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Risk factors for hospitalization and death from diarrhea in a public pediatric hospital in Rio de Janeiro, Brazil
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RISK FACTORS FOR HOSPITALIZATION AND DEATH FROM DIARRHEA IN A PUBLIC PEDIATRIC HOSPITAL IN RIO DE JANEIRO, BRAZIL


ABSTRACT

Objective. This study was carried out in a public pediatric hospital located in the city of Rio de Janeiro, Brazil, with the aim of identifying risk factors for hospitalization and/or death due to diarrhea in children.

Material and methods. The study included 406 children under three years of age who were seen or admitted for diarrhea from January 1987 to February 1988. The main variable of interest was the outcome of clinical evaluation and subsequent hospitalization, which was classified as follows: 1) outpatient treatment; 2) hospitalization and survival; and 3) death during hospitalization. The chi-square test was used to identify variables (p<0.05) that were significantly related to the treatment outcome. The logistic regression analysis was used to establish the most significant associations with the risk of hospitalization and death from diarrhea.

Results. The group was composed by 60.6% males and 39.4% females. A proportion of 26.8% of children was under two months of age, 24.9% was 3-5 months old, 25.9% was 6-11 months old, and 22.4% was 12 months or older. The variables most significantly related to the risk of hospitalization and death from diarrhea were age, current nutritional status (weight-for-age percentile), and concomitant illness. Variables most significantly associated with risk

RESUMEN

Objetivo. En un hospital pediátrico de la ciudad de Río de Janeiro, Brasil, se llevó a cabo un estudio para identificar factores de riesgo para hospitalización y/o muerte por diarrea en niños. Material y métodos. El estudio incluyó a 406 niños menores de tres años, que recibieron consulta o fueron hospitalizados por diarrea. La principal variable de interés fue el resultado de la evaluación clínica y subsecuente hospitalización, clasificado en tres categorías: a) tratamiento ambulatorio; b) hospitalización y sobrevivencia; y c) muerte durante la hospitalización. Se empleó la prueba de chi-cuadrada para identificar variables significativamente relacionadas con el resultado del tratamiento (p<0.05). Las variables se sometieron a un análisis de regresión logística múltiple, para establecer las asociaciones más significativas con el riesgo de hospitalización y muerte por diarrea. Resultados. El 60.6% de los niños estudiados eran del sexo masculino y 39.4% del femenino. El 26.8% eran menores de dos meses de edad, 24.9% tenían entre tres y cinco meses, 25.9% entre seis y once meses, y 22.4% tuvieron doce meses o más. Las variables más significativamente re-
HE UTILIZATION OF epidemiology in the systematic study of characteristics of health care users can lead to a precise definition of risk attributes and increase the efficacy and effectiveness of health interventions. Techniques for detecting risk groups are available and accessible to health professionals, but these tools have not been used in the Brazilian context. Patients are thus still seen on a case by case basis, within the specific context of the patient-physician relationship, without global parameters to characterize those at higher risk of complications and death.

Diarrhea has decreased proportionally as a cause of infant mortality in Rio de Janeiro, from 20% of all deaths in children under one year of age in 1979 to 4.52% in 1993. Even so, mortality coefficients from diarrhea are still quite high: 23.9 per 10,000 live births per year.

Data from the previous medical and life history of these children can greatly contribute to the prevention of such deaths. In this article we present a profile of children hospitalized for diarrhea in a public hospital in Rio de Janeiro, Brazil.

METHODS

This study included 406 children under three years of age, who were diagnosed with diarrhea from February 1987 to February 1988 in the Hospital Municipal Salles Neto (HMSN), located in Rio Comprido, a central neighborhood easily accessible in the city of Rio de Janeiro.

The HMSN is a small pediatric hospital. It is heavily used by children with diarrhea since it has been a reference center for this disease for many years.

Data were collected three times a week, on Mondays, Tuesdays, and Wednesdays, for 13 months. These three days of the week were chosen because of the routine for processing fecal samples collected for investigating the etiology of diarrhea. All children seen for diarrhea in the emergency ward of the HMSN on these three days were investigated. Since the mean hospital stay was long (five days), it was possible to investigate all of the children who were hospitalized for diarrhea during the study period. The study thus covered all such hospitalizations at the HMSN and a sample of children drawn from the outpatient visits.

Since we had data on all of the hospital admissions for diarrhea, we had the opportunity to check whether the hospitalizations occurring on the days we stayed at the hospital were different from those on any other days of the week in terms of severity, age, and origin of the children. By analogy, we presume that there were probably no such differences in terms of day of the week for the children seen in the outpatient unit.

Data were collected by two researchers (a nurse and a biologist) who had been duly trained in this procedure. Data came from two sources: those referring to medical/hospital care were taken directly from the patient’s medical record; social data and medical history were obtained directly from the child’s mother at the time of the hospital visit. In addition, the child’s weight and height were measured and compared with the standards from the U.S. National Center for Health Statistics (NCHS).1

The children were weighed unclothed, using a Filizola brand pediatric scale with ten-gram precision, and their height was measured using a wooden ruler with 0.5 cm intervals.

Key words: diarrhea, infantile; risk factors; hospitalization; Brazil
Current nutritional status was defined by the percentile corresponding to the weight on the NCHS reference curve, according to the child’s age.

Low birth weight was defined as weight under 2,500 g at the moment of birth.

We should point out that 12.8% of the mothers was not contacted, and the respective questionnaires were left incomplete.

The study’s dependent variable was treatment outcome, which we classified as follows: non-hospitalized, hospitalized, and death. Independent variables used in the study were the following: birth weight, current nutritional status, age, duration of exclusive breast-feeding, clinical diagnosis, history of hospitalization, number of mother’s prenatal visits, mother’s level of schooling, and in-door running water.

For purposes of statistical analysis, we initially used the chi-square independence test to identify variables associated with treatment outcome (p<0.05). We later performed a multiple logistic regression to select factors most closely associated with risk of hospitalization or death from diarrhea.

We analyzed the results of two regressions: the first compared non-hospitalized and hospitalized children (including deaths in the latter), and the second compared children who were hospitalized and survived with those who died.

### RESULTS

The majority (84%) of the children in this study lived in the municipality of Rio de Janeiro, while the rest (16%) lived in the other municipalities within the Greater Rio de Janeiro Metropolitan Area.

Location of households is a good factor for characterizing this population as low-income, since 64% of the families lived in favelas (slums). The mothers in general had very little schooling: 80% of them had completed first-grade of elementary school or less. Few mothers (32.4%) had a remunerated job outside the home.

Regarding sanitation, 85% of the households had running water, 70% were connected to the sewage system, and 46% had garbage collected by the city waste removal system.

Of the 406 children in the study, 60.6% was male and 39.4% female. Of the total, 72.4% was hospitalized and 27.6% was seen in the emergency ward and discharged. Those hospitalized stayed for five days on average. Based on medical diagnosis, 70% of the children was dehydrated at the time of examination.

Table I shows that 11.6% of the non-hospitalized children was born with low weight, while for those who died this figure was three times higher (37.5%).

Of the hospitalized children who were born weighing 2,500 grams or more, 5.1% died, while for those with low birth weight this figure was 10.5%.

### TABLE I

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Birth weight *</th>
<th>Weight / age **</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 2500 g</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Non-hospitalized</td>
<td>12</td>
<td>11.6</td>
</tr>
<tr>
<td>Hospitalized</td>
<td>51</td>
<td>21.4</td>
</tr>
<tr>
<td>Died</td>
<td>66</td>
<td>37.5</td>
</tr>
<tr>
<td>Total</td>
<td>69</td>
<td>19.3</td>
</tr>
</tbody>
</table>

* $\chi^2 = 7.956$ (p < 0.005)

** $\chi^2 = 39.031$ (p < 0.001)
Regarding nutritional status at the time of examination, the children were split into two groups: those below the third percentile and those above or equal to the third percentile. Note that the group of children below the third percentile increases considerably from the non-hospitalized to the hospitalized group and to those who died; from 15.1% in the former up to 72.2% in the latter.

In Table II, it is noteworthy the fact that 77.8% of the children who died from diarrhea were three months of age or younger, while 73.2% of the entire sample were older than three months.

In general, weaning occurred very early in these children; 58.6% of them were already on some other type of food before reaching one month of age, which shows that breast-feeding has been insufficient in this group as a whole.

Moreover, the variation of supplementary feeding in the first month was as follows: 50.5% for non-hospitalized infants, 61.0% for hospitalized ones, and 83.3% in those who died. This suggests that a short period of breast-feeding is associated with a higher risk of hospitalization and/or death from diarrhea in the early months of life.

An analysis of Table III shows that hospitalization and death from diarrhea were associated with concomitant disease, mainly acute respiratory infections and malnutrition. Of the children who were hospitalized and/or died, 50.0% had associated diseases, while this figure was only 17.0% for non-hospitalized children. History of hospitalization was also a factor associated with increased severity of diarrheal disease. There was a gradual increase in the percentage of children, from the non-hospitalized group (24.1%) to the group of those who died (60.0%).

According to Table IV, prenatal care was a good indicator for defining the risk of being hospitalized and/or dying from diarrhea. Of the children who were not admitted to the hospital, 83.8% had mothers who had made four or more prenatal visits, as compared to 62.7% of those who were hospitalized and only 50% of those who died.

Table V shows the results of the multiple logistic regression analysis when comparing the non-hospitalized and hospitalized groups (including deaths in the latter). All of the variables described in the previous tables were analyzed, including in the model the child’s age, current nutritional status, concomitant diseases, and number of prenatal visits.

Risk of hospitalization due to diarrhea for children under three months of age in the hospital we studied was 3.2 times greater than for those aged three months and older. In relation to weight-for-age, we observed a risk 3.8 times greater for children under the third percentile.

### TABLE II

<table>
<thead>
<tr>
<th>Outcome</th>
<th>&lt;3 months</th>
<th>≥3 months</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Non-hospitalized</td>
<td>14</td>
<td>12.5</td>
<td>98</td>
</tr>
<tr>
<td>Hospitalized</td>
<td>81</td>
<td>29.3</td>
<td>195</td>
</tr>
<tr>
<td>Died</td>
<td>14</td>
<td>77.8</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>26.8</td>
<td>297</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exclusively breast-fed</th>
<th>&lt;30 days</th>
<th>≥30 days</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Non-hospitalized</td>
<td>55</td>
<td>50.5</td>
<td>54</td>
</tr>
<tr>
<td>Hospitalized</td>
<td>150</td>
<td>61.0</td>
<td>96</td>
</tr>
<tr>
<td>Died</td>
<td>10</td>
<td>83.3</td>
<td>02</td>
</tr>
<tr>
<td>Total</td>
<td>215</td>
<td>58.6</td>
<td>152</td>
</tr>
</tbody>
</table>

* χ² = 36.391 (p < 0.001)
** χ² = 6.575 (p < 0.05)
Presence of associated diseases increased this risk by 2.8 times and insufficient number of prenatal visits by 2.6 times.

Only two of the seven variables introduced into the model were chosen for comparing the group of hospitalized children with the group of those who died: child’s age and previous hospitalization.

Risk of death was 19.4 times greater in children under three months of age. This result should be viewed with caution, since the confidence interval was broad, although the lower limit (4.17) indicated a risk of death at least four times greater for the under-three-month group, which in itself is quite significant. Risk of death increased 3.7 times for children with previous hospitalization.

### DISCUSSION

Studies carried out in Latin America estimate that the prevalence of low birth weight (<2500 g) is about 11%. Our research showed similar data for non-hospitalized children, but one should take into consideration the fact that we were dealing with ill children. Prevalence in the overall infant population in Rio de Janeiro is probably lower than that reported in this study. In Pelotas, in the State of Rio Grande do Sul, Brazil, prevalence of low birth weight was 8.8% in 1982.5

Low birth weight is the most important factor associated with risk of death in the first year of life.6,7 although the effect on mortality differs depending on whether the low birth weight is due to prematurity or to delayed fetal growth.5 In our study, low birth weight also appears as an important predictor of infant death risk.

There is a controversy concerning the relationship between incidence of diarrhea and the child’s nutritional status.8,9,10 It is not known for sure whether diarrhea
produces malnutrition or malnutrition facilitates diarrhea.\textsuperscript{11} There is no doubt whatsoever that diarrhea aggravates malnutrition and that a malnourished child is prone to suffer complicated, serious, and sometimes fatal diarrhea.\textsuperscript{12,13} The impact of diarrhea on child growth was shown by Bittencourt \textit{et al.}, in a longitudinal study in a poor area of the city of Rio de Janeiro.\textsuperscript{14}

In our study, 72.2\% of the children who died were malnourished and 77.8\% were under three months of age, suggesting a synergism between these two factors in the occurrence of infant death. In a study on children in São Paulo, Brazil, Benício \textit{et al.}, found that the incidence of hospitalization due to diarrhea in the under-six-month group was 4.4 times greater than in the 6-11-month group and almost 40 times greater than in children over two years of age.\textsuperscript{15}

Numerous studies have shown the protective effect of mother’s breast milk against diarrhea.\textsuperscript{16,17,18} In Pelotas, Rio Grande do Sul, Brazil, Victora found that children receiving mixed diets had a risk of dying 4.2 times greater than those receiving only breast milk.\textsuperscript{19}

In our study, only 41.4\% of the children were exclusively breastfed after the first month of life. One must consider that in our study the hospitalized children were not accompanied by their mothers, meaning that breast-feeding was interrupted. In addition, some of these children had a history of hospitalization, suggesting that the first hospital admission occurred very early in life.

Therefore, the association between interruption of breast-feeding and risk of death from diarrhea is real, but not necessarily causal.

Several studies have discussed methodological issues involved in studying the association between breast-feeding and infection and death from diarrhea.\textsuperscript{20}

The association of diseases found in our study is an indicator of the severity of disease at the time of the child’s hospital admission. Children who die from diarrhea, who are mostly newborn, malnourished, and with immature immune systems, are particularly prone to systemic infections, and it is common to find concurrent pneumonia, septicemia, and other infections.

This broad picture of infections affecting newborns with serious diarrhea leads to difficulties in defining both the primary cause of death and consequently the infant mortality statistics. A study by the Infant Mortality Surveillance System in the Greater Rio de Janeiro Metropolitan Area in 1986-1987, showed that when the primary cause of death was corrected by checking medical histories, 45\% of deaths previously attributed to diarrhea were reclassified under pneumonia and 36\% under malnutrition, while 11.5\% of the deaths previously attributed to the latter two causes were reclassified as diarrhea.\textsuperscript{21}

In a case-control study on infant mortality in Rio Grande do Sul, Nobre \textit{et al.}\textsuperscript{22} also reported substantial changes in the definition of the primary cause of death.

### Table V

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>p-value</th>
<th>Risk (Odds ratio)</th>
<th>Confidence interval (95 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitalized x non-hospitalized</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>1.1597</td>
<td>0.0013</td>
<td>3.187</td>
<td>1.57-6.47</td>
</tr>
<tr>
<td>Weight / age</td>
<td>1.3312</td>
<td>0.0001</td>
<td>3.785</td>
<td>1.92-7.45</td>
</tr>
<tr>
<td>Concomitant disease</td>
<td>1.0193</td>
<td>0.0015</td>
<td>2.771</td>
<td>1.48-5.10</td>
</tr>
<tr>
<td>Prenatal care</td>
<td>0.9389</td>
<td>0.0090</td>
<td>2.557</td>
<td>1.26-5.17</td>
</tr>
<tr>
<td>Hospitalized x died</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>2.9634</td>
<td>0.0002</td>
<td>19.363</td>
<td>4.17-89.97</td>
</tr>
<tr>
<td>Prior hospitalization</td>
<td>1.3156</td>
<td>0.0224</td>
<td>3.727</td>
<td>1.20-11.53</td>
</tr>
</tbody>
</table>
from diarrhea, with an agreement with official statistics of only 59%.

The history of hospitalization found in 60% of the children who died leads us to reflect on the opportunity that health services have lost for teaching these mothers (during the child’s first hospitalization) the signs and symptoms of dehydration and how to treat them early. We had the opportunity to discuss this with mothers and observed that no knowledge about the disease had been transmitted to them. Considering that in the specific case of diarrhea/dehydration the interventions for survival of children depend on the mother’s perception, it is unfortunate to observe the lack of sensitivity and responsibility with which health professionals have treated this issue.

Use of prenatal care was a protective factor against death from diarrhea in this study. This is due to the fact that prenatal care is an indirect indicator of the mother’s care for her own health and (by extension) that of her family. Mothers who undergo proper prenatal care also have an earlier perception of diarrhea, leading them to seek immediate care for their children when needed.

In a study on a cohort of births in São Paulo, Benício et al. observed that mothers who did not go to prenatal examinations had a five-fold greater risk of giving birth to low-weight babies than those who did receive such care.

As expected, other factors like the mother’s level of schooling and in-door running water did not present statistically significant differences. We believe this is due to our having studied the demand in a public hospital, which in our country provides services to a very socially homogeneous group. As we noted above, the mothers’ level of schooling is very low and coverage of running water by the public utilities company is quite extensive, so that this study population was quite homogeneous in terms of these two indicators.

Nevertheless, one should consider that complex relations between hygienic habits and health cannot always be captured when focused on as superficially as in this study, where they were not the main objective. Kolsky has approached this issue quite appropriately, reflecting on the need for a more global understanding of such interactions.

Note that the logistic regression in the final analysis excluded low birth weight and early weaning. Low birth weight appeared as an associated variable in the univariate analysis, but it lost its significance when current nutritional status was introduced as a variable in the model. There is a major association between these two variables, so that one can even state that current weight-for-age is updated information on birth weight.

Regarding early weaning, the fact that it was not included as an explanatory variable in the regression is conditioned on the inclusion of child’s age as a variable in the model. A child at risk of being hospitalized or dying from diarrhea is very young, and interruption of breast-feeding often occurs because of hospitalization itself, as we commented earlier. Since breast-feeding is closely associated with the child’s age, the latter variable was chosen because it has greater explanatory power.

Finally, risk factors for hospitalization from diarrhea at the Hospital Municipal Salles Neto are probably applicable to the city of Rio de Janeiro as a whole, since it is a reference hospital, and include child malnutrition, child’s age, synergism with other infections, and mother’s lack of prenatal care. As for risk of dying, early age contributes increasingly as a factor heavily associated with prior hospitalization, defining the profile of hospitalized children who progress to death.

ACKNOWLEDGMENTS

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