

Prevalence of trachoma in Pernambuco State, Brazil (2014-2015)

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ABSTRACT

To estimate the prevalence of cases of trachoma in the population at social risk aged 1-9 years in Pernambuco State and its mesoregions. This was a cross-sectional study in which secondary data from the National Household Survey on Trachoma (2014-2015) were analyzed. The study covered 96 census tracts distributed across the mesoregions of Pernambuco State (Metropolitan Region of Recife, Zona da Mata, Agreste, Sertao do Sao Francisco and Sertao Pernambucano). The study included all homes with children aged 1-9 years, and all of them were examined for trachoma, using the WHO criteria. Among the total of 7,423 children aged 1-9 years who participated in this survey, 446 presented with active trachoma. Thus, the prevalence of trachoma in Pernambuco State, in children between 1-9 years old was 6.65%, and it was higher among children aged 5-9 years (7.12%) and among girls (7.23%). This result was seen in the majority of the mesoregions studied, except in the Zona da Mata and Sertao do Sao Francisco, where there were higher prevalences in the age group of 1-4 years (5.55%) and among boys (5.90%). A tendency towards a higher prevalence between 1 and 6 years of age was observed. The follicular trachoma continues to be an important public health problem in Pernambuco State. It particularly affects poor people, including those living in urban areas of the State.

KEYWORDS: Follicular trachoma. *Chlamydia trachomatis*. Prevalence. Prevention and control. Epidemiological surveillance.

INTRODUCTION

Trachoma is a neglected disease caused by *Chlamydia trachomatis*¹. It is directly transmitted, particularly in domestic environments². Children with active infection, aged up to 10 years old are the main reservoir for this endemic disease^{3,4}. There are five clinical forms of this disease and their diagnosis is essentially based on clinical and epidemiological data: trachomatous follicular inflammation (TF); trachomatous intense inflammation (TI); trachomatous scarring (TS); trachomatous trichiasis (TT) and corneal opacification (CO). Transmission occurs between individuals with active infection who present the TF and TI forms, but sequelae occur in TS, TT and CO forms⁵.

This disease continues to be an important public health problem that causes visual deficiencies. The World Health Organization (WHO) has estimated that there are 41 million people with active trachomatous infection worldwide and 7.6 million people with TT, while 1.3 million present with serious visual impairment and blindness caused by trachoma^{6,7}.

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The highest prevalences of trachoma in the world are in African countries, in the Western Pacific region and in Southeast Asia⁸. It is mainly transmitted in populations living in poor rural areas in underdeveloped countries⁹, i.e. among people living under poor sanitation conditions and water supply¹⁰⁻¹². Nonetheless, trachoma continues to be endemic in more than 50 countries, including Brazil¹³.

In Brazil, detection of trachoma is a task under the responsibility of States, the federal district and municipalities, with support from the Ministry of Health. These entities are tasked with organizing surveys to detect and treat cases aiming to reduce the prevalence of the disease and control it, and to notify these activities through the official information system^{5,14}. Between 2002 and 2008, a survey conducted in Brazilian schools found that the prevalence of “active infection” was 5%. However, some areas were found to have rates higher than 5%, which was indicative of an endemic disease that was not under control⁵.

Trachoma is among the preventable causes of blindness. The WHO Global Elimination of Trachoma program (GET 2020) has the aim of eradicating trachoma as a cause of blindness around the world by the year 2020¹⁵. Brazil is a program signer but has not yet reached the target of eliminating trachoma, despite making a commitment to do so by the year 2015¹³.

Over the last few years, studies on trachoma have been conducted in different regions and States of Brazil, revealing a high diversity among the populations studied and large variations in estimates of the prevalence of trachoma, with different degrees of severity^{3,5,11,14}.

Several authors have pointed out the need for new studies in Brazil, with the aim of identifying the prevalence of trachoma^{1,5,11,14}. However, this need would be for household-based surveys, given that those conducted previously were school-based^{11,14}. Therefore, the present study aimed at estimating the household-based prevalence of cases of trachoma among the population aged 1-9 years, living in areas at social risk in Pernambuco State.

MATERIALS AND METHODS

The study design was defined as cross-sectional, given the need to ascertain the prevalence of trachoma in the population aged 1-9 years that was at social risk. The study area comprised the five mesoregions of Pernambuco State, in Northeastern Brazil: Metropolitan Region of Recife, Zona da Mata, Agreste, Sertão do São Francisco and Sertão Pernambucano (Figure 1). The estimated children between 1-9 years old in 2014 was 9,252,442 inhabitants (4,446,635 boys and 4,805,807 girls)¹⁶.

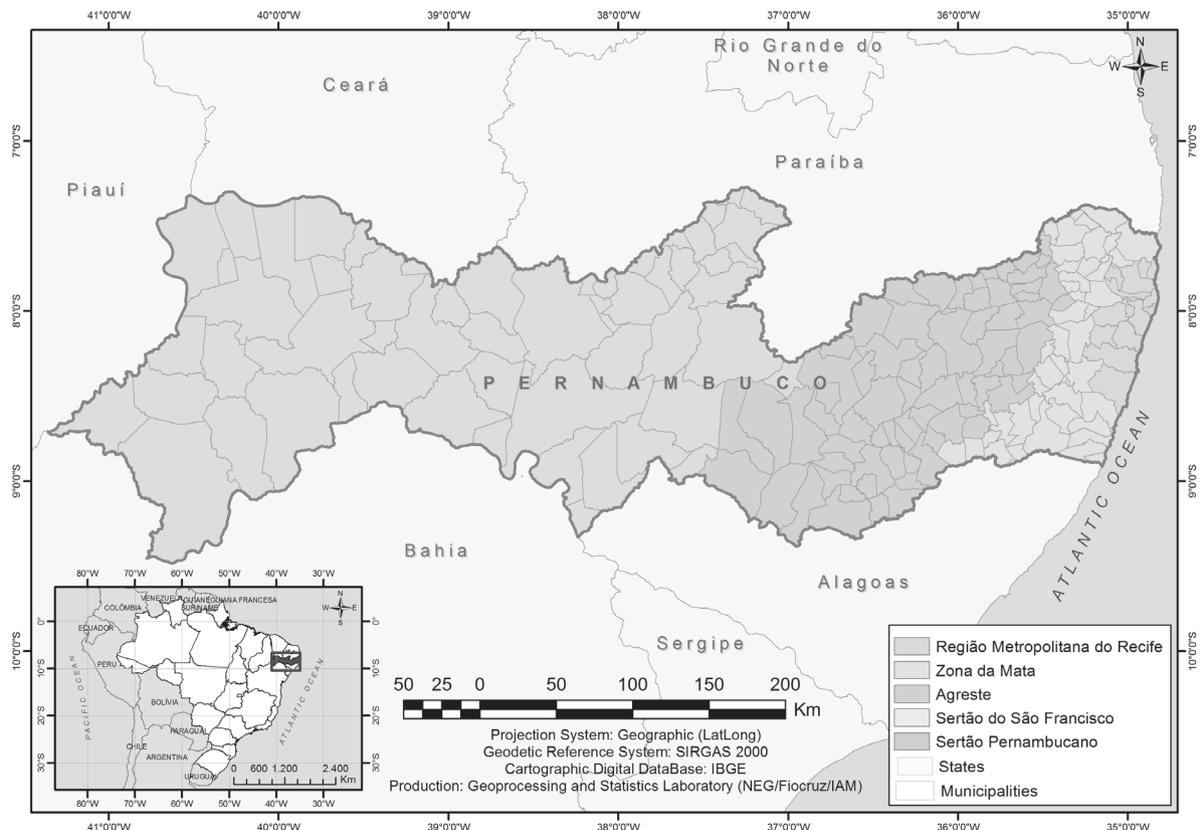


Figure 1 - Geographic location of Pernambuco State and its division by mesoregions.

This study consisted of an analysis of secondary data from the National Household Survey on Trachoma that was conducted between 2014 and 2015¹⁷. The following parameters were used to select the sample: prevalence of active trachoma of 5%, confidence interval of 95%, maximum margin of error of 0.02 and correction factor for finite populations with an effect of 4⁴. Active trachoma was considered to be the clinical inflammatory forms of the disease (TF and / or TI) and they are called active trachoma because they are transmissible and must be treated¹⁸.

The prevalence and the number of cases of trachoma were defined in accordance with the WHO criteria, in which it is considered that trachoma has been eliminated as a cause of blindness in a given area when the prevalence of TF among children aged 1-9 years in that area is less than 5%^{5,18}.

Census tracts with the following characteristics were eligible for the criterium of low socioeconomic status: at least 50% of the households with a per capita household income of not more than ¼ of a monthly minimum wage; and less than 95% of the households with connection to the general water supply network.

In this manner, 1,778 census tracts were found to be eligible. Out of these, a sample of 96 census tracts was drawn for screening. The criteria for excluding households in these census tracts were the following: no children in the age group of interest; legal guardians of these children were not present; home found to be unoccupied at the time of three visits by the team; and refusal of the householders to participate.

All children aged between 1 and 9 years in the households were included and examined, provided that their legal guardians agreed to this, through signing a free and informed consent statement.

Case confirmation was essentially achieved through a clinical diagnosis, by means of an external ocular examination using a magnifying glass (2.5 X), under either natural or artificial illumination, performed by trained and

standardized examiners¹⁸. All the clinical forms of trachoma were investigated, and individuals presenting with trachoma were notified and referred for treatment.

The prevalence of trachoma was calculated considering the 95% confidence interval (CI) for each study location (Pernambuco and its mesoregions), according to gender and age. The database provided by the survey was adjusted by applying a correction factor¹⁷. The data were adjusted by applying a correction factor to account for random effects and cluster sample sizes^{19,20}. Weights and clusters were adjusted through the Generalized Linear and Latent Mixed Model (GLLAM) method²⁰.

The software used in this study comprised: Microsoft Excel (version XP 2010, Microsoft, Redmond, WA, EUA) and, for data analysis, the STATA Software (version 12.0, StataCorp, Chicago, IL, EUA). The project was approved by the research ethics committee of the Oswaldo Cruz Foundation, in Pernambuco (CAEE 21192013.0.0000.5190).

RESULTS

A total of 4,238 households were evaluated, examinations were performed on 7,423 children aged 1-9 years, and 446 cases of active trachoma were found, which were all in the follicular inflammatory form. The prevalence of trachoma for the entire Pernambuco State was 6.65% (CI 5.39-8.17), with prevalences > 5%, except in the mesoregion of the Sertao Pernambucano. The Metropolitan Region of Recife had a prevalence rate of 6.41% (CI 5.02-8.15), and most of the trachoma cases in this region were living in urban areas of the municipalities (Table 1).

Table 2 presents the prevalence of trachoma according to age group and gender. In terms of age groups, 2,922 children aged 1-4 years were examined, among whom 155 cases were diagnosed; and 4,501 children aged 5-9 years were examined, among whom 291 cases were detected. The

Table 1 - Prevalence of trachoma in Pernambuco State and its mesoregions, years 2014 and 2015.

Locality	Number of examined	Number of cases	Prevalence (%)	CI ^c (95%)
Pernambuco State^a	7,423	446	6.65	5.39 – 8.17
Mesoregions^b				
RMR	1,535	101	6.41	5.02 – 8.15
Zona da Mata	1,322	63	4.88	3.45 – 6.86
Agreste	1,655	148	8.87	6.70 – 11.65
Sertao do Sao Francisco	1,361	77	5.28	2.71 – 10.04
Sertao Pernambucano	1,550	57	3.83	2.73 – 5.36

^aPrevalence weighted by mesoregion and adjusted by the random effect of the enumeration areas; ^bPrevalence weighted by municipality of the mesoregion and adjusted by the random effect of the census sector; ^cConfidence Interval

respective prevalences were 5.87% (CI 4.77-7.23) and 7.12% (CI 5.57-9.07). There was a higher prevalence of trachoma among children aged 5-9 years, throughout Pernambuco except in the Zona da Mata (Table 2). The Sertao Pernambucano had prevalence rates of less than 5% for both investigated age groups.

In relation to gender, there were more cases among

girls, comprising 238 cases and prevalence of 7.23% (CI 5.74-9.04). However, in the mesoregion of the Sertao do Sao Francisco, boys were more often infected than were girls (Table 2).

Figure 2 shows that the number of cases increased in older ages, up to six years. The number of cases among girls corresponded to an important proportion of this increment,

Table 2 - Prevalence of trachoma in Pernambuco State and its mesoregions according to age and gender, years 2014 and 2015.

Locality	Number of examined	Number of cases	Prevalence (%)	CI ^c (95%)
Pernambuco State^a				
Age Group				
From 1 to 4 years	2,922	155	5.87	4.77 – 7.23
From 5 to 9 years	4,501	291	7.12	5.57 – 9.07
Gender				
Male	3,849	208	6.12	4.69 – 7.96
Female	3,574	238	7.23	5.74 – 9.04
Mesoregions^b				
RMR				
Age Group				
From 1 to 4 years	633	37	5.38	3.57 – 8.02
From 5 to 9 years	902	64	7.11	5.45 – 9.22
Gender				
Male	793	45	5.96	4.20 – 8.41
Female	742	56	6.91	4.63 – 10.2
Zona da Mata				
Age Group				
From 1 to 4 years	523	28	5.55	3.86 – 7.91
From 5 to 9 years	799	35	4.44	2.88 – 6.77
Gender				
Male	690	26	3.89	2.72 – 5.53
Female	632	37	5.96	3.80 – 9.22
Agreste				
Age Group				
From 1 to 4 years	601	47	8.11	6.31 – 10.4
From 5 to 9 years	1,054	101	9.31	6.50 – 13.2
Gender				
Male	834	68	8.46	5.95 – 11.9
Female	821	80	9.30	6.59 – 13.0
Sertao do Sao Francisco				
Age Group				
From 1 to 4 years	570	25	3.72	1.70 – 7.91
From 5 to 9 years	791	52	6.45	3.29 – 12.2
Gender				
Male	691	43	5.90	2.61 – 12.8
Female	670	34	4.65	2.60 – 8.19
Sertao Pernambucano				
Age Group				
From 1 to 4 years	595	18	2.69	1.63 – 4.38
From 5 to 9 years	955	39	4.54	3.17 – 6.47
Gender				
Male	841	26	3.24	1.96 – 5.31
Female	709	31	4.57	3.12 – 6.63

^aWeighted by mesoregion and adjusted by the random effect of the census tract enumeration areas; ^bWeighted by municipality of the mesoregion and adjusted by the random effect of the census sector; ^cConfidence Interval

given that this number was greater at most investigated ages (Figure 3).

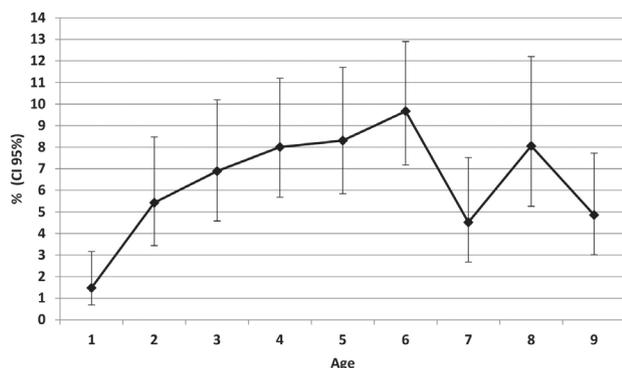


Figure 2 - Distribution of positive cases of trachoma in Pernambuco State according to age and confidence intervals, years 2014 and 2015.

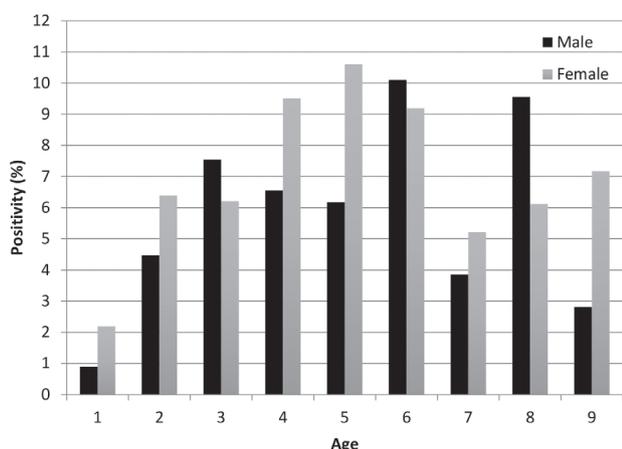


Figure 3 - Distribution of positive cases of trachoma in Pernambuco State according to age and gender, years 2014 and 2015.

DISCUSSION

This household survey showed a high prevalence of follicular trachoma among children aged 1-9 years living in Pernambuco State. Through stratification of the State, it was observed that in 80% of the area, more than 5% of the sample presented with active trachoma. This was especially true in the Metropolitan Region of Recife, where TF was identified in urban areas. The sample of the present study was larger than those of all the school-based surveys conducted in Brazil^{2,5,10,11,14}. Moreover, this was the first survey on trachoma in Brazil to use households as the sampling unit.

Thus, it is plausible to accept that the prevalence of trachoma was underestimated in the earlier school-based surveys. In those surveys, the age group from 1 to 4 years was not fully investigated. Schools are often targeted for evaluations and interventions regarding diseases because of the easier access to and the availability of the children.

However, a household-based investigation conducted in four African countries (Nigeria, Ethiopia, Mali and Niger) found that trachoma was more common among children of preschool age than among children of school age²¹.

In Brazil, only a minority of children aged 0-4 years are enrolled in daycare centers. For most children in this age group, their homes and immediate surroundings are the only places where they have social contact. Corroborating the findings of the study conducted in Africa²¹, only a single mesoregion of Pernambuco presented more cases among children of preschool age, compared with those of school age. However, the prevalence found in the age group from 1 to 4 years was higher than 5%, except in two areas of the Sertao mesoregion. Bero *et al.*¹⁵ stated that these age groups were the main reservoir of the etiological agent in populations in which trachoma is endemic, and that with increasing of age, the prevalence reduces because of better hygiene practices or a buildup of partial immunity, leading to a diminished risk of the infection or duration of infection among children²²⁻²⁶.

WHO considers that trachoma is under control when its prevalence in the active form is less than 5% among children aged 1-9 years^{5,14}. The present study shows that measures for the monitoring and surveillance of trachoma need to be implemented, in conjunction with intersectoral health promotion actions, improvements to socioeconomic conditions and education for the population⁹, especially with attention to TF among children.

In the present study, 446 cases of active trachoma were diagnosed, with growth of the sample as age increased, up to the age of six years. According to Ferede *et al.*²², the age at the onset of infection influences the evolution of the disease, such that the earlier the disease starts, the greater the severity²². Healthcare services should therefore be prepared to attend to sequelae such as TS, TT and CO among adults and elderly people. Regarding the differences in the prevalence of trachoma among the five mesoregions studied, three of them presented with prevalences higher than the one recommended by the WHO criteria^{5,14}. This indicates the importance of integrating proactive surveillance actions. One proposal for this surveillance that would be feasible in Brazil would consist of a healthcare model in which family health teams would care for children of preschool ages and school health teams would care for children of school age.

According to Alves *et al.*¹¹, many municipalities in Pernambuco State have never received any interventions from the healthcare sector regarding active searching for cases of trachoma, associated with treatment, not even among school children. Surveys on trachoma in these municipalities might reveal a transmission chain for trachoma within Pernambuco State¹¹. This possibility,

together with the difficulty in gaining access to children who are not regularly enrolled in schools, favors the maintenance of the disease in communities that are in greatest need to assistance due to social restrictions both in rural areas and in urban areas, as seen in the Metropolitan Region of Recife.

Girls presented TF more frequently than did boys, both at preschool and at school ages. Corroborating the results of our study, King *et al.*²¹ showed that girls were more often infected and that younger girls were at greater risk of contracting follicular trachoma²¹. Although the analysis of results according to the gender did not show any significant difference, there were more cases of the disease among girls, just like in studies conducted in other countries around the world^{7,27,28}, and studies conducted in Brazil among school-age populations^{5,14}. It is possible that the higher frequency of trachoma among girls may be due to the more affective behavior of girls, along with a genetically-determined increased susceptibility towards immuno-inflammatory reactions of greater intensity to infection by *Chlamydia trachomatis*²⁹.

The results found here corroborated those from surveys in schools conducted by Ferraz *et al.*³⁰ Meneghim *et al.*¹³ and Alves *et al.*¹¹. Those studies showed that trachoma was present in several Brazilian States and that, despite a marked decline in the incidence of this disease over recent decades, it persists. It particularly affects poor people in all regions of Brazil, including urban areas of large cities.

Our study confirms that in endemic areas for trachoma, healthcare services need to be prepared to make this diagnosis in pediatric clinics, especially among children up to the age of nine years. Furthermore, once the cases have been identified, there is a need to implement a surveillance in the homes and in the immediate surroundings, actively searching for cases in children up to the age of six years, and in the school environment, searching for cases in older children, given that identification of cases solely through surveys is a more expensive epidemiological tool than the implementation of measures within the routine healthcare.

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CONFLICT OF INTERESTS

The authors declare that there are no conflicts of interest in conducting this study. The authors alone were responsible for the content and writing of this article.

ETHICAL APPROVAL

The project was approved by the research ethics committee of the Oswaldo Cruz Foundation, in Pernambuco (CAEE 21192013.0.0000.5190).

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