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ANÁLISIS DE LO INDICADOR DIARRREA EM LA EVALUACIÓN DE LA RELACIÓN ENTRE RESIDUOS SÓLIDOS Y SALUD

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*EVALUATION OF THE DIARRHEA INDICATOR IN THE ASSESSMENT
OF THE RELATION BETWEEN SOLID WASTE AND HEALTH*

Abstract

Diarrhea morbidity has been the most used health indicator in the assessment of the impact of sanitation improvement on health. There are few studies that have used this indicator for the assessment of the relation between solid waste disposal and human health. In the present work, diarrhea is used as a health indicator in a study developed to evaluate the health risk of people who live near a municipal solid waste landfill, located in the city of São Paulo, SP, Brazil. This epidemiological study used a transversal design. The study population was 972 children, from 1 to 5 years of age, living next to the landfill. The studied area was divided into 500-meter bands, starting from the landfill limit to define the exposure conditions. The health indicator used was diarrhea prevalence. A logistical regression model was used to study the factors related to diarrhea occurrence. In the study area, the data related to the following aspects were achieved: social and economical conditions of the family, house conditions and waste water system, water supply, domestic solid waste, urban drainage, biological and mechanical vectors, family and children health conditions and neighboring residential conditions. The results led to the conclusion that the diarrhea morbidity indicator was not specific to the assessment of the researched associations.

Key Words: Diarrhea Diseases, Environmental Exposure, Epidemiology, Landfill, Solid Waste.

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Resumo

A morbidade por diarreia tem sido o indicador de saúde mais utilizado nas avaliações das intervenções em saneamento sobre a saúde pública. Contudo, há poucos estudos que utilizam o indicador diarreia na avaliação de impactos sobre a saúde da disposição ambiental de resíduos sólidos. No presente trabalho, a morbidade por diarreia é empregada como o indicador de saúde em um estudo epidemiológico desenvolvido com o objetivo de avaliar o risco à saúde da população vizinha a um aterro sanitário, localizado na cidade de São Paulo, SP, Brasil. O delineamento epidemiológico adotado na investigação foi um estudo do tipo seccional. A população de estudo foi composta por 972 crianças na faixa etária de 1 a 5 anos de idade. A área de estudo foi dividida em três faixas distantes de 500m do limite do aterro, para a definição das condições de exposição. O indicador de saúde utilizado foi a prevalência por enfermidades diarreicas. Na área de estudo foram levantados os seguintes dados referentes: às condições socioeconômicas da família, às condições da habitação e esgotamento sanitário, ao abastecimento de água, aos resíduos sólidos domiciliares, à drenagem urbana, aos vetores biológicos e mecânicos, às condições de saúde da família e da criança e às condições do peridomicílio. Com os resultados obtidos pode-se concluir que a morbidade por diarreia demonstrou não ser um indicador específico para as associações pesquisadas.

Palavras chave: Aterro Sanitário, Diarreia, Doença, Epidemiologia, Exposição Ambiental, Resíduos Sólidos.

Introduction

Heller (1997), commenting about the variables applicable to studies on the impact of sanitation interventions, affirmed that the selection of a variable or indicator that reflects the health conditions of a population group must conciliate the need to effectively express the collective health condition and the suitability to that specific research, by means of its validity, reliability and capacity to represent the effect of what is exposed.

In case studies surveyed by Heller (1995), when an analysis was performed based on 238 studies on the assessment of the association between sanitation and health conditions, it was verified a higher frequency of the employment of morbidity caused by diseases related to diarrhea as health indicator in the studies researched.

Azevedo (2003) carried out a comparative analysis among several health indicators commonly reported in literature in studies on the assessment of the impacts of sanitation procedures, aiming at evaluating the most adequate indicators of the effect of the interventions in sanitation on health. The author investigated the following indicators: morbidity caused by diarrhea, infection by helminthes, chronic malnutrition, acute malnutrition, isolated weight deficit, protozoosis, helminthiasis, infection by enteropathogens of fecal-oral transmission and the presence of enteropathogens associated to fecal piocytes.

The indicators analyzed were compared according to these five criteria: sanitation interventions; epidemiologic characteristics; epidemiologic inferences; determination characteristics; operational viability. According to Azevedo (2003), the indicator morbidity by diarrhea demonstrated sensitivity to reflect the sanitation conditions evaluated, besides being

of low cost and practicable in field conditions. Nevertheless, the author highlights that morbidity by diarrhea is not a specific indicator and does not determine objectively.

According to Briscoe et al. (1986), morbidity by diseases related to diarrhea is adopted as an indicator of health in the assessment of impacts of interventions in sanitation, because: it is very important in public health; it employs valid and trustable instruments in its determination; it can respond to changes in the sanitation conditions and it proved to be of low cost and practicable in its determination. As for the significance in public health, the authors say that the diseases related to diarrhea are the main cause of child morbidity in developing countries.

In this study, diarrhea was defined as the occurrence of three or more liquid intestinal movements, which assume the shape of the container in 24 hours. A diarrhea event is conventionally defined as that which starts in the first period of 24 hours, in which diarrhea is defined, and ends in the last day preceding at least two consecutive days without the event of the definition (Lima & Guerrant, 1992 apud Heller, 1997).

Heller (1995) highlights that diarrhea is a symptom of several distinct etiologies, each one with its respective risk factors. However, according to the author, studies on diseases related to diarrhea and their determinants are common, due to their significance in public health and the possibility of the development of common strategies for diarrhea control, regardless of the etiology.

After a comprehensive bibliographic review, Azevedo (2004) observed that the morbidity by diseases related to diarrhea has not been used in studies on the assessment of the impact of the environmental deposition of solid waste on health, although it is the health indicator most frequently employed in the evaluations of sanitation interventions on public health.

The present work aims at presenting an analysis of the use of the indicator diarrhea in an epidemiological study developed to evaluate the risk for the health of the population living in the areas surrounding locations used for final deposition of solid waste, in which the landfill was considered a field of environmental exposure.

The results analyzed in the present work are part of a more comprehensive study, developed by Azevedo (2004). The research was carried out in the city of São Paulo, SP, Brazil and included the development of a transversal epidemiological study to evaluate the risk to the health of the population living near the Landfill Bandeirantes, located in the northwest region of the city of São Paulo.

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Objective

The present work aims to present an analysis of the use of the diarrhea indicator in an epidemiological study developed to evaluate the risks for the health of the population that lives near the areas of solid waste deposition, in which the landfill was considered a field of environmental exposure.

Methodology

Area of Study

The data collection was carried out in the child population living in the suburb called Perus, in the northwest region of the city of São Paulo, SP, Brazil, located in the surrounding area of the Bandeirantes landfill. When the research was developed, Perus had around 70,715 inhabitants, with a population growth of 3.88 % a year. São Paulo, the largest city of the Southern hemisphere, had 10 million inhabitants and a demographic density of 67.2 inhabitants/ha. São Paulo produced around 15,000 tons of solid waste a day, 90.1 % of which was deposited in two landfills: Bandeirantes and São João.

At Bandeirantes landfill have been disposals around 6,000 tons a day of municipal solid waste. The total area of landfill was 1,400,000 m², containing approximately 33 million tons of residues, with the total height of 143 m. The volume of leachate produced was around 1,200 m³/day. This landfill has been in operation since 1979.

Epidemiological Design Adopted

It was adopted a transversal epidemiological design in this investigation, through which the data related to the occurrence of diarrhea diseases were collected. The population of study was 972 children from 1 to incomplete 5 years of age, who live near the Bandeirantes landfill.

The area of study was divided into three 500 metres bands starting from the limit of the landfill, for the definition of the conditions of exposure. The “non-exposed” population, in the age group previously specified, was that living farther than 1,000 metres from the limit of the landfill (Area designate by acronym SPC). The exposed group was considered as the population, in the same age group, living up to 1,000 m far from the landfill. The exposed group was divided into two groups – the first one was composed of children who lived up to 500 metres far from the landfill

(Area designate by SPA), and the second group was formed by children who lived between 500 and 1,000 metres far from the limit of the landfill (Area designate by SPB), as shown in Table 1.

TABLE 1. Exposure condition

Area	Distance from the limit of landfill	Exposure condition
SPA	0 a 500 m	High exposure
SPB	500 a 1,000 m	Medium Exposure
SPC	farther than 1,000 m	No exposure

For the study population was applied a questionnaire, which was answered by the child's mothers or caretakers. The questionnaire contained 193 questions which allowed the collection of data and information related to the identification of the house: identification of the person who was interviewed; family composition; socioeconomic conditions; house and domestic sewage conditions; water supply; domestic solid waste; urban drainage; biological and mechanical vectors; family health conditions and neighboring residential area conditions; mother's reproductive history; children's prenatal and postnatal care history; health conditions; children's hygienic habits and behaviors; food habits, and survey on the prevalence of diseases related to diarrhea. The individuals who lived in the area and presented episodes of diarrhea in the 48 h preceding the questionnaire application were considered "sick".

Data Analysis

The method of analysis adopted was based on the study of the frequency of all the variables collected for each child and the comparison of the three areas of study, according to the selection of these variables. For the qualitative variables, the differences of the frequencies found, among the three areas, were statistically tested by either the Fisher's Exact Test or the Chi-square Test for proportions, when indicated. All the variables surveyed were grouped into eleven categories or blocks, as follows: family structure; socioeconomic condition; house condition; sewage; water supply; solid waste; urban drainage; environmental conditions of the peridomiciliar area; information about the children; hygienic habits and environmental indicators.

The univariate analysis was carried out for each group or block of variables, having as the response variable the occurrence of diarrhea or not. The explanatory variables that achieved a p-value lower than 0.25 in the univariate analysis were selected as candidates to be included into the final multivariate model of the logistic regression.

The logistic regression model was used to investigate the factors associated to the occurrence of diarrhea – the response variable considered in the analysis. For the construction of the final

model, it was used the *forward* procedure, which is the inclusion of one explanatory variable at a time. Because of the great amount of variables, the adjustment occurred per blocks or categories, as previously mentioned. Only the variables that changed the values of the original Odds Ratio (OR) and were associated to $p < 0.05$ in the analysis of each category or block of variable entered the regression model. Some variables were grouped with the objective of dichotomize their categories. The level of statistical significance adopted was 5 %. It was employed the SPSS for Windows statistical software system.

Results

The occurrence of diarrhea in the population studied was statistically different in the three areas of study evaluated (Table 2). However, in the logistic regression analysis, the relationship between landfill distance and diarrhea did not remain in the final model, which demonstrates that this indicator was not sensitive to show the conditions of environmental exposure researched – the nearness of the residence to the landfill.

The final result of the logistic regression model is presented in Table 3. According to the Hosmer-Lemeshow, the p -value achieved for the adjustment of the logistic regression model was 0,991 (HOSMER & LEMESHOW, 2000).

TABLE 2. Characterization of the three areas of study according to the frequency of diarrhea occurrence in the population studied

Variable	Attribute	Freq.	SPA	SPB	SPC	χ^2	p
Diarrhea in the last 48 hours	No	n	282	333	251	8.721	0.013
		%	95.3	89.3	89.6		
	Yes	n	14	40	29		
		%	4.7	10.7	10.4		

TABLE 3. Final result of the logistic regression model

Significant variable in the model	Coefficient	Value-p	Odds ratio (OR)*	
			Estimate	IC (95 %)**
Hand washing after defecation	1.433	0.022	4.190	(1.226; 14.322)
Waste sorting in the house	-1.057	0.010	0.347	(0.155; 0.780)
Problems of lack of water in the house	1.212	0.001	3.360	(1.633; 6.915)
Use of domestic water reservoir	1.540	0.047	4.498	(1.020; 19.829)
Frequency of water tank cleaning	0.986	0.011	2.680	(1.248; 5.754)
Constant	-5.049	0.000	0.006	

* Odds Ratio

** IC – confidence interval at 95 %

The variables that remained in the final model of the multivariate analysis were: the children's habit of washing their hands after defecation; waste sorting in the house; occurrence of lack of water in the house; indirect water supply; frequency of water tank cleaning.

The results achieved by the logistic regression model demonstrated that the indicator morbidity by diarrhea was more efficient to show the variables related to the interventions in water supply and the practices of domestic and personal hygiene. The Figure 1 presents the distribution of diarrhea occurrence in the population studied.

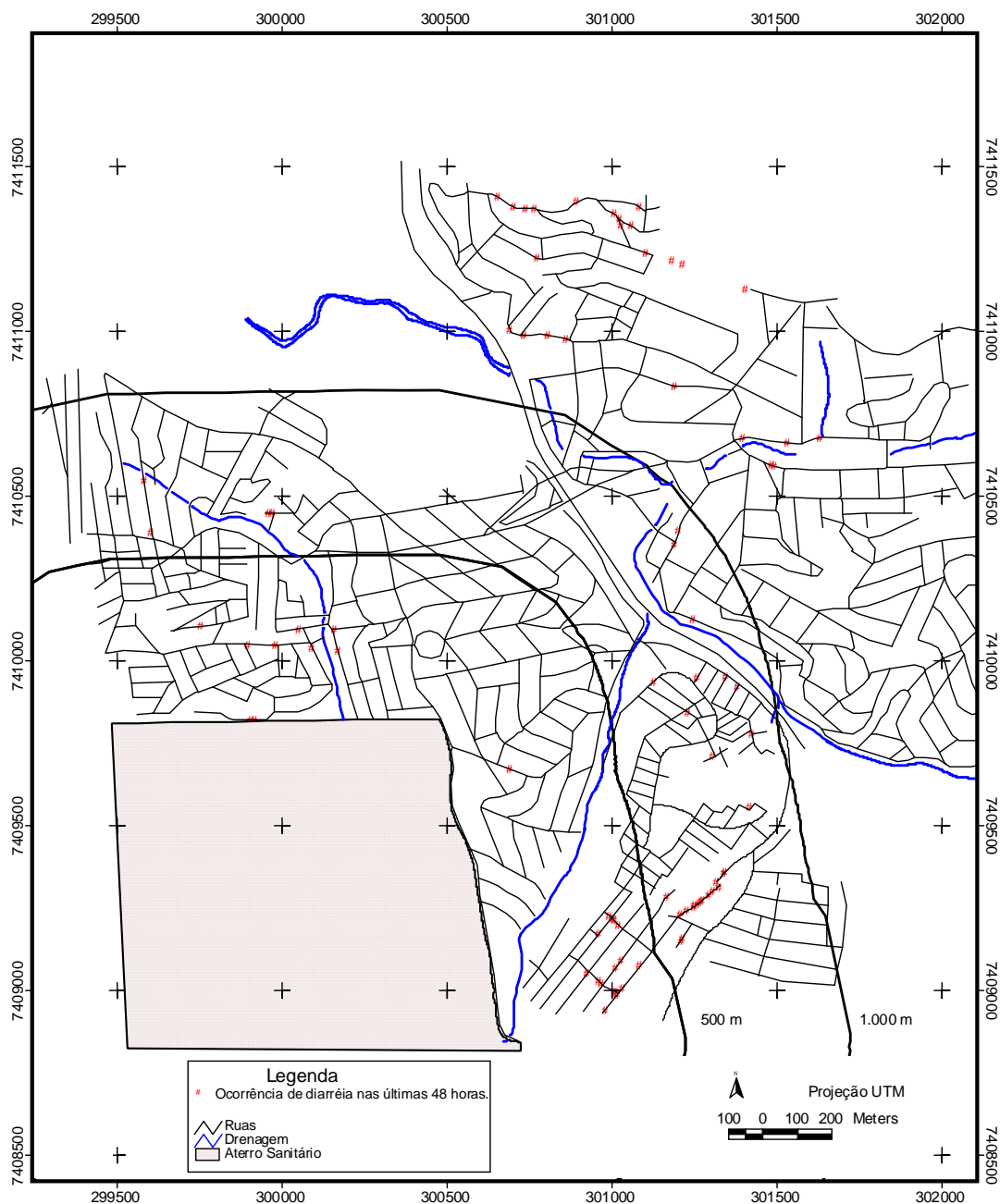


FIGURE 1. The distribution of diarrhea occurrence in the population studied.

Conclusion

Through the present epidemiological study and the results achieved from the statistical analysis using the logistic regression technique, in which the morbidity by diseases related to diarrhea in children from 1 to incomplete 5 years of age was considered as health indicator, it was possible to conclude that the disposal of the solid waste according to the landfill technique, following the operation conditions adopted in the Bandeirantes landfill in the city of São Paulo, did not mean an increase of diarrhea prevalence in children from 1 to 5 years of age, living near the landfill. The distance between the residence and the landfill does not affect the health of the child population, from 1 to 5 years of age, concerning the diseases related to diarrhea.

The indicator morbidity by diseases related to diarrhea was not specific for the associations researched. Therefore, the research for more precise indicators, which demonstrate more clearly the relation between solid waste and health, should be encouraged, so that studies on the assessment of the impacts of the environmental disposal of solid waste may comprise the ways and areas where the diseases are transmitted.

It was possible to conclude that the methodology employed in the development of the present study was appropriate to evaluate the associations researched and that it can be applied in similar studies on the assessment of the impacts of the environmental disposal of solid waste on health.

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