is relevant given the severity of the disease. However, the dependence on clinical criteria for a considerable number of cases (n=68) exposes structural weaknesses, especially in inland municipalities, where limited laboratory resources may restrict access to tests such as culture and PCR, compromising diagnostic accuracy.

This pattern contrasts with a study on viral meningitis conducted in Pernambuco⁽¹⁶⁾, in which the most widely used method was chemocytology (95.6%), followed by clinical criteria (2.2%) and viral PCR (0.9%). The difference can be explained by the etiological approach adopted, since culture is less applicable in viral meningitis. In Rondônia, however, the diversity of etiological agents investigated justifies greater use of culture, even though the isolated adoption of clinical criteria represents a point of vulnerability for epidemiological surveillance. Thus, the analysis reinforces the need to expand laboratory diagnostic capacity, especially in areas outside the capital, in order to ensure greater uniformity and reliability in the confirmatory criteria employed.

In Rio Grande do Sul⁽¹⁷⁾, for example, authors identified that pregnant women represented 0.85% of cases reported in ten years, a proportion very similar to that observed in Rondônia. In the Northeast⁽¹⁸⁾, studies have pointed not only to the low frequency of cases in pregnant women, but also to greater severity, with mortality of up to 23.5% in this group, especially in the first and third trimesters, which reinforces the epidemiological importance even in the face of small absolute numbers.

Another relevant aspect is spatial concentration: in Rondônia, Porto Velho accounted for 167 cases and Cacoal for 103, totaling 74.1% of the state total, a pattern similar to that found in other regions of Brazil. In Rio Grande do Sul⁽¹⁷⁾, Porto Alegre accounted for almost half of the

notifications (47%), while in the Northeast⁽¹⁸⁾, capitals such as Recife, Teresina, and Salvador stood out as epicenters. This concentration in urban centers points to factors such as population density, urbanization, and the movement of people as determinants of transmission. In short, although Rondônia has lower absolute numbers, the data follow the national logic: predominance in non-pregnant women, strong concentration in metropolitan areas, and clinical relevance of cases in pregnant women, which, even if sporadic, require special attention due to potential maternal-fetal complications.

The data analyzed reveal that, although cases of meningitis in pregnant women were infrequent during the period evaluated, their occurrence should not be underestimated given the potential for maternal and fetal complications. The literature indicates⁽¹⁹⁾ that central nervous system infections during pregnancy can be aggravated by immune changes specific to this period, increasing susceptibility to unfavorable outcomes such as premature birth, intrauterine growth restriction, and even fetal death. In this sense, the presence of confirmed cases in the first two trimesters of pregnancy is particularly concerning, since these periods represent critical stages of embryonic and fetal development, in which infectious processes can more intensely compromise maternal-fetal health.

Additionally, it is observed that the lack of complete information on the clinical evolution of affected pregnant women makes it difficult to assess the real magnitude of the impact of meningitis in this group. Previous studies highlight⁽⁸⁾ that the absence of adequate records can lead to underreporting of complications, masking the severity of the disease among pregnant women. The association of meningitis with high rates of maternal morbidity and mortality, as already reported in national investigations, reinforces the importance of targeted epidemiological surveillance, early management, and preventive strategies, including vaccination and screening of vulnerable populations. Therefore, even in the face of low absolute

frequency, the integrated analysis of local data and the literature shows that meningitis in pregnant women is a public health problem that requires greater attention and qualification in the care process.

CONCLUSION

In conclusion, the study presented a detailed overview of the epidemiological profile of cases of gestational meningitis in

Rondônia between 2014 and 2023, highlighting a worrying lack of reporting. The higher number of cases among adolescents aged 15 to 19 years reinforces the need for intervention by primary care to prevent and avoid an increase in the number of teenage pregnancies, as well as cases of meningitis infection, despite underreporting. In addition, the failure to fill in the specification of the etiological agent on the notification form was another alarm-

ing point identified, as it compromises the safe and appropriate choice of antimicrobial treatment, in addition to restricting the understanding of maternal and fetal risks. Accurate reporting of data, as well as the constant and updated development of epidemiological research, can contribute to the planning of interventions and public policies aimed at promoting health, ensuring collective protection, and reducing clinical impacts on pregnant women.

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