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Morbidity and mortality due to gastroenteritis in the State of Pará, Brazil

Morbimortalidade por gastroenterites no Estado do Pará, Brasil

Morbimortalidad por gastroenteritis en el Estado de Pará, Brasil

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ABSTRACT

In Brazil, gastroenteritis mainly affects children aged 0 to 5 years and is considered a significant public health problem. The reduction of the morbidity and mortality rates caused by gastroenteritis is responsible for the decrease in the rates of overall infant mortality and infant mortality due to infectious diseases in developing countries. This work is a descriptive study developed in collaboration with the Epidemiology Department of Pará State in order to determine the importance of gastroenteritis as a cause of hospitalizations and deaths in Pará State. Initially, data about morbidity and hospitalization were obtained from Information Systems on mortality, health and hospital admissions and from health indicators and the Monitoring of Acute Diarrheal Diseases (MADD) program in the period between 2000 and 2004. There were 590,595 recorded cases of diarrhea. There was an increase in the number of cases of diarrhea notified by MADD during this period, with the highest frequency rates found in children aged 1 to 4 years old (average of 48,887 cases), followed by 33,151 cases in children below 1 year of age. In 2004, the hospitalization rate due to diarrhea in children below one was of 35 per 1 thousand live births. The coefficient of mortality decreased during the period studied, reaching 2.91 per 100 thousand inhabitants in 2004, following the reduction trend of mortality rates by diarrhea in Brazil. Despite this reduction, diarrhea remains a major cause of morbidity and mortality in Pará State, especially affecting children below 1 year of age.

Keywords: Gastroenteritis; Diarrhea; Indicators of Morbidity and Mortality; Information Systems; Infant Mortality.

INTRODUCTION

Gastroenteritis is an infection of the digestive tract that causes clinical symptoms that include vomiting, malaise, fever (temperature above 38° C), and diarrhea[25,20]. Infants in their first year of life constitute its main risk group, in terms of both incidence and risk of complications and death. Studies on the etiology of diarrheal diseases have demonstrated that the prevalence of pathogens varies according to several factors, such as socioeconomic stratum, geographic location, type and location of residence, age of the studied population, and seasons of the year[1].

Diarrhea is still one of the main causes of infant mortality in developing countries, and is associated with a complex set of environmental, nutritional, social, economic, and cultural factors[27]. Despite the decreasing trend in infant mortality rates, diarrheic diseases remain a severe public health issue in countries with unequal wealth distribution, including Brazil[13,17,8].

Regardless of its etiology, diarrhea has a significant direct global impact, manifested by the compromised health of individuals as a consequence of dehydration and chronic malnutrition, which can lead to death; it also has a considerable indirect impact, due to the damage to the economy caused by hospital admission costs, the loss of work hours and the reduction of family income[27,7]. In light of these consequences, there is a need for continuous monitoring of diarrhea morbidity and mortality indicators through the use of Health Information Systems.

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Health Information Systems are defined as a group of components that act in an integrated fashion through collection, processing, analysis, and transmission of data that are necessary to implement decision-making processes in a Health System[22,16]. Regarding the epidemiologic status of diarrhea, the monitoring activities and the data provided by these systems allow the understanding of the patterns of presentation of diarrhea and the hygienic and sanitary conditions of a given region. They also underlie proposals of preventative and control measures that aim to solve individual and collective problems related to these diseases[26,9].

The Health Information Systems used to analyze the epidemiologic status of diarrhea are the *Sistema de Informação Hospitalar* - Hospital Information System (SIH), used to identify the number of hospital admissions due to diarrhea; Brazil's *Sistema de Informação sobre Mortalidade* - Mortality Information System (SIM) and *Sistema de Informação sobre Nascidos Vivos* - Brazil's Live Births Information System (SINASC)[19]. Another information source is the *Monitoramento das Doenças Diarreicas Agudas* - Monitoring of Acute Diarrheal Diseases (MDDA) system, which is used to notify cases of diarrhea in several localities, to identify the most affected age group, and to detect and investigate outbreaks[23].

According to SIM data available from Datasus[18], Brazil has high rates of hospital admissions and deaths due to diarrhea in children under five years of age, with an annual average of 119,489.75 admissions and 378.25 deaths from 2000 to 2003. A progressive decrease in the number of records of deaths and hospital admissions due to diarrhea has been observed in recent years, especially among children under one year of age.

These changes, however, have not been uniform; they vary between Brazilian regions and state capitals[21]. Despite the need for regionalized studies, few published scientific articles can be found on infant mortality in Brazil up to 2006. The Southeast Region accounts for over 50% of the published studies, followed by the Northeast Region. No publication has been registered for the Northern Region[10].

Even when other types of publication such as theses, dissertations, and official reports are considered, there is still a lack of studies on the causes and factors that affect infant mortality in the Northern Region. In the city of Belem, a study by Oliveira[21] observed a decrease in infant mortality, in contrast with an increase in hospital admissions due to diarrhea, from 1995 to 2005. No other study was found to report the epidemiologic status of diarrhea in Pará State.

Given the lack of published data on this topic and considering the limitations of the available information systems, there is an evident need for an adequate service of epidemiological surveillance, management, monitoring, and analysis of data from local information systems in Pará State. Therefore, the goal of this study is to demonstrate the use of these information systems as tools for the epidemiological analysis of diarrhea in Pará State, describing the frequency and distribution of this disorder in the pediatric population as well as its impact in terms of hospital admissions and deaths in the State.

MATERIALS AND METHODS

The present work is a descriptive study developed in collaboration with the *Departamento de Epidemiologia do Estado do Pará* - Pará State Department of Epidemiology (DEPI). The data collection was performed through the Health Information Systems, comprising data from 2000 to 2004. Next, based on these data, health indicators such as morbidity and mortality rates and hospital admission rates were calculated. The Health Information Systems used in the present work were SIH, SIM, and SINASC[19].

Data on the number of cases of diarrhea were obtained from information contained in the MDDA program and made available by the DEPI. Cases were classified according to age group, gender, and month, depending on the availability of data in the program.

Data on hospital morbidity correspond to admissions associated with gastroenteritis or diarrhea (primary or secondary diagnosis). This information was obtained from the SIH, based on the number of hospital admissions claims (HAC) due to diarrhea, classified according to the 10th Revision of the International Classification of Diseases (ICD-10) of the World Health Organization (WHO) – Chapter I, codes A01 to A09.

The number of deaths associated with gastroenteritis was obtained from the SIM, based on the same international classification as that used for hospital information. The numbers of hospital admissions and deaths due to diarrhea were classified according to age group, gender, and month of occurrence.

Data on the number of live births were obtained from SINASC and classified according to gender and month of occurrence. A survey of the population residing in Pará State from 2000 to 2004, stratified by age group and gender, was obtained from the *Instituto Brasileiro de Geografia e Estatística* - Brazilian Institute of Geography and Statistics (IBGE).

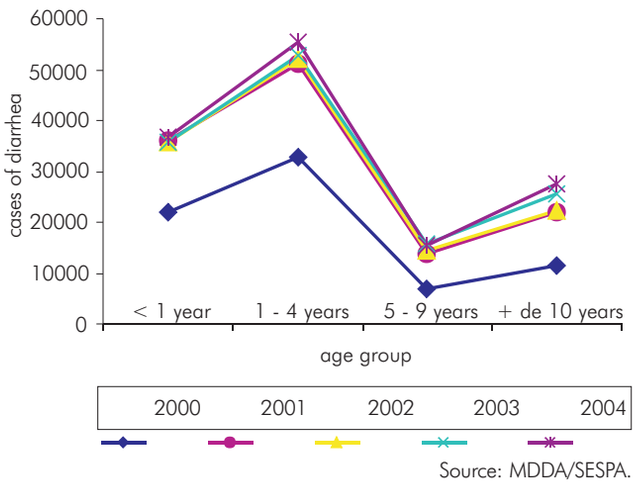
The following epidemiologic indicators were used in this study: morbidity rates; mortality rates (infants and others) due to specific causes (diarrhea); and hospital admission and mortality rates due to diarrhea. These rates were calculated for the following age groups: under one year old, from one to four years old, and under five years old[15].

RESULTS

From 2000 to 2004, 590,595 cases of diarrhea were notified in Pará State. In 2000, 73,727 cases were recorded. In the following years, there was a slight increase in these notifications, culminating with 136,287 cases in 2004.

The largest number of diarrhea cases was observed in the one-to-four-year-old group (an average of 48,887 cases notified annually from 2000 to 2004), followed by the under-one-year-old age group, which had an annual average of 33,151 cases of diarrhea in the same period (Figure 1). An increase in diarrhea cases

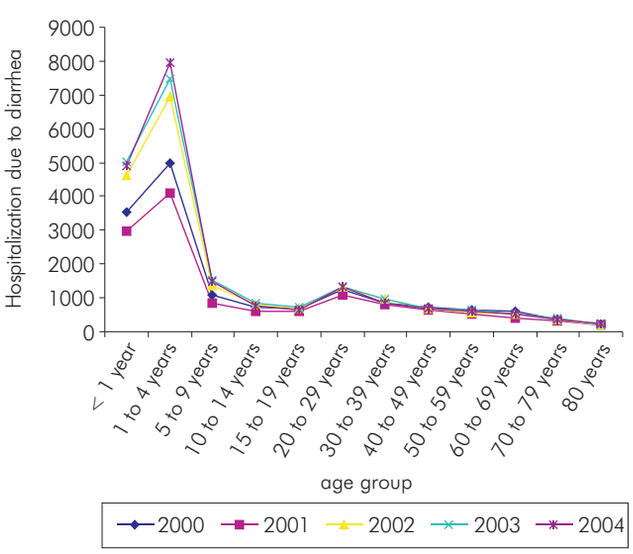
was observed from January to March, which corresponds with the rainy season in the Northern Region. The months with the fewest cases of diarrhea were June and December.



Source: MDDA/SESPA.

Figure 1 – Number of diarrhea cases by age group, Pará State, 2000 to 2004

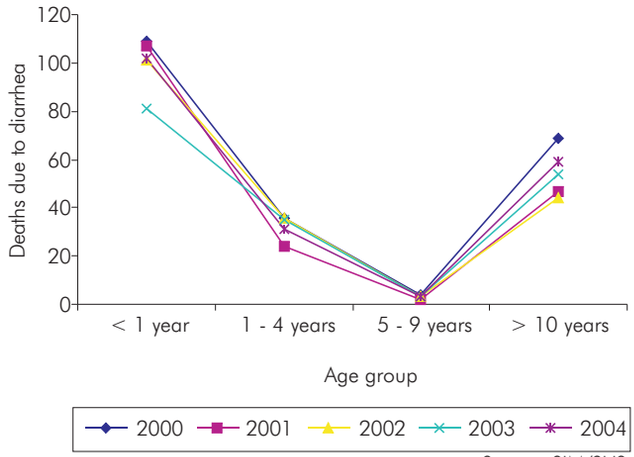
Between 2000 and 2004, the lowest numbers of hospital admissions due to diarrhea were recorded in 2000 (15,684) and 2001 (13,083); increases were observed in 2003 (20,376) and 2004 (20,311). The age groups with the greatest number of admissions were the under-one-year-old and the one-to-four-year-old groups (Figure 2).



source: SIH/SUS.

Figure 2 – Hospitalizations due to diarrhea by age group, Pará State, 2000 to 2004

The trends in the number of deaths due to diarrhea in Pará State indicate that its peak occurred in 2000 (218 deaths), decreasing in the following years, but increasing again in 2004 (195 deaths). The under-one-year-old age group had the largest number of deaths due to diarrhea (Figure 3), accounting for almost half of the total number of deaths. The Chi-square test did not show a statistically significant association between the absolute number of deaths due to diarrhea and gender ($p<0.05$).



Source: SIM/SUS.

Figure 3 – Distribution of deaths due to diarrhea by age group, Pará State, 2000 to 2004

The morbidity rates due to diarrhea in the general population (per 100 inhabitants) increased in 2001, as compared to 2000, in all age groups, and then remained relatively constant in the following years, with the highest morbidity rate in the under-one-year-old age group. In 2004, eight in every 100 children aged one to four years old and 22 of every 100 children under one year old had at least one diarrheal episode (Table 1).

Table 1 – Morbidity rates due to diarrhea according to age group, Pará State, 2000 to 2004

Year	Morbidity rate due to diarrhea (per 100 inhabitants)			
	General population	Under 1 year old	1 to 4 years old	Under 5 years old
2000	1,19	14,39	5,24	7,02
2001	1,95	23,12	7,96	10,92
2002	1,94	22,53	8,00	10,83
2003	2,00	22,14	7,96	10,72
2004	2,04	22,43	8,17	10,95

Source: Diarrhea cases - MDDA; Population - IBGE.

Hospital admission rates in children under one year old (per 1,000 live births) and in children one to four years old and under five years old (per 1,000 inhabitants) decreased in 2001 and increased in 2002. A neutral trend was observed in subsequent years. In 2000, for each group of 1,000 children under five years old, 11 hospital admissions due to diarrhea were recorded, increasing to 15 in 2004. The highest admission rates were observed in the under-one-year-old age group. In 2000, there were approximately 28 diarrhea admissions per 1,000 live births of children under one year old, increasing to 34 in 2004. In contrast, there was a smaller increase in the one-to-four-years-old age group, from eight admissions per 1,000 children in 2000 to 12 admissions per 1,000 children in 2004 (Table 2).

Table 2 – Hospital admissions rates due to diarrhea according to age group, Pará State, 2000 to 2004

Year	Hospital admission rates due to diarrhea		
	Under 1 year old (per 1,000 live births)	1 to 4 years old (per 1,000 inhab. aged 1 to 4)	Under 5 years old (per 1,000 inhab.<5)
2000	28,33	7,99	10,98
2001	22,47	6,41	8,91
2002	34,28	10,62	14,25
2003	35,01	11,21	15,09
2004	34,65	11,72	15,25

Source: Hospital admissions - HIS/SUS; Live births - SINASC/SUS; Population - IBGE

The hospital lethality rate due to diarrhea was inversely associated with the age of the admitted children, varying on average from 2.5% in the under-one-year-old age group to 0.5% in the one-to-four-year-old age group and 1.34% in the under-five-years-old age group (Table 3).

Table 3 – Hospital lethality rates according to age group: under 1 year old, 1 to 4 years old, and under 5 years old, Pará State, 2000 to 2004

Year	Hospital lethality index		
	Under 1 year old	1 to 4 years old	Under 5 years old
2000	3,08	0,72	1,70
2001	3,58	0,58	1,84
2002	2,19	0,52	1,19
2003	1,62	0,47	0,93
2004	2,08	0,39	1,04

Source: Hospital admission rates- SIH/SUS; Deaths - SIM/SUS.

The mortality rate due to diarrhea decreased by 17.2% in the period analyzed; this effect was more evident in the one-to-four-year-old group when compared to the under-one-year-old age group. The highest rates of infant mortality (0.9/1,000 live births) and mortality among children one to four years old (5.7/100,000) were recorded in 2000.

Table 4 – Mortality rates due to diarrhea according to age group: under 1 year old, 1 to 4 years old, and under 5 years old, Pará State, 2000 to 2004

Year	Mortality rates due to diarrhea		
	Child / 1,000 live births	1 to 4 years old / 100,000 inhab. 1 to 4 yrs old	Under 5 years old/100,000 inhab. < 5 years old
2000	0,87	5,75	18,64
2001	0,80	3,74	16,44
2002	0,75	5,51	16,89
2003	0,57	5,26	14,04
2004	0,72	4,57	15,80

Source: Deaths - SIM/SUS; Population - IBGE; Live births - SINASC.

DISCUSSION

In Pará State, the number of cases of diarrhea increased noticeably between 2000 and 2001, showing small variations in the subsequent years. The under-one-year-old age group was the most affected (average of 20 per 100 live births). In other words, in Pará State, the lower the age of children, the higher the impact of diarrhea. This pattern is similar to the one found in other regions and in Brazil in general[18,21,11].

The increased number of diarrhea cases recorded by MDDA may represent an actual increase in the number of cases and notifications by municipalities, or an expansion of notification units, since the State has had access to this system since 1996, when the state-based program was implemented. To ensure that this information accurately reflects reality, new studies should be proposed to evaluate the quality of MDDA records in the State. In this program, the difficulties in monitoring diarrheal diseases are due to its high incidence, the failure to comply with mandatory notification of outbreaks, and the acceptance by both the lay population and the majority of health professionals of diarrhea as a common event in our environment [23].

According to the SIH, admissions due to diarrhea in Pará increased from 2002 to 2004, and the greatest number of admissions occurred in the one-to-four-year-old group, followed by the under-one-year-old age group. However, the admission rates reveal that the under-one-year-old group had the highest frequency of admissions due to diarrhea. The admission and morbidity rates demonstrate that both cases of and admissions due to diarrhea increased between the first and the last years of the study (2000 and 2004) (Tables 1 and 2).

Similarly to the situation in other Brazilian cities, such as Rio de Janeiro[4] and Sao Luis[24], where an increased incidence of diarrhea hospital admissions has been observed, hospital admissions are still increasing in Pará, leading to a high demand for hospital services and higher health care expenditures. A decrease in hospital admissions would be ideal to demonstrate that the provision of health care and the resolution of diarrhea cases are happening at the primary health care level.

Despite the increased number of diarrhea cases and admissions from 2000 to 2001, there was a stabilization trend from 2001 to 2004. However, the mortality rate in the under-five-years-old age group, as well as the infant mortality rate, decreased (Table 4), following the decreasing trend of these rates in other Brazilian regions and states[27,17,26,9,23,18,10,15,24,5].

The infant mortality rate due to diarrhea in Brazil has declined in the last decades, mirroring the global trends of developed countries and some developing countries,. In 1997, Brazil registered 31.9 deaths among children under one year old per 1,000 live births. In 2000, this rate decreased to 27.4 deaths and, in 2006, to 20.7. Pará State recorded 32.7 deaths per 1,000 live births in 1997, decreasing to 23.7 in 2006. Despite this

continuous decline from 2000 to 2004, diarrhea was the fourth most important cause of infant death in Brazil, excluding perinatal causes[23]. This indicates that diarrhea is an important cause of late infant mortality in Brazil, as is the case in other developing countries. It is estimated that diarrhea causes as many as 1.5 million deaths per year worldwide among children under five years old[6].

According to Costa et al.[9], the mortality rates in 1999 due to diarrheal diseases in children under five years old in the States of Paraná and Rio Grande do Sul were 0.5 and 0.08 deaths per 1,000 live births, respectively. The mortality rate was 1.7 deaths per 1,000 live births in the State of Bahia and 4.7 in the State of Pernambuco. In this study, the infant mortality rate decreased from 0.9 in 2000 to 0.7 in 2004 (Table 4).

Diarrheal diseases play an important role in health disorders among children under one year of age. The hospital lethality rate in this group was high, which demonstrated that admitted children have a more severe clinical status. Although it decreased by 32.4% during the study period, the hospital lethality rate in children under one year old remained high, with 2.1 deaths per 100 admissions; it was also higher than the rate found in children between one and four years old (Table 3). The predominance of children under one year old among diarrhea-related hospital admissions that resulted in death reveals that this age group has a greater predisposition to water and electrolyte imbalance and a more severe clinical course due to immunological immaturity and a predisposition to secondary infections[22,2].

According to Andrade et al.[2], in order for a drastic reduction in diarrhea mortality to occur, current knowledge of hydro-electrolyte physiology will have to be supplemented by new advances in our understanding of the epidemiology and interactions between enteropathogenic agents and the host. The overall goal interventions to reduce diarrheal diseases is to improve the quality of life of the population through sanitary infrastructure, ensuring the quality of supply and provision of treated water, adequate nutrition, and improved pediatric health care[12,27,3].

Regarding the seasonal pattern in the number of cases and deaths due to diarrhea, the highest rates were observed during the rainy season (January to May). Similar results were reported by the *Núcleo de Epidemiologia do estado do Ceará* - Center of Epidemiology of the State of Ceará, using MDDA, for the period of 1999 to 2003; the highest rates were recorded in the first trimester for each of the four years in the report, which corresponds to the rainy season in Ceara State[23]. Kale et al[14] also described a seasonal pattern in Rio de Janeiro from 1995 to 1998, with a higher incidence of deaths in winter. Hospital admissions occurred more frequently from March to May, a period that starts in the month of highest incidence of diarrhea cases and extends to the month with the highest death rate.

The increase in the number of cases of diarrhea shortly after peak rainfall may be associated with the ingestion of water from different sources than usual, contamination of the water table by septic tanks, or the circulation of other etiological agents. The increased rate of bacteriological contamination of water wells in the shallow water table is associated with rain. This worsening of the water quality would be associated with the drainage of rainwater carrying human and animal waste. The use of this untreated water would increase the frequency of diarrhea in the rainy period[9], especially in localities without a clean water supply and with a low-income population.

The results indicate that children under one year old constitute the group most affected by diarrhea. The reduction of infant vulnerability to diarrhea must include a concentrated effort in the development of integrated care, with a special focus on basic care measures in health care units of the Family Health Program; the promotion of higher quality care in clinical practice, focused on the maintenance of the balance between preventative and curative measures; and better sanitary conditions as provided by a clean water supply and a sewage system. The evaluation of sanitary-epidemiological data obtained through a set of well-structured information systems is essential to guide the process of implementation, consolidation, and reformulation of health care measures.

Unlike death (SIM) and hospital admission (SIH) records, which are compulsory but still under-recorded, the notification of diarrhea cases through MDDA is not mandatory and is implemented only in public primary care services[9], with the exception of medical visits to emergency departments, probably leading to a higher number of cases. Therefore, although they are official, diarrhea records available for epidemiologic studies are incomplete and reflect only a subset of the population. Even with these limitations, these systems are used to monitor trends in the occurrence of diarrhea throughout Brazil. Nevertheless, in order to more consistently analyze the epidemiological status of diarrhea in the country, it is necessary to continuously follow the notification registries, evaluate any inconsistencies, and ensure the implementation of notification in more health care units.

Since this is a study that uses secondary data, it is necessary to consider the limitations due to the quality of the information. It is worth noting, for example, that the increase in the number of diarrhea cases may have been due to the implementation and/or expansion of the MDDA system to other health care units or increased awareness among health care professionals regarding the notification of cases. In addition, the increase in hospital admissions may have also occurred due to a higher supply of hospital beds.

CONCLUSION

The analysis of morbidity, hospital admissions, mortality, and lethality rates during the study period demonstrated that children under one year old were the ones who most frequently became ill and were hospitalized and, consequently, the ones who had the highest mortality rate in Pará State.

The results reinforce the importance of the implementation of evaluation and control measures that may contribute to reducing the risk of death due to diarrhea. To achieve this goal, it is necessary to effectively

strengthen the monitoring of health information systems, which provide the basis for planning health care measures and elaborating new public policies.

This study highlights the need for a continuous analysis of these indicators and the monitoring activities of acute diarrheal diseases in order to enable effective integration between epidemiologic surveillance and other areas of health care, such as child health care, basic care, sanitary surveillance, environmental surveillance, and health education. This, in turn, will promote immediate and long-term results in the implementation of more efficient measures for the prevention and control of diarrhea in Pará State.

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Morbimortalidade por gastroenterites no Estado do Pará, Brasil

RESUMO

No Brasil, as gastroenterites acometem principalmente as crianças menores de 5 anos de idade e são consideradas um importante problema de saúde pública. O declínio da morbimortalidade por enteroinfecções resulta na queda da mortalidade infantil e da mortalidade por doenças infecciosas nos países em desenvolvimento. O presente trabalho é um estudo descritivo, realizado em colaboração com o Departamento de Epidemiologia do Estado do Pará, desenvolvido com intuito de conhecer a importância das gastroenterites como causa de internações e óbitos no Estado do Pará. Realizou-se: o levantamento de dados sobre mortalidade e internação por meio dos Sistemas de Informação em Saúde e do Monitoramento das Doenças Diarreicas Agudas durante o período de 2000 a 2004; além dos cálculos dos indicadores de saúde. No cômputo geral, foram notificados 590.595 casos de diarreia. Foi observado um aumento no número de casos de diarreia notificados no Monitoramento das Doenças Diarreicas Agudas durante este período, sendo as maiores frequências encontradas na faixa etária de 1 a 4 anos de idade (média de 48.887 casos), seguido de 33.151 casos em menores de 1 ano de idade. A taxa de internação por diarreia em menores de 1 ano de idade foi de 35 por mil nascidos vivos em 2004. No período estudado, o coeficiente de mortalidade diminuiu, atingindo em 2004 o valor de 2,91 para cada 100 mil habitantes, seguindo a tendência de diminuição das taxas de mortalidade por diarreia no Brasil. Mesmo com este declínio, a diarreia ainda se apresenta como uma das principais causas de morbimortalidade no Estado do Pará, acometendo especialmente crianças menores de 1 ano de idade.

Palavras-chave: Gastroenterite; Diarreia; Indicadores de Morbi-Mortalidade; Sistemas de Informação; Mortalidade Infantil.

Morbimortalidad por gastroenteritis en el Estado de Pará, Brasil

RESUMEN

En Brasil, la gastroenteritis afecta principalmente a niños menores de 5 años de edad, y se considera un importante problema de salud pública. La disminución de la morbimortalidad por enteroinfecciones se debe a la reducción de la mortalidad infantil y de la mortalidad por enfermedades infecciosas en los países en desarrollo. Este trabajo es un estudio descriptivo, realizado en colaboración con el Departamento de Epidemiología del Estado de Pará, desarrollado con el objetivo de conocer la importancia de la gastroenteritis como causa de ingresos hospitalarios y muertes en el Estado de Pará. Se recopilaron datos mediante sistemas de información en salud en torno a mortalidad, hospitalización y mediante el monitoreo de enfermedades diarreicas agudas entre 2000 y 2004, y también mediante el cálculo de los indicadores de salud. Se contabilizaron un total de 590.595 casos de diarrea. Se observó un mayor número de casos de diarrea notificados en el monitoreo de las enfermedades diarreicas agudas durante ese período. Las tasas más altas se dieron entre los niños de 1 a 4 años de edad (un promedio de 48.887 casos), seguidos por 33.151 casos en niños menores de 1 año de edad. La tasa de hospitalización por diarrea en niños menores de un año fue de 35 por mil nacidos vivos en 2004. Durante el período estudiado, la tasa de mortalidad disminuyó, alcanzando en 2004 la cifra de 2,91 por cada 100 mil habitantes, siguiendo la tendencia de las tasas de disminución de la mortalidad por diarrea en Brasil. A pesar de ese descenso, la diarrea sigue siendo una de las principales causas de morbimortalidad en el Estado de Pará, afectando principalmente a niños menores de 1 año de edad.

Palabras claves: Gastroenteritis; Diarrea; Indicadores de Morbimortalidad; Sistemas de Información; Mortalidad Infantil.

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