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Advancing towards the elimination of trachoma as a cause of blindness in two cities in Sao Paulo State, Southeastern Brazil

Norma Helen Medina[1], **Vera Helena Joseph**[1], **Inês Kazue Koizumi**[2], **Renata Piffer Pereira**[3], **Miriá Lazzarin da Silva**[4], **Expedito Luna**[5]

ABSTRACT

The World Health Organization recommends conducting prevalence surveys to validate the elimination of trachoma as a public health problem by the year 2030. The recommendation specifies that the surveys should be directed to previous endemic poor rural areas. Brazil is an endemic country for trachoma and has experienced a large internal migration from the rural areas to the outskirts of the major cities. This study aimed to determine the prevalence of trachoma in children aged 1 to 9 years old in two of the poorest municipalities on the outskirts of Sao Paulo to test the hypothesis of whether internal migration brought trachoma with it. A household survey was conducted between 2013 and 2014. The field teams went door-to-door to collect data on households with children of the selected age group and their members. The trachoma prevalence in this group was 1.5% (79/5,393). In the 10 to 19 years old group, the trachoma prevalence was significantly higher among girls 3.2% (47/1,448) than among boys 1.5% (20/1,361). This result adds evidence to the elimination of trachoma as a public health problem and will be included in the supporting material to validate its elimination in Brazil.

KEYWORDS: Trachoma. Epidemiology. Surveillance, prevention and control. Brazil.

INTRODUCTION

Trachoma is a chronic inflammatory disease that affects the conjunctiva and cornea with a recurrent evolution. It is the most common infectious cause of blindness worldwide[1]. It is considered a neglected tropical disease and afflicts some of the poorest regions of the globe where access to water and sanitation is limited[2].

Blindness due to trachoma can be prevented. The World Health Organization recommends the SAFE strategy – Surgery for trachomatous trichiasis cases, treatment with Antibiotics for active cases, Face washing, and Environmental improvement – to advance towards the elimination of trachoma as a public health problem[3].

Brazil is still an endemic country for trachoma. The prevalence of trachomatous inflammation–follicular (TF) among school children was 5.1% in the last national trachoma school survey[4]. In Sao Paulo State, the prevalence was lower: 3.8% according to the same survey. The prevalence was higher in some small towns in Sao Paulo State[5]. However, school surveys miss the preschool age group, which is usually the highest risk group for TF[6]. More recent studies have shown a decreasing prevalence, particularly in poor rural areas of Brazil[7,8].

The occurrence of trachoma is associated with poor hygiene, lack of water, and low social-economic conditions[3]. Such a situation is frequent in poor rural areas. Brazil has experienced a large internal migration from the rural areas to the

[1]Secretaria da Saúde do Estado de São Paulo, Centro de Vigilância Epidemiológica, Centro de Oftalmologia Sanitária, São Paulo, São Paulo, Brazil

[2]Secretaria da Saúde do Estado de São Paulo, Centro de Vigilância Epidemiológica, Divisão de Pesquisa e Capacitação, São Paulo, São Paulo, Brazil

[3]Prefeitura de Francisco Morato, Serviço de Assistência Médica, Francisco Morato, São Paulo, Brazil

[4]Secretaria Municipal de Saúde de Itapevi, Vigilância Epidemiológica, Itapevi, São Paulo, Brazil

[5]Universidade de São Paulo, Faculdade de Medicina, Instituto de Medicina Tropical de São Paulo, São Paulo, São Paulo, Brazil

Correspondence to: Norma Helen Medina
Secretaria da Saúde do Estado de São Paulo, Centro de Vigilância Epidemiológica, Centro de Oftalmologia Sanitária, Av. Dr. Arnaldo, 351, sala 613, Cerqueira Cesar, CEP 01246-000, São Paulo, SP, Brazil
Tel: +55 11 30668120, +55 11 30668153

E-mail: nhm2@hotmail.com

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outskirts of the major cities. As a result, the urban periphery areas of Brazilian large cities have limited access to basic services such as water supply, sewage network and garbage collection[9]. The internal migration may have brought trachoma with it.

WHO had established targets for global elimination of blinding trachoma as a public health problem by 2020[3]. The elimination goal was not achieved. As a result, the Alliance for the Global Elimination of Trachoma target date was altered to 2030[10]. The aim is to reach a prevalence of TF in children aged 1 to 9 years old of < 5%, in each formerly endemic district, and also a prevalence of trachomatous trichiasis (TT) unknown to the health system below 2 cases per 1,000 in the population 15 years of age and older[11]. To validate the elimination WHO recommends conducting household surveys in representative samples of the target population[12].

This study was carried out in two of the poorest municipalities in the outskirts of the Sao Paulo metropolitan area, according to the Brazilian Institute of Geography and Statistics (IBGE) poverty index[9]. A household survey was conducted, using a random sample targeting the poorest census tract in these cities, to assess the prevalence of trachoma in children aged 1 to 9 years old[13].

We aimed to determine the prevalence of trachoma in children aged 1 to 9 years old in two of the poorest municipalities in the outskirts of Sao Paulo to test the hypothesis that internal migration brought trachoma with it.

MATERIALS AND METHODS

In order to validate the elimination of trachoma as a public health problem, WHO recommends conducting household surveys among children aged 1 to 9 years old in districts with a population ranging between 100,000 and 250,000 inhabitants.

The survey was conducted in Itapevi city (23°32'56''S; 46°56'03''W) in 2013 and Francisco Morato city (23°16'54''S; 46°44'43''W) in 2014, municipalities located in the Sao Paulo metropolitan area, with a population in 2014 of 220,250 and 166,505 inhabitants, respectively[13]. In these two municipalities, a two-stage cluster sample frame was used to select a sample of children aged 1 to 9 years old, from the census tracts with a mean per capita income below ¼ of the Brazilian minimum wage. The census tracts were listed according to the proportion of households in this condition. The ones with the largest proportion were included in the sample. All households within these census tracts were visited.

Considering an estimated prevalence of 5%, accepting an error of 1% of the estimate in 95% of the samples, and adding 20% to compensate for possible losses (refusals, children that were missing in the days of the survey), the sample size was estimated in 2,400 children in each municipality[14].

The field teams went door-to-door in the selected census tracts to collect data on households and their members. Households with children in the selected age group were included in the study. If no one was at home, two additional visits were made. After the third unsuccessful visit, the household was considered a "loss". The study was conducted in accordance with the guidelines of the Declaration of Helsinki, and according to the Brazilian Guidelines for research involving human subjects. It was approved by the Research Ethics Committee of the Sao Paulo Municipal Health Secretariat (statement Nº CAAE 12241113.5.1001.0086). The households with children aged 1 to 9 years old received a home visit in which the study's aims and procedures were presented to the parents or legal guardians of the eligible participants. If they showed interest to participate, the Informed Consent Form was read, explained, and signed by each household member who was 18 years or over. Parents consented on behalf of children who were less than 18 years, and those aged 12 to 17 years also provided written consent. All members of the family were examined for signs of trachoma. A questionnaire on household sanitation (water source, household sanitation facilities, and garbage collection), hygiene practices and socio-demographic data was filled.

The external eye examination with a 2.5X magnifying glass, according to WHO criteria, was performed in households with children aged 1 to 9 years old and their relatives. The eyelids and cornea were examined first. Then the upper eyelid was everted and the tarsal conjunctiva was carefully examined for the presence of tarsal follicles and scars. Standardized trained trachoma graders performed all examinations. They underwent a refresher course on trachoma grading. An 80% agreement to the diagnosis of the senior grader was required[15]. The WHO case definition was used[16].

Trachoma cases diagnosed in the surveys were notified to the Brazilian National Disease Reporting System and treated with azithromycin according to the Ministry of Health guidelines, free of charge[17]. All members of the household were also treated, regardless of presenting signs of trachoma.

Educational activities on trachoma prevention and face hygiene were conducted. According to the Sao Paulo State Trachoma Control Guidelines[18], the trachoma cases were scheduled to be re-examined twice, at six-month intervals, in the primary care clinic closest to their home. If they continue to manifest signs of trachoma, then they would be treated again.

The questionnaires were reviewed before entering the data. Data were organized in a database using Epi Info software (version 6.0, CDC, Atlanta, GA, USA). After entering, the data consistency analysis was performed. Frequencies of the variables were described. The chi-square test was used for differences between qualitative variables, when appropriate.

RESULTS

In the selected households there were 15,275 dwellers. Among them, there were 5,709 children aged 1 to 9 years old. 5,393 (94.5%) participated in the study.

A total of 179 cases of trachoma, with overall prevalence of 1.2%, was identified. There were 178 TF cases and only one TS case, related to a 66-years-old man. Cases of TI, TT or CO were not identified.

In the 1 to 9 years old group, the trachoma prevalence was 1.5% (79/5,393), the prevalence of TF was 1.2% among boys and 1.7% among girls ($\chi^2 = 1.73$; p = 0.19). But, in the 10 to 19 years old group, the prevalence was significantly higher among girls (3.2%) than among boys (1.5%), p = 0.003 (Table 1). The prevalence was higher at the ages of 6 and 9 (Figure 1).

The majority of the households was brickwork (97.4%), had piped water inside of the house by the public network (94.5%) – but in 45.1% there was a lack of running water one or more days weekly –, had toilet flush inside of the household (94.5%) and garbage collection three or more days a week (81.1%). The variables "garbage collection" and "schooling of household heads" were significantly associated with the prevalence in Itapevi city, while in Francisco Morato city the only variable significantly associated with the prevalence was "sharing the bed with another household member" (Table 2).

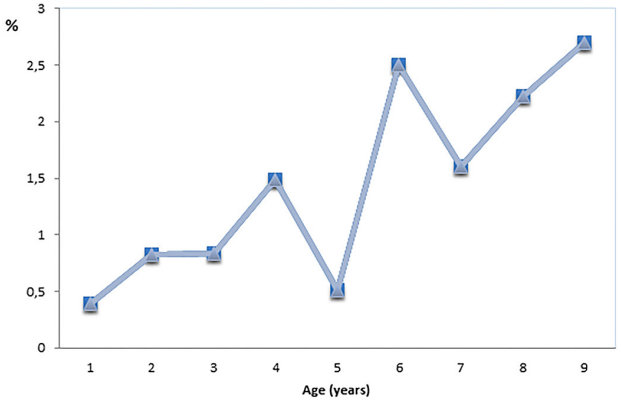

Figure 1 - Prevalence of trachomatous inflammation–follicular (TF) in children aged 1 to 9 years old according to age group, Itapevi city and Francisco Morato city, Sao Paulo State, Brazil, 2013–2014.

DISCUSSION

The prevalence of trachomatous inflammation–follicular (TF) in these two municipalities of Sao Paulo State was less than 5% in children aged 1 to 9 years old. This finding adds evidence that trachoma has been eliminated as a public health problem in both cities[19].

There are not many surveys done in large metropolitan areas of Brazil: two were performed in the Sao Paulo metropolitan area, both in the early 2000s, showing prevalence higher than ours and one study conducted in Recife city, Northeastern Brazil, in 2014–15[20-22].

Our results are in line with other trachoma prevalence surveys conducted in Brazil lately, which have shown the decline of trachoma prevalence even in previous endemic areas[7,8].

The survey design followed the WHO guidelines for trachoma control recommended at the time when the survey was planned[14]. Although the sampling methodology of this study is different from the one recommended by WHO, now we postulate that it is similarly representative of the target population. Later, with the adoption of the trachoma mapping project, the recommended sampling frame was changed. With the methodology we have used, the sample size was larger than the current one thus we considered that our results were accurate[23]. Despite being conducted in mountainous, difficult-to-access and unsafe regions, we were successful in getting community participation in the survey, with only 5.5% of losses.

In the 10 to 19 years old group, the trachoma prevalence

Table 1 - Prevalence of trachomatous inflammation–follicular (TF) by age and sex, Itapevi city and Francisco Morato city, Sao Paulo State, Brazil, 2013-2014.

Age group	FEMALE			MALE			χ^2	p-value
	Nº	%	Nº examined	Nº	%	Nº examined		
1 – 9	45	1.7	2,641	34	1.2	2,752	1.74	0.188
10 – 19	47	3.2	1,448	20	1.5	1,361	8.76	0.003
20 +	24	0.6	4,246	9	0.3	2,827	1.73	0.188
Total	116	1.2	8,335	63	0.9	6,940	7.25	0.007

Table 2 - Risk factors for trachomatous inflammation–follicular (TF) in children aged 1 to 9 years old, Itapevi city and Francisco Morato city, Sao Paulo State, Brazil, 2013–2014.

Variable	Itapevi city					Francisco Morato city				
	Examinations	%	Trachoma		p-value	Examinations	%	Trachoma		p-value
			TF	%				TF	%	
Gender					0.48					0.24
Female	1,207	48.4	20	1.7		1,428	49.5	25	1.8	
Male	1,288	51.6	16	1.2		1,457	50.5	17	1.2	
Water Source					0.39					0.94
Piped water inside of the house by the public network	2,392	95.9	33	1.4		2,761	93.8	39	1.4	
Other	103	4.1	3	2.9		182	6.2	3	1.6	
Garbage Collection					0.00003					0.22
No collection and collection less than one time per week	80	3.2	6	7.5		343	11.9	8	2.3	
More than one time per week	2,415	96.8	30	1.2		2,542	88.1	34	1.3	
Sharing the bed with another member					0.99					0.04
Yes	1,492	59.8	22	1.5		1,592	55.2	30	1.9	
No	1,003	40.2	14	1.4		1,293	44.8	12	0.9	
Schooling of household heads					0.02					0.91
No schooling or less than four years	154	6.2	6	3.9		394	13.7	6	1.5	
Four years or more	2,341	93.8	30	1.3		2,491	86.3	36	1.4	
Income of household heads					0.09					0.51
One minimum wage	503	24.1	11	2.2		793	27.6	14	1.8	
More than one minimum wage	1,586	75.9	17	1.1		2,075	72.4	28	1.3	

in girls was higher in Itapevi city, similar to the results found in the study done in Oman[24]. The importance of this finding is not due to the disease severity among them to cause blindness in the future but to the maintenance of possible infection sources for transmission to children. It could be a reflection of the past transmission, the maintenance of the disease in those who became infected as children. Another possibility is the sharing of make-up among girls.

Schooling of household heads in Brazil has been considered as a proxy for the social-economical stratum. In our sample, it was associated with the prevalence of trachoma. The low frequency of garbage collection is also a feature of the deprived neighborhoods. On the other hand, the observed association of trachoma with sleeping alone is the opposite of what we expected. None of these variables are sufficient to explain the occurrence of trachoma in these communities.

The major limitation of this study is the long time elapsed since the field work. Despite this limitation, we postulate the results are still important once few trachoma prevalence studies have been conducted in outskirt, impoverished communities of Brazil's large metropolitan areas. All but one of them were done in the previous decades[20-22].

The Sao Paulo State Trachoma Control Program is implementing its elimination plan. Ten surveys have been planned and are being conducted, with the objective to assess the prevalence and distribution of trachoma, in order to implement the control activities aiming at its elimination as a public health problem.

After the trachoma elimination, surveillance for TF prevalence should be conducted in high-risk communities biased toward the least developed. Eye examination of 100 children aged 1 to 9 years old in each selected biased census tract should be done, together with the continuing implementation of eye care activities in the schools.

The State trachoma control program has conducted extensive training activities on trachoma and also on primary eye health care, targeting health professionals working in the Brazilian Public Health System (SUS). Trachoma control will be part of a broader program of eye health and prevention of blindness.

CONCLUSION

Since 2003, Brazil has taken several measures to reduce extreme poverty, including the "Bolsa Familia" monthly

cash allowance, the most relevant one. Most evaluations of the program point to a reduction in extreme poverty and an overall improvement in the living standards of the poorest segment of the Brazilian population. It has been shown that the program has had an impact on the reduction of the incidence of leprosy and has led to a reduction of the children under – 5 mortality rate[25,26].

The program's expansion occurred at the same time as the present trachoma survey was being carried out. It is possible that the expansion of the program has impacted trachoma prevalence.

AUTHORS' CONTRIBUTIONS

NHM: planning of the survey, sampling design, training of the teams, coordination, field work, trachoma examiner, data analysis, and writing of the manuscript; VHJ: planning, sampling, training of the teams, coordination of the field work, field work, trachoma examiner, and manuscript writing and approval; RPP: household survey, field wok, trachoma examiner, data entry, supervision of the data, and manuscript review and approval; MLS: household survey, field work and questionnaire supervisor, data entry, manuscript review and approval; IKK: sampling, data analysis, and manuscript review and approval; EL: planning, data analysis, and manuscript writing.

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