Risk factors for diarrhea occurrence in children living in Guaratiba Island (RJ)

Fatores de risco para ocorrência de diarreia em crianças residentes na Ilha de Guaratiba (RJ)

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ABSTRACT This article aimed to analyze the occurrence of acute diarrhea in children under five years old assisted by the Family Health Strategy of Guaratiba Island, and housing and sanitation conditions of the locality. A cross-sectional epidemiological study was carried out. The analysis of the variables was made by using simple and multiple logistic regression. The variables that showed association with diarrhea were: (a) children <2,5 years old; attend daycare/school and family income <one minimum wage; (b) presence of water filter and home water treatment; (c) presence of floods, open-air sewer, overflow of septic tank and garbage in the open. In the logistic regression model, two epidemiological scenarios, with and without floods, were considered. In the first scenario, the variables that maintained a statistically significant association with the outcome were: home water treatment, open sewer and presence of floods. In the second scenario, evidence was found of association also of the variable attendance to daycare/school. Therefore, this article highlights the importance of public policies, programs and actions with a view to the expansion of basic sanitation, the planning of public health actions and the guarantee of access to early childhood education.

KEYWORDS Diarrhea. Social Determinants of Health. Housing. Sanitation. Family Health Strategy.

RESUMO *Este artigo visou analisar a ocorrência de diarreia aguda em crianças menores de 5 anos assistidas pela Estratégia Saúde da Família de Ilha de Guaratiba, e as condições habitacionais e de saneamento da localidade. Foi realizado um estudo epidemiológico transversal. A análise das variáveis foi feita por meio de regressão logística simples e múltipla. As variáveis que apresentaram associação com a diarreia foram: (a) criança de idade <2,5 anos; frequentar creche/escola e renda familiar <um salário mínimo; (b) presença de filtro de água e tratamento domiciliar da água; (c) presença de inundações, esgoto a céu aberto, transbordamento de fossa e lixo a céu aberto. No modelo de regressão logística, foram considerados dois cenários epidemiológicos, com e sem inundações. No primeiro cenário, as variáveis que mantiveram associação estatisticamente significante com o desfecho foram: tratamento domiciliar da água, esgoto a céu aberto e presença de inundações. No segundo cenário, encontrou-se evidência de associação também da variável frequência a creche/escola. Portanto, este artigo ressalta a importância de políticas públicas, programas e ações com vistas à ampliação do saneamento básico, ao planejamento de ações de saúde pública e à garantia do acesso à educação infantil.*

PALAVRAS-CHAVE *Diarreia. Determinantes Sociais da Saúde. Habitação. Saneamento. Estratégia Saúde da Família.*

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Introduction

All over the world, acute diarrhea represents a disease with high morbimortality, especially in developing countries. Among the age groups most susceptible to the disease are children up to 5 years of age. A report by the Pan American Health Organization (Paho)[1] points out that, in 2017, 8% of mortality, equivalent to 448 thousand children under 5 years of age died from diarrhea in the world.

In Brazil, 218.012 individuals hospitalized for this disease were accounted for in 2018, with 36.2% of this total comprising children under 5 years[2].

The occurrence of diarrheal disease encompasses a set of factors related both to individual health conditions and to social, economic, cultural and environmental determinants. Among these factors, the disease is mainly associated with poor housing conditions and inadequate basic sanitation with a negative impact on the environment, causing contamination of the soil and water sources that favor the transmission of infectious diseases, including diarrhea[3-6].

In order for a dwelling to be considered healthy, it must include minimum requirements for the promotion and protection of human and environmental health, which include the structural and socio-cultural ones present in intra and extra household spaces. Inadequate housing is a risk factor for diarrhea, especially physical infrastructure and sanitation services[4,7].

Although basic sanitation is a constitutional right, the coverage of this service still remains deficient in several Brazilian municipalities. About 10 million homes do not have access to piped water, and only 59.1% are directly connected to the sewage collection system[6,8].

Given this scenario, the expansion of the Family Health Strategy (FHS) represents a significant advance in the field of health promotion and the prevention of communicable diseases such as diarrhea. The work of the health teams is carried out in the community and the professionals work both in the Basic Health Units and in the homes. The strategy is based on the individual's comprehensive view, considering his/her family scope, guiding the planning of actions and health care focused on the reality of each location, contributing to the improvement of the population's health status. In addition, it provides for the encouragement of individuals to participate in social control[9,10].

In this context, this article presents the risk factors present in homes. Considering the inadequacy of the sanitation service, the association with the occurrence of diarrhea in children aged 1 to 5 years living on the Guaratiba Island was studied, a location covered by the FHS, in order to expand the knowledge about the implications that the housing and sanitation conditions have on the prevalence of the disease.

Methodology

This is an exploratory study on factors associated with the prevalence of diarrhea in children under 5 years of age residing on Guaratiba Island. As a method, a population-based controlled cross-sectional epidemiological study was carried out, which is the option of a study design recommended for the investigation of a disease with a high prevalence.

The study was carried out on the Guaratiba Island, located in the Guaratiba neighborhood, municipality of Rio de Janeiro (RJ). Guaratiba Island belongs to Programme Area 5 (PA 5) and the Administrative Region of Guaratiba (RA XXVI). The Guaratiba neighborhood makes up 92% of the RA (139,44 km²) and 82% of its population has an average income of R$ 780[11]. Based on the Demographic Census of the 2000 Brazilian Institute of Geo-graphy and Statistics (IBGE), the location also presents very low social development rates (0,433) and human development index (0,744) within the municipality of Rio de Janeiro (RJ)[12]. As for demographics, between the 1990 and 2000 Censuses, population growth was 5.83%, a

value that exceeds the municipality's growth rate, which was, in the same period, of 0.74%[11].

In 2016, the estimated population of Guaratiba Island was 11.698 people, of which 6.090 were female and 5.608 were male[13]. The homes were 68.7% masonry. All had access to electricity. The municipal urban cleaning service collected 98% of the solid waste generated. The water supply was provided by a piped network in 72.6% of the households, and through a well or spring in 26.9%. As for the destination of the waste, 93.5% of the households used pits and 6.44% had them out in the open[13].

The choice of the research area was due to the fact that it was the place of professional activity of one of the authors of this article as a nurse in the FHS, as well as the local characteristics: predominantly rural area, without the universality of piped water supply and also devoid of sewage.

For the study, it was considered a case of diarrhea the occurrence of an increase in the frequency and amount of intestinal eliminations and a change in its consistency[14]. The study population corresponds to children in the age range of 1 full year to 5 incomplete years, living on Guaratiba Island. The inclusion criterion was to be registered with the Family Health Unit (FHU) active from June 1 to June 30, 2016. Exclusion criteria were: congenital malformations, severe acute illnesses and chronic illnesses leading to immune deficiency.

The selection of the study population was carried out using the electronic medical record of the FHU of the locality, in two stages: 1st) selection of micro-areas where approximately 70% of the children with active FHS registration lived in June 2016, and who presented different scenarios in relation to the level of urbanization, type of buildings and vegetation pattern; and 2nd) selection of participants in the 15 elected micro-areas, where all children had their homes visited, and the eligibility criteria applied.

The study data were collected using two instruments: interview and home observation. The data collected in the interviews were related to the child's characteristics, the family's socioeconomic status and the residence's sanitation.

The interviews were carried out in person with the guardians of the children, family members who lived in the same household or caregivers, and each one was given the Informed Consent Form (ICF) to be read and, in case of consent to participation, signed before the interview. If the guardians were not present, another attempt was made to find them, on a different day and time.

The collected data were stored in a digital database created in the Epidata software version 3.1.

The period for conducting the interviews was between August 10 and September 30, 2016.

The study's dependent variable was the occurrence of diarrhea in children up to 30 days prior to the interview, referred by the respondent. The independent variables were grouped into three dimensions: (a) child and family factors: sex and age of the child, family income less than a minimum wage, receiving of Family Allowance Programme, attendance at daycare/school, breastfeeding; (b) household factors: presence of toilet, presence of kitchen, presence of refrigerator, presence of filter and home water treatment; (c) sanitation and environmental factors: water supply source (public system versus well/spring), cleaning of the water tank, sanitary sewage (septic tank), cleaning of the septic tank, presence of floods, open sewage, presence of sewage in the backyard, overflow of septic tank, garbage in the open and presence of garbage in the backyard.

Data analysis was carried out in two stages: in the first, the completeness and quality of the data were evaluated. In the second, statistical analysis of the data was carried out. Initially, the prevalence of diarrhea and its respective confidence intervals were calculated according to extracts defined

from biological, socioeconomic and demographic characteristics. Then, measures of association between the factors studied and the occurrence of diarrhea were calculated. A bivariate analysis was performed, using simple logistic regression models for all independent variables and the outcome. The Odds Ratio (OR) association measure was used to represent the prevalence ratio. In addition to making point estimates of this measurement of association, their respective confidence intervals were also calculated to a level of 95%. The last phase consisted of estimating the association measures adjusted using multiple logistic regression models. For each of the three dimensions, variables related to diarrhea were selected, which remained associated with the outcome at a significance level of 5%. For the final model, all variables selected in the final models of each dimension were considered, which maintained an association at a significance level of 5% and, therefore, they were considered risk factors for diarrhea. A sensitivity analysis was also carried out (comparison of models with and without the factor in question) to assess the influence of a variable that had a strong association, the occurrence of flooding. Statistical analysis of the data was performed using the Stata program, version 13.0.

The research was submitted and approved by the Ethics Committees of the proposing institution and the co-participant, through Plataforma Brasil.

Results and discussion

The studied population consisted of 220 children, residing in 214 homes, 110 boys (50%) and 110 girls (50%) aged 1 to 5 years of age, average of 2,9 years *(table 1)*. Of this total, 78 (35.4%) had diarrhea in the 30 days prior to the interview, with 40 cases in girls and 38 in boys.

With regard to the educational level of the 220 responsible for the children, 128 had incomplete high school, and in this range the highest prevalence of diarrhea was observed among children. It is known that educational level is an important factor to be considered, since the knowledge and practices of the child's caregiver influence the adoption of preventive measures in relation to the condition, especially those related to hygiene care. This has been discussed in some studies[15], which cite the importance of the guardian's education level, although they have found no association with the outcome. Others[16] present the study time of the guardians as a protective factor against diarrhea. As well as a similar study[17], which points to a higher prevalence of diarrhea in homes where there are lower levels of education.

As for family income, diarrhea was more prevalent in the range below the minimum wage, with more than half of the children in this group having diarrheal condition. The prevalence was even higher in families that reported having no income: 72.7%. In most houses, more than three individuals were found per household. However, it was in households with more than six residents that there was a prevalence of 47.8%, higher than that found in other household densities. As for the length of stay, the highest prevalence – 42.9% – was found among those who lived in that household for 'up to 1 year'.

Table 1. Characteristics of the studied population and the occurrence of diarrhea. Guaratiba Island, Rio de Janeiro, august to september 2016

Factors	Presence of diarrhea				Total
	Yes	**%**	**No**	**%**	
Sex					
Male	38	34.5	72	65.5	110
Female	40	36.4	70	63.6	110
Education level of the person responsible for the child					
Illiterate	1	50	1	50	2
Incomplete elementary school	21	38.9	33	61.1	54
Complete elementary school	9	40.9	13	59.1	22
Incomplete high school	20	40	30	60	50
Complete high school	23	31.5	50	68.5	73
Incomplete higher education	2	33.3	4	66.7	6
Complete higher education or more	2	15.4	11	84.6	13
Family income in minimum wages					
No incomes	8	72.7	3	27.3	11
Up to 1 MW	29	46.8	33	53.2	62
From 1 to 3 MW	37	28	95	72	132
From 4 to 5 MW	3	27.3	8	72.7	11
More than 5 MW	1	25	3	75	4
Number of residents per domicile					
2 residents	1	50.0	1	50.0	2
3 residents	15	26.8	41	73.2	56
4 residents	23	34.3	44	65.7	67
5 residents	17	34.7	32	65.3	49
6 or more residents	22	47.8	24	52.2	46
Time of residence at domicile. in years					
Up to 1 year	15	42.9	20	57.1	35
From 1 to 5 years	18	32.1	38	67.9	56
More than 5 years	45	34.9	84	65.1	129

Source: Own elaboration.

According to the bivariate analysis, in the group of child and family factors *(table 2)*, those who were associated with diarrhea were 'Age <2,5 years', 'Attending daycare/school' and 'Family income <1 MW'.

Table 2. Child and family factors related to diarrhea. Guaratiba Island, Rio de Janeiro, august to september 2016

Characteristics	Diarrhea		Odds Ratio	95% CI
	Yes	No		
Female sex				
Yes	40	70	0.92	0.53 - 1.60
No	38	72		
Age <2,5 years				
Yes	42	54	1.90	1.08 - 3.33
No	36	88		
Family Allowance Programme				
Yes	26	44	1.11	0.61 - 2.00
No	52	98		
Attends daycare/school				
Yes	10	47	0.29	0.14 - 0.62
No	68	95		
Family Income <1 MW				
Yes	37	36	2.65	1.48 - 4.76
No	41	106		
Breastfeeding				
Yes	73	135	0.75	0.23 - 2.46
No	5	7		

Source: Own elaboration.

As for the age group, it can be seen that children under the age of 2,5 years had a higher prevalence of diarrhea than those with a higher age. The immune system is one of the factors that justify this relationship, since it develops with age[18]. Also considering the child's vulnerability to unfavorable environmental conditions[15], other studies emphasize age as a risk factor[4,19].

Family income is a relevant factor for the occurrence of diarrhea, since it influences living conditions and access to goods and services. In this study, it was found that children whose family income was less than one minimum wage were 2,5 times more likely to have diarrhea, when compared to those with higher family income. In agreement, some authors[17] ratify a higher prevalence of diarrhea in households with a lower level of family income. Other authors[16] still point out higher infant mortality rates due to diarrhea in countries with lower percentages of income. Therefore, family income is a determining factor in the level of social well-being[15]. It can be inferred that the higher the family's income, the more adequate is their access to education, food and structurally complete housing, comprising rooms such as kitchen reserved for food preparation, toilet inside, and sanitation, with adequate supply water, sewage and regular garbage collection.

In contrast, children included in early childhood education were 3 times less likely to become ill due to the condition, with only 17% of them having the disease, although some studies present the school environment as a risk site for the spread of communicable infectious diseases, as a result

greater vulnerability of children under 5 years old[21,22]. These authors[22] note that the factors related to the establishment are physical and human resources characteristics, number of regulars, hygiene habits in caring for children and the environment. And they suggest that the permanent education of education professionals and general employees, as well as the adoption of adequate hygiene measures in the handling of children are important for reducing the transmission of infectious agents in these places. However, the study carried out in this article reaches results similar to those of another study[16], with attendance at day care centers as a protective factor against diarrhea, since in these places the child has access to adequate food and water for consumption, and there are practices used in the handling of children that respect hygiene measures relevant to disease prevention.

Access to early childhood education is a child's right and a duty of the State. It must be offered adequately in its physical structure and with trained human resources, aiming at both the quality of teaching and the prevention of disease transmission, through the detection and control of outbreaks, which often occur in the school and kindergarten environment. Although it is known that such environments favor the transmission of infections and infestations, the study showed that the child's permanence in these places worked as a protective factor against diarrhea. No associations were found between the variables 'family allowance programme', 'breastfeeding', 'sex' and the outcome studied.

With regard to the characteristics of the dwellings *(table 3)*, the items that showed association with diarrhea were 'Presence of water filter' and 'Home water treatment', both as protective factors.

Table 3. Home factors related to diarrhea. Guaratiba Island, Rio de Janeiro, august to september 2016

Characteristics	Diarrhea		Odds Ratio	95% CI
	Yes	**No**		
Presence of Toilet				
Yes	77	142	-	It was not possible to calculate
No	1	0		
Presence of Kitchen				
Yes	76	140	0.54	0.07 - 3.93
No	2	2		
Presence of refrigerator				
Yes	76	142	-	It was not possible to calculate
No	2	0		
Presence of water filter				
Yes	32	90	0.40	0.23 - 0.71
No	46	52		
Home water treatment				
Yes	31	92	0.36	0.20 - 0.63
No	47	50		

Source: Own elaboration.

Of the children whose homes had a water filter, only a third had diarrhea. The chance of having diarrhea was less than half the chance presented by children who did not have the utensil. Similarly, children who lived in households where home water treatment was accomplished (considering filtration, boiling and/or chlorination) were less likely to have diarrhea. This is also seen in other studies[19,24,25], which point to the importance of home treatment of drinking water as a means of preventing the transmission of diarrhea, especially in places where there is no public water supply system or when there are sources of supply concurrent, as found in the study area. Water treatment can also be performed by residents who are dissatisfied or do not believe in the public sanitation service[25], as observed in this study through information from some residents.

In the factors 'presence of toilet' and 'presence of refrigerator', it was not possible to identify the association with the disease, since all children who had diarrhea also had a toilet and refrigerator in their homes.

It is worth mentioning, however, the importance of these factors in the occurrence of diarrhea, as pointed out in other studies[19,24]. It is known that the presence of a refrigerator is indispensable for the preservation of food in conditions suitable for consumption. The presence of a toilet in the residence seems to be a factor associated with the occurrence of diarrhea, since homes that do not have a toilet are lacking in adequate sanitation, which contributes to the contamination of the soil in the surroundings and of water tables, which are often used as sources of drinking water. It should also be noted that in houses where there is no sanitation, there is a greater tendency for water contamination in areas subject to flooding, as observed in the study area.

Among the conditions of sanitation and the environment (*table 4*), three factors associated with diarrhea were identified, with the 'presence of floods' being the most strongly associated condition.

Table 4. Sanitation and environmental factors related to diarrhea. Guaratiba Island, Rio de Janeiro, august to september 2016

Characteristics	Diarrhea		Odds Ratio	95% CI
	Yes	No		
Water supply source (well)				
Yes	30	56	0.96	0.54 - 1.69
No	48	86		
Cleaning of the water tank				
Yes	51	107	0.79	0.32 - 1.94
No	9	15		
Sanitary sewage (septic tank)				
Yes	78	139	-	It was not possible to calculate
No	0	3		
Cleaning of the septic tank				
Yes	29	66	0.67	0.38 - 1.18
No	49	75		

Table 4. (cont.)

Characteristics	Diarrhea		Odds Ratio	95% CI
	Yes	No		
Presence of floods				
Yes	38	1	133.95	17.83 - 1006.12
No	40	141		
Open sewage				
Yes	43	31	4.39	2.42 - 7.99
No	35	111		
Presence of sewage in the backyard				
Yes	21	17	2.71	1.33 - 5.52
No	57	125		
Overflow of septic tank				
Yes	39	28	4.07	2.22 - 7.47
No	39	114		
Garbage in the open				
Yes	45	55	2.16	1.23 - 3.78
No	33	87		
Presence of garbage in the backyard				
Yes	34	42	1.83	1.03 - 3.26
No	44	100		

Source: Own elaboration.

Diarrhea was more prevalent in places where flooding occurred in the period, affecting about 98% of children who lived in these conditions. The OR indicates that contact with floods increased the chance of children becoming ill from diarrhea 133 times. Some studies[26-29] also show an association between the presence of floods and the incidence of diarrhea in the world. In Brazil[30] similar result was found: higher illness due to diarrhea in homes with the occurrence of floods.

The studied territory presents as geographical characteristics variations in altitude, which, associated with the absence of a local rain drainage network[31], favor the existence of areas subject to floods, especially in times of intense rain. Guaratiba Island has several areas and public spaces with potential points of flooding and inundations due to the overflow of rivers and water channels. They are: Rio da Olaria, on the Olaria Road; and Valão do Cachimbau, on the Cachimbau Road. There are also critical points for flooding or inundations caused by heavy rainfall, such as Island Road, on the corner of the road with Morro Cavado's Road. Still, there is an area with recurrent overflow, that of Olaria River[32]. During home observation, other points of flooding were noticed, in areas close to those mentioned.

It is important to consider that in this region there is a predominance of the use of septic tanks in households. One hypothesis is that, due to inadequate cleaning of the septic tanks or the presence of open sewage, there may be a high prevalence of diarrhea in the places where floods occurred in the

period. Some authors[33] point out that diarrheal diseases associated with floods are due to contamination of drinking water by flood water. Corroborating this, a study[34] mentions a higher prevalence of diarrhea in periods of intense rain, especially in places where sanitation is inadequate.

The presence of open sewage at home or in the neighborhood made children living in these places about 4.5 times more likely to have diarrhea. Of the children exposed to open sewage, more than half had the disease, and of the total number of children studied, those who lived in homes in these conditions also had more diarrhea than the others.

The 'overflow of the septic tank' was considered separately in relation to the factor 'open sewage', with a similar association. Diarrhea was present in approximately 60% of children who suffered from overflow in the home, which increased the chances of diarrheal disease 4 times.

As in the present study, another author[29] identifies exposure to open sewage as a risk factor for the occurrence of diarrhea in children under 5 years of age. Still, another study[19] points out a high association between the presence of waste in the open sky and illness due to diarrhea.

Open sewage reflects the sanitation situation of the territory, since, in the absence of a sewage collection network, individuals make use of other ways of disposing waste, either through inadequate alternatives, in sinkholes and in the open, more appropriately, with the use of septic tanks.

As for the territory of the study, the information obtained through the interview about the maintenance or periodic cleaning of the tanks was different from that observed in home visits. Sometimes, although the information obtained in the interview indicated that cleaning was performed periodically, as recommended by the National Health Foundation (Funasa)[35], there was an overflow, pointing out inconsistency

between what was said and the observation data of the domicile. This divergence of data points to the possibility that the maintenance or cleaning of the tanks in the study location is not being carried out properly. Thus, it becomes more frequent the irregular disposal of effluents inside or near homes, depending on the location of installation of the tanks, providing an environment that facilitates the spread of microorganisms that cause diarrhea.

This study chose to address, as a priority, sanitation issues related to water supply and sanitary sewage. However, taking into account the reviewed literature, the variables 'garbage in the open' and 'presence of garbage in the backyard' were added to the bivariate analysis. In addressing these factors, in the studied population, an association was found between inappropriate waste disposal and diarrhea. This finding is in accordance with previous studies, which demonstrate the inadequate packaging of solid waste as a risk factor for illness due to this disease[36].

As for the 'source of water supply', there was no evidence of an association with diarrhea, as in another study[4]. This may have been due to the existence of a significant number of households that performed home water treatment: 123 households with wells performed some home care with drinking water. However, the relevance of water supply in the occurrence of diarrhea cannot be ignored. Authors[4] reinforce the importance of water supply through the public system, which makes it possible to carry out the treatment and distribution of drinking water in accordance with legally established drinking standards. This can no longer be guaranteed in water from alternative sources to public supply.

As for the 'sanitary sewage' factor, the presence of a septic tank was studied (yes or no). Among the 220 children studied, 217 used, in their homes, the septic tank for the disposal of waste, and in 3 of these homes,

residents reported connection to the public sewer system. Thus, it was not possible to demonstrate an association between the existence of a sewage collection network and the prevalence of diarrhea in the studied group, however several studies[37,38] point to the importance of this association. In another study[38], the reduction in mortality from diarrhea in children under 5 years was attributed to adequate conditions of sanitary sewage.

In the study of the factors 'cleaning of the water tank' and 'cleaning of the septic tank', there was also no association with the studied outcome. For the identification of factors associated with diarrhea, two epidemiological scenarios were considered: (a) with all the factors that were shown to be associated with diarrhea in the analysis of the groups – model 1; and (b) without

considering the influence of the occurrence of floods – model 2. This approach is justified because the magnitude of the association between the presence of floods and diarrhea is great and, in a way, this condition indicates in isolation a serious health condition public. On the other hand, the 'presence of floods' diverts what can be considered as an effect of the other factors. In the scenario in which floods were considered (model 1), those that maintained a statistically significant association with the outcome were: 'home water treatment', 'open sewage' and 'presence of floods' (*table 5*). In the second scenario (model 2), when excluding the variable 'presence of floods', evidence of association was found, in addition to those previously described, also of the variable 'attending daycare/school'.

Table 5. Child, home, sanitation and environment factors associated with diarrhea. Guaratiba Island, Rio de Janeiro, august to september 2016

Characteristics	Model 1		Model 2	
	Odds Ratio	95% CI	Odds Ratio	95% CI
Attending daycare/school	0.47	0.18 - 1.20	0.30	0.13 - 0.68
Home water treatment	0.18	0.08 - 0.42	0.34	0.18 - 0.64
Open sewage	2.53	1.15 - 5.59	4.69	2.47 - 8.90
Presence of floods	150.08	18.52 - 1216.18	-	-

Source: Own elaboration.

The World Health Organization (WHO) points out that investment in sanitation is capable of reducing the incidence of diarrhea in the world by 36 %[39]. Sanitation is a right guaranteed by law, recognized by the United Nations Assembly in 2010, based on General Comment nº 15 of 2002[22], which established the Human Right to Water and Sanitation (HRWS). Furthermore, it delegated to the

States the responsibility of ensuring access to these services in quality and availability to the entire population. The importance of basic sanitation in health promotion lies in guaranteeing the economic and social well-being of the population.

The main limitations of this study concern the study design (cross-sectional) and the characteristics of the analyzed population. A

longitudinal study would allow observing the relationships in a more appropriate way, as it would guarantee the temporal precedence of the exposures in relation to the outcome. Still, given the nature of the exposure factors and the outcome, it would be unreasonable to think about reverse causality. For this reason, the associations detected in a sectional study must be valued.

Despite the homogeneity of some sociodemographic characteristics, such as the education of the person in charge, low family income and lack of access to the sewage network, it was possible to detect the influence of other socio-environmental factors, such as the presence of floods, home treatment of drinking water, attendance at day care and school, and the presence of open sewage, all associated with the incidence of diarrhea.

During the visitation, some difficulties were encountered in reaching the total number of children selected. Due to the large number of houses for rent and kitchenettes in the territory, there is a higher turnover of housing for the population. So, the change of residence, whether inside or outside the territory, was a complicating factor, as well as the absence of a guardian in the residence, as many parents were working at the time of the approach at home, although more than one attempt was made to visit to these residences. However, the number of children reached for the research allowed to find the associations between the exposure factors and diarrhea in the study territory.

The knowledge produced by this study, in addition to contributing to the understanding of the diversity of factors associated with the occurrence of diarrhea and to the identification of associative conditions briefly investigated – such as floods as risk factors and early childhood education as a protective factor to the condition – can also support primary care, through the FHS, for planning actions within the territory, aiming at health promotion and prevention of diarrheal disease. Immediate

measures can be taken regarding guidelines to the population on important aspects related to the occurrence of diarrhea found in this study, such as home care for drinking water, proper food conservation, hygiene practices, the appropriate procedure in the occurrence of floods in the territory, the proper storage of solid waste, the correct cleaning of water tanks and septic tanks. To community health workers, who are the professionals who carry out the monitoring at home, this study can promote the necessary knowledge to observe the relevant aspects and potentially associated with diarrhea in the homes and in the territory, when reporting the complications and contributes to the minimization of the risks. In addition, it can facilitate community mobilization in order to seek the guarantee of access to adequate and equal sanitation in the territory.

Final considerations

Acute diarrhea is a disease related to several socio-environmental factors that favor the transmission of the agents that cause the disease and the illness of exposed individuals, especially the most vulnerable, among them, children. In this study, it was sought to identify the association between acute diarrhea in children under 5 years of age and the housing and sanitation characteristics of a community assisted by the FHS.

Thus, from bivariate and multiple analysis, the exposure factors that favored the occurrence of childhood diarrhea were evidenced in the studied territory: presence of open sewage and presence of floods, the latter being the most important association of the study. This, in addition to protective factors: home water treatment and the child's attendance at daycare or school. The diversity of the nature of the factors related to illness due to diarrhea is emphasized, be it of conditions that increase, or of conditions that decrease the frequency of the disease. Prevalence of lower diarrhea

was found in children who attended day care and school. On the other hand, households with open sewage and subject to flooding represented important risk factors for the disease, as both maintained an independent and significant association with the outcome, after applying the multivariate model. In turn, home water treatment was a protective factor: filtration, boiling and chlorination have minimized the risks of diarrhea.

This article, through the study of childhood diarrhea in Guaratiba Island, presented the implications that the absence or inefficiency of the sanitation service and its negative effects on the environment have on the health of the populations. In this scenario, health services, especially primary care with assistance from the FHS, can contribute to the reduction of risks related to the lack of basic sanitation in communities. The family health team, from the knowledge of the territory, can carry out health plans and actions oriented to the specific characteristics of their locality, with a view to promoting health and preventing diarrheal disease. Such measures range from encouraging daily practices through guidelines for adequate home water treatment to periodic practices, such as cleaning the water tank and drains, and environmental care, in order to minimize the occurrence and consequences of floods. Another relevant point is related to the role of health professionals and their link with the population, acting as facilitators and promoters of community mobilization in the search for guaranteeing the rights that should be guaranteed to them. This article is concluded by intending that its findings, in addition to contributing to the expansion of knowledge about the panorama of infectious diarrhea and socio-environmental determinants, corroborate the importance of formulating public policies, programs and actions in the scope of basic sanitation, with a view to universalization, in the planning of public health actions and in guaranteeing access to education.

Collaborators

Aguiar KCG (0000-0001-5203-2803)*, Cohen SC (0000-0001-6228-6583)*, Maciel EMGS (0000-0002-9095-3141)* and Kligerman DC (0000-0002-7455-7931)*, contributed to the elaboration of the following activities: they participated in the conception, planning, analysis, interpretation of data, critical review of the content and approval of the final version of the manuscript. ∎

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