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Factors associated with trachoma treatment and control treatment in schools of municipality of the Northeast Region, Brazil

Fatores associados ao tratamento e ao controle do tratamento do tracoma em escolares de município da Região Nordeste, Brasil

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ABSTRACT: ***Introduction:*** Trachoma maintains itself as a public health problem and an important cause of morbidity, visual impairment and preventable blindness in Brazil. ***Objective:*** To analyze factors associated with treatment and control of trachoma treatment in schoolchildren diagnosed during the national campaign in 2014, in the town of Russas, Ceará. ***Methodology:*** A cross-sectional study was brought out from January to April 2016. Social, demographic, economic and follow-up data were collected for 390 schoolchildren aged five to 14 years old, diagnosed with trachoma in the campaign in 2014. They were defined dependent variables: trachoma treatment and control of trachoma disease, categorized as adequate and inadequate, and multivariate analyzes were performed. ***Results:*** Treatment was considered adequate in 56.7% of schoolchildren and in only 5.9% treatment control was classified as adequate. In the multivariate analysis, they have got an association with the trachoma treatment result: rural residence zone and waste destination in a non-public space. The last control of the treatment of trachoma remained associated to the variables: rural residence zone; family income less than a minimum wage and school not examined by the physician. ***Conclusion:*** Inadequate treatment and control of trachoma treatment showed an association with socioeconomic variables and follow-up of primary care. Health education activities were not accessible to the entire community, indicating the need for more involvement by primary care professionals.

Keywords: Trachoma. Drug therapy. Control.

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RESUMO: ***Introdução:*** O tracoma mantém-se como problema de saúde pública e importante causa de morbidade, deficiência visual e cegueira evitável no Brasil. ***Objetivo:*** Analisar fatores associados ao tratamento e ao controle do tratamento do tracoma em escolares diagnosticados durante Campanha Nacional de Hanseníase, Verminoses, Tracoma e Esquistossomose, em 2014, no município de Russas, Ceará. ***Metodologia:*** Estudo transversal desenvolvido de janeiro a abril de 2016. Foram coletados dados sociais, demográficos, econômicos e de acompanhamento pela atenção básica de 390 escolares de 5 a 14 anos de idade diagnosticados com tracoma, na campanha em 2014. Definiram-se as variáveis dependentes: tratamento do tracoma e controle do tratamento do tracoma, categorizadas em adequado e inadequado, realizando-se análises bi e multivariada. ***Resultados:*** O tratamento foi considerado adequado em 56,7% dos escolares, e em apenas 5,9% o controle do tratamento foi classificado como adequado. Na análise multivariada, mantiveram associação com o desfecho tratamento do tracoma as variáveis zona de residência rural e destino dos dejetos em rede não pública. O desfecho controle do tratamento do tracoma permaneceu associado às variáveis: zona de residência rural, renda familiar menor que um salário mínimo e escolar não examinado pelo médico. ***Conclusão:*** O tratamento e controle do tratamento inadequados do tracoma mostraram associação com variáveis socioeconômicas e de acompanhamento pela atenção básica. As atividades de educação em saúde não foram acessíveis a toda a comunidade, indicando a necessidade de maior envolvimento dos profissionais da atenção básica.

Palavras-chave: Tracoma. Tratamento farmacológico. Controle.

INTRODUCTION

Trachoma is a chronic and recurrent keratoconjunctivitis caused by *Chlamydia trachomatis*. It remains a public health problem and it is an important cause of visual impairment and preventable blindness in Brazil[1]. It is considered to be the leading infectious cause of blindness worldwide and one of the 18 neglected tropical diseases (NTDs), which affect more than one billion of the world's poorest people[2].

In order to eliminate trachoma as a preventable cause of blindness, in 1997, the World Health Organization (WHO) created the Alliance for the Global Elimination of Trachoma by 2020 (GET2020), with Brazil being one of the participants[3]. To achieve this goal, the *SAFE* strategy is recommended:

- *S*: surgery in cases of trachomatous trichiasis (TT);
- *A*: antibiotic therapy for cases of inflammatory trachoma;
- *F:* face washing, health education and body care / facial hygiene;
- *E*: environmental health, improving access to sanitation and water availability[1].

In order to subsidize these actions aimed at eliminating trachoma in Brazil, from 2002 to 2008, the Ministry of Health (MOH) conducted a national survey on the prevalence of the disease in schoolchildren, with the goal of knowing the occurrence and distribution of this disease in the country. Then, in 2011, a plan to eliminate trachoma as a cause of blindness emerged. Its purpose was to eliminate or reduce this disease in the country[4]. In

2013, the first National Campaign for Leprosy, Vermin, Trachoma and Schistosomiasis took place. It was aimed at a target audience of schoolchildren aged 5 to 14 years old in the public education system. Its objectives included identifying and treating at least 80% of trachoma cases, and eliminating the disease as a cause of blindness[5].

Some of the objectives of epidemiological surveillance of trachoma are to diagnose and treat cases with active infection, by adopting relevant prevention and control measures, in addition to controlling the occurrence of trachoma through regular surveys/active searches for cases and home visits for contacts[1].

According to worldwide estimates, in 2010, approximately 2.2 million people were visually impaired due to trachoma, of which 1.2 million had irreversible blindness[6].

In Brazil, in the period from 2008 to 2016, 3,908,921 people were examined, and 149,752 trachoma cases were identified, representing a positivity percentage of 3.8%, with average variations between 2.4 and 4.9%[7].

In the state of Ceará, the results of the National Campaign for Leprosy, Vermin, Trachoma and Schistosomiasis in 2014 showed that, of the 249,822 schoolchildren aged 5 to 14 years that were examined, 8,471 were diagnosed with trachoma[8]. In the municipality of Russas, 486 cases of the disease were detected in 8,160 students in this age group, with a positivity rate of 5.96%, and representing almost 6% of the total cases in the state[9].

During the campaign period in 2014, Russas had only two doctors and an endemic control agent trained to carry out surveillance and disease control actions, that is, there was an insufficient number of professionals involved in these activities[10]. This fact, in conjunction with the epidemiological situation of trachoma among children and adolescents in the city, could have compromised treatment and treatment control in this age group. Such data justifies and highlights the importance of this research, which aimed to analyze factors associated with the treatment and control of the treatment of trachoma in schoolchildren diagnosed in the campaign carried out in 2014, in the municipality of Russas.

METHODOLOGY

A cross-sectional study was carried out from January to April 2016, in the municipality of Russas, whose estimated population, for 2015, was 75,018 inhabitants[11]. The primary care network has 20 Family Health Strategy teams, nine Oral Health Teams and two Family Health Support Centers. Secondary care is composed of a Psychosocial Care Center, a Health Center, a Specialized Care Service, a Specialized Rehabilitation Center, a Diagnostic and Therapeutic Support Service, a polyclinic, a Dental Specialties Center, two hospital units, an Emergency Care Unit and a Mobile Emergency Care Service[12].

The sample was composed of 8,160 schoolchildren aged 5 to 14 years old, who were enrolled in the Russas public education system and examined during the National Campaign for Leprosy, Verminosis, Trachoma and Schistosomiasis that took place from January to December 2014. Of these individuals, 486 were diagnosed with trachoma, and they made

up the study population. However, 96 were not located at the addresses listed nor was there information about their current place of residence in the municipality, corresponding to a loss of 20%. Thus, the study sample was made up of 390 schoolchildren. Exclusion criteria were defined as schoolchildren diagnosed with trachoma who had moved away from the municipality of Russas.

The diagnosis of trachoma is essentially clinical. It is performed through the examination of the external eye. Any individual with one or more of the following signs is confirmed to have the disease if there is: follicular trachomatous inflammation (TF); intense trachomatous inflammation (TI); conjunctival scarring trachoma (TS); TT and corneal opacification (CO)[1].

The active search and case control forms, which are filed at the Municipal Health Secretariat, and the forms that were applied during home interviews made up the research data sources. Initially, in order to identify students with trachoma and learn about the clinical diagnosis and prescribed treatment, the active search forms that were filled in during the campaign were reviewed. In order to verify that an eye exam was performed after six months, the case control forms were analyzed. These forms recorded the control of the treatment of patients with the disease. From January to April 2016, home visits were carried out, using a form that was applied to mothers or the legal guardians, in order to collect socioeconomic and demographic information, and information regarding the primary care team's monitoring of students.

Two dependent variables (outcomes) were defined: trachoma treatment in schoolchildren and control of trachoma treatment in schoolchildren.

The dependent variable called trachoma treatment in schoolchildren was classified as either adequate or inadequate. The variable was considered to be adequate if it was in accordance with the treatment parameters of trachoma cases, defined by the MOH as: azithromycin for 100% of the cases at a dose of 20 mg/kg of weight, in a single dose, orally, with a maximum dose of 1 gram[1], provided that the weight and dosage were noted on the consult form. Although the MOH recommends home treatment with azithromycin for all members of a family nucleus when one or more cases of TF and/or TI are detected, in the present study, for the purpose of classifying treatment as adequate or inadequate, performing treatment was not taken into account for the other contacts.

The dependent variable called control of trachoma treatment in schoolchildren, was classified as adequate and inadequate. It was considered to be adequate if an eye exam was performed six months after the beginning of treatment, as instructed by the MOH[1].

The independent variables were grouped into the following characteristics: demographic, socioeconomic, behavioral and primary care follow-up.

Regarding demographic and socioeconomic characteristics, the following variables were verified: age (at the time of the campaign), sex, race/color, education level, family income in minimum wages (MW), area of residence (rural or urban), housing material (clay or masonry), number of rooms and residents at home, source of water supply (public or not), garbage collection (public or not) and waste destination (public or not). The behavioral variable analyzed was the use of a towel, which was classified as individual or collective use.

As for the follow-up in primary care in the municipality, variables related to the work process of FHS professionals were collected:

- In the area of residence covered by a community health agent (CHA), the CHA explained how to avoid trachoma;
- the agent combating endemics (ACE) clarified how to avoid trachoma;
- a doctor examined the student at the Basic Family Health Unit (UBASF);
- the student went to UBASF to receive medicine;
- the school of the nurse gave the student guidance on trachoma.

The data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) software version 20.0.

To assess the association between dependent and independent variables, the odds ratio was used. Initially, a bivariate analysis was performed, and the gross OR was calculated, adopting a 95% confidence interval (95% CI), using the χ^2 test or Fisher's exact test. Subsequently, a multivariate analysis was performed. It used a logistic regression to adjust for the confounding effects, including variables that presented $p<0.20$ in the bivariate analysis. The variables number of rooms in the house, garbage collection, and student receiving guidance from the nurse about trachoma did not enter into the bivariate analysis because they presented cells with zero information, thus not allowing for the calculation of the OR.

The multivariate model was started using the Forward Stepwise (Wald) procedure, and variables with $p < 0.05$ remained in the final model.

The project was approved by the Research Ethics Committee of the State University of Ceará, with substantiated report number 1,386,050.

RESULTS

The treatment of trachoma was considered to be adequate in 221 students (56.7%). Regarding socioeconomic, demographic and behavioral variables, the area of residence, the source of water and the destination of waste showed an association with the outcome variable treatment of trachoma. It was found that schoolchildren from rural areas, without access to treated water and those who were living in a residence without public waste collection, were 2.14 ($p=0.000$), 1.67 ($p = 0.014$) and 3.57 ($p=0.000$) times more likely, respectively, to receive inadequate treatment. The variable number of rooms in a household was included in the multivariate analysis, considering $p < 0.20$ (Table 1).

Among the variables monitored by primary care, only the variable explanation from CHA on how to avoid trachoma showed a statistically significant association with the outcome variable, treatment of trachoma ($p < 0.05$). However, the variables, area of residence covered by CHA, the student visited UBASF in order to receive medicine, and the student received guidance from nurses on trachoma, were included in the multivariate analysis because they presented $p < 0.20$ (Table 2).

Table 1. Socioeconomic, demographic and behavioral factors associated with the treatment of trachoma in schoolchildren. Russas, Ceará, 2016.

Variables	Treatment				OR not adjusted	p
	Inadequate		Adequate			
	N	%	N	%		
Sex						
Female	88	45.1	107	54.9	1.15 (0.77 - 1.73)	0.474
Male	81	41.5	114	58.5	1.00	
Age range (years)						
5 to 9	89	43.4	116	56.6	1.01 (0.67 – 1.50)	0.973
10 to 14	80	43.2	105	56.8	1.00	
Race/Color						
White	59	45.0	72	55.0	1.11 (0.69 – 1.69)	0.629
Dark-skinned and light-skinned black	110	42.5	149	57.5	1.00	
Family income (in minimum wages)						
< 1 MW	92	46.5	106	53.5	1.29 (0.87 – 1.94)	0.205
≥ 1 MW	77	40.1	115	59.9	1.00	
Area of residence						
Rural	110	51.6	103	48.4	2.14 (1.41 – 3.22)	0.000
Urban	59	33.3	118	66.7	1.00	
N of residents in the household						
2 or 3	60	44.4	75	55.6	1.07 (0.70 – 1.63)	0.747
4 to 10	109	42.7	146	57.3	1.00	
N of rooms in the household						
1 to 3	12	63.2	7	36.8	2.34 (0.90 – 6.07)	0.074
4 to 13	157	42.3	214	57.7	1.00	
Public water source						
No	83	50.6	81	49.4	1.67 (1.11 – 2.51)	0.014
Yes	86	38.1	140	61.9	1.00	
Public garbage collection						
Yes	126	43.6	163	56.4	1.04 (0.66 – 1.65)	0.858
No	43	42.6	58	57.4	1.00	
Public waste collection						
No	158	47.2	177	52.8	3.57 (1.78 - 7.15)	0.000
Yes	11	20.0	44	80.0	1.00	

MW: minimum wages; OR: *odds ratio*.

With regard to treatment control, a total of 83 students (21.3%) did it outside the scheduled date, and 284 (72.8%) did not do it. This totals 367 (94.1%) students with treatment control that is considered to be inadequate. Thus, the treatment control was pointed out to be adequate in only 23 students (5.9%), for being carried out in the period recommended by the MOH (Table 3).

Regarding socioeconomic, demographic and behavioral factors, the variables, family income (p = 0.004), and area of residence (p = 0.000) showed a statistically significant association with the variable treatment control outcome, revealing that schoolchildren with a family income below one minimum wage and living in the countryside were 3.99 and

Table 2. Monitoring variables for primary care associated with the treatment of trachoma in schoolchildren. Russas, Ceará, 2016.

Variables	Treatment				OR not adjusted	p
	Inadequate		Adequate			
	N	%	N	%		
Residence area covered by a CHA						
Yes	143	45.7	170	54.3	1.65 (0.98 - 2.78)	0.059
No	26	33.8	51	66.2	1.00	
CHA explained how to prevent trachoma (n = 313)						
Yes	107	50.2	106	49.8	1.79 (1.10 – 2.93)	0.018
No	36	36.0	64	64.0	1.00	
ACE clarified how to prevent trachoma						
No	118	45.6	141	54.4	1.31 (0.98 – 2.01)	0.212
Yes	51	38.9	80	61.1	1.00	
Student was examined by a doctor at UBASF						
Yes	27	45.8	32	54.2	1.12 (0.64 – 1.96)	0.683
No	142	42.9	189	57.1	1.00	
Student went to UBASF to receive medicine						
No	119	46.3	138	53.7	1.43 (0.93 – 2.19)	0.100
Yes	50	37.6	83	62.4	1.00	
Received guidance from the nurse on trachoma						
Yes	96	48.0	104	52.0	1.48 (0.99 – 2.21)	0.056
No	73	38.4	117	61.6	1.00	

CHA: community health agent; ACE: agent to combat endemics; UBASF: Basic Family Health Unit (*Unidade Básica de Saúde da Família*); OR: *odds ratio*.

14.20 times more likely, respectively, to receive inadequate treatment control. The variables age, race/color and number of residents in the household were included in the multivariate analysis because they had p <0.20 (Table 3).

Table 3. Socioeconomic, demographic and behavioral factors associated with the treatment control of trachoma in schoolchildren. Russas, Ceará, 2016.

Variables	Treatment Control				OR not adjusted	p
	Inadequate		Adequate			
	N	%	N	%		
Sex						
Male	186	95.4	9	4.6	1.60 (0.67 – 3.78)	0.282
Female	181	92.8	14	7.2	1.00	
Age range (years)						
10 to 14	178	96.2	7	3.8	2.15 (0.86 – 5.36)	0.092
5 to 9	189	92.2	16	7.8	1.00	
Race/Color						
White	127	96.9	4	3.1	2.51 (0.84 – 7.55)	0.067*
Dark-skinned and light-skinned black	240	92.7	19	7.3	1.00	
Family income (in minimum wages)						
< 1 MW	193	97.5	5	2.5	3.99 (1.45 – 10.98)	0.004
≥ 1 MW	174	90.6	18	9.4	1.00	
Area of residence						
Rural	211	99.1	2	0.9	14.20 (3.28 – 61.46)	0.000*
Urban	156	88.1	21	11.9	1.00	
N of residents in the household						
2 or 3	130	96.3	5	3.7	1.97 (0.72 – 5.44)	0.181
4 to 10	237	92.9	18	7.1	1.00	
Public water source						
Yes	157	95.7	7	4.3	1.71 (0.69 – 4.25)	0.245
No	210	92.9	16	7.1	1.00	
Public collection of waste						
Yes	54	98.2	1	1.8	3.79 (0.50 – 28.75)	0.225*
No	313	93.4	22	6.6	1.00	

*Fisher's exact test; MW: minimum wages; OR: *odds ratio*.

The variables related to the primary health care CHA follow-up explained how to avoid trachoma and ACE clarified how to avoid trachoma had a statistically significant association with the treatment control outcome variable ($p < 0.05$). The variable, student was examined by a doctor at UBASF, was included in the multivariate analysis because it had $p < 0.20$. Approximately 30% of the families did not receive guidance from the CHA on how to avoid trachoma, and only 15.1% of the students were examined by the doctor at UBASF (Table 4).

Table 5 expresses the results of the multivariate analysis, verifying that, for the outcome variable treatment of trachoma, only the variables, area of residence, and destination of waste, remained in the multivariate model, showing that students from rural areas and living in homes without a public sewage system were 1.77 and 2.79 times more likely, respectively, to receive inadequate treatment.

Regarding the outcome variable, trachoma treatment control, the following variables remained in the multivariate model: area of residence, income, and student examined

Table 4. Monitoring variables for primary care associated with the treatment control of trachoma in schoolchildren. Russas, Ceará, 2016.

Variables	Treatment Control				OR not adjusted	p
	Inadequate		Adequate			
	N	%	N	%		
Residence area covered by a CHA						
No	73	94,8	4	5,2	1,18 (0,39 – 3,57)	0,770
Yes	294	93,9	19	6,1	1,00	
CHA explained how to prevent trachoma (n = 313)						
Yes	205	96,2	8	3,8	3,17 (1,23 – 8,14)	0,012
No	89	89,0	11	11,0	1,00	
ACE clarified how to prevent trachoma						
No	250	96,5	9	3,5	3,32 (1,40 – 7,90)	0,004
Yes	117	89,3	14	10,7	1,00	
Student was examined by a doctor at UBASF						
No	314	94,9	17	5,1	2,09 (0,79 – 5,54)	0,131
Yes	53	89,8	6	10,2	1,00	
Student went to UBASF to receive medicine						
No	243	94,6	14	5,4	1,26 (0,53 – 2,99)	0,600
Yes	124	93,2	9	6,8	1,00	

CHA: community health agent; ACE: agent to combat endemics; UBASF: Basic Family Health Unit (*Unidade Básica de Saúde da Família*); OR: *odds ratio*.

by a doctor at UBASF, noting that those in the rural area, coming from families with an income below one minimum wage, and those who were not examined by a doctor were 21.10, 5.33 and 4.99 times more likely, respectively, to perform inadequate treatment control.

DISCUSSION

In the present study, most students were given medicine, but in almost half of them, the treatment was considered inadequate, due to the fact that the medication administered was not registered in the campaign's attendance form.

The correct treatment of trachoma cases is important both at the individual level, for curing infections, and at the population level, considering that the objective is to interrupt the chain of transmission of the disease and reduce the circulation of the etiological agent in the community, decreasing the frequency of reinfections and the severity of cases[1].

Studies carried out in Brazil revealed the presence of the disease in much of the country, especially in areas with the worst quality of life indicators, where the positivity percentage remains above 10%, suggesting an epidemiological situation that can evolve to cases of blindness[7].

Families in rural areas find it difficult to travel to UBASF due to lack of access to transportation and the geographical distance, which compromises the use of this health service. The influence of geographic factors on access to and use of health services of families living

Table 5. Final multiple logistic regression model of factors associated with treatment and control of trachoma treatment. Russas, Ceará, 2016.

Treatment			
Variables	Adjusted OR	95%CI	p
Student's residence area (risk: rural)	1.77	1.15 - 2.72	0.009
Destination of waste (risk: non-public collection)	2.79	1.36 - 5.75	0.005
Treatment Control			
Variables	Adjusted OR	95%CI	p
Student's residence area (risk: rural area)	21.10	4.44 - 100.23	0.000
Family income (risk: <1 MG)	5.33	1.59 - 17.79	0.007
Student was examined by the doctor (risk: No)	4.99	1.42 - 17.48	0.012

MW: minimum wages; OR: *odds ratio*; 95%CI: 95% confidence interval.

in rural areas has been described by several authors[13,14], showing that great geographical distances, transport difficulties and poverty concentration represent important barriers[15].

The association of the variable treatment of trachoma with living in homes without access to the public sewage system suggests an unfavorable socioeconomic situation for families, which limits their search for health facilities. The homes of schoolchildren diagnosed with trachoma in Russas mostly use septic tanks for feces, and the public system is responsible for a small percentage of the collection of these wastes. The situation is even more serious in rural areas. Improving access to sanitation and water are recommendations present in the *SAFE* strategy, to reach the goal of eliminating this disease[1]. In a study carried out in Pelotas, RS, the authors found a predominance in the lack of access to health services among people with lower economic conditions[16].

With regard to primary health care actions, although most students lived in an area covered by a CHA, approximately one third of the families did not receive guidance on disease prevention by this professional. It is worth noting the high percentage of students who were not examined by the doctor at UBASF or guided by the ACE on how to avoid trachoma. These findings can be explained by the fact that there is only one CHA in the municipality that is responsible for evaluating students during the campaign. They did not have time for home visits for all those diagnosed with the disease, and only two doctors were trained to assist these patients.

Inequality in the distribution of human resources in health, especially doctors, persists as a serious problem, contributing to inequity in access to health services[17], especially in rural or underserved regions[18], with a shortage of doctors in primary care and a concentration of specialists in the private sector[19].

Health education activities with information on treatment, forms of prevention and control of trachoma, especially by the primary care team, are some of the main strategies for the elimination of the disease[5]. In the present research, during the interviews at home, the causes most cited by mothers or guardians for not undergoing treatment were: lack of information from FHS professionals about the need to use the medication, medication not being delivered, and the adolescent's refusal to take the medication.

Regarding the control of trachoma treatment, a minimum percentage was considered adequate. Among the students examined during treatment control, the fact that in more than half, the inflammatory signs of the disease persisted, the treatment scheme was restarted, and home contacts were also treated. Repeated episodes of active trachoma will result in scarring of the eyelids, progressing to TT, which, if left untreated, can lead to OC, causing decreased visual acuity and even blindness[20].

The association of the dependent variable treatment control with the variables, family income below one minimum wage, rural residence area and child not having been examined by a doctor, reinforces the influence of socioeconomic conditions on access and use of health services. Authors show the effects of poverty on the lack of information and health care[21].

Health education interventions and improvements in housing, access to water, the proper destination of waste and the quality of life of the population, as well as body care, personal

and family hygiene, are the most effective preventive actions related to disease transmission and control[1,22].

The study's limitations include distance and difficulty in accessing some locations in rural areas, in addition to the affective bond between the members of the health team and the interviewed families, which may have contributed to an underestimate or overestimate of the negative responses and statements regarding primary care monitoring.

CONCLUSION

The inadequate treatment of trachoma was associated with residence in a rural area, and the destination of waste in septic tanks/open areas, while the factors associated with inadequate treatment control were rural residence, income below one minimum wage, and the student not being examined by the doctor.

The high percentage of treatment and treatment control considered inadequate allows us to conclude that the actions of the trachoma control program in schoolchildren in the municipality of Russas are not being carried out as recommended by the Ministry of Health.

Health promotion and disease prevention activities were not accessible for the entire community, indicating the need for greater involvement in health education actions by primary care professionals, especially the CHAs, who work directly in homes. They aim to achieve comprehensive care and the effective integration between primary care and health surveillance in the municipality.

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