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Effects of Socioeconomic Status on Presentation With Acute Lower Respiratory Tract Disease in Children in Salvador, Northeast Brazil

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Summary. Two different socioeconomic groups of children with pneumonia were studied, and their clinical and demographic aspects were evaluated. The diagnosis of pneumonia was based on findings of cough and tachypnea, or on crackles on auscultation or on radiologically confirmed infiltrate. This was a prospective cross-sectional study conducted at the Professor Hosannah de Oliveira Pediatric Center, which cares for children of lower socioeconomic status (PHOPC), and at one private hospital which cares for children from middle to high socioeconomic status (Aliança Hospital, AH). Demographics and clinical differences were assessed by the Pearson chi-square test or Fisher's exact test as appropriate; means of continuous variables were compared by Mann-Whitney U-test.

In a 26-month period, 3,431 cases were recruited. The 2,476 cases identified at the PHOPC were younger than the 955 identified at AH (2.2 ± 2.3 vs. 4.5 ± 3.1 years, $P < 0.0001$) and had higher scores for severity (3.5 ± 1.5 vs. 2.7 ± 1.7, $P < 0.0001$), duration of hospitalization (days) (10.9 ± 12.1 vs. 6.2 ± 7, $P < 0.0001$), frequency of tobacco smoker in the household (48% vs. 31%, $P < 0.0001$), cardiopathy (15.3% vs. 5.9%, $P = 0.003$), fever (44.4% vs. 36.3%, $P = 0.0001$), tachypnea (67.6% vs. 32.3%, $P < 0.0001$), crackles (69.5% vs. 64.9%, $P = 0.02$), somnolence (19.9% vs. 10.4%, $P < 0.0001$), malnutrition (13.7% vs. 5%, $P < 0.0001$), hospitalization rate (27.4% vs. 22.5%, $P = 0.003$), and death (0.9% vs. 0.1%, $P = 0.009$). However, other features were more frequent among AH cases: parent's university level of education (38.2% vs. 1.0%, $P < 0.0001$), underlying chronic illness (40.6% vs. 28.5%, $P < 0.0001$), asthma (62.7% vs. 50.8%, $P = 0.01$), rhinitis (9.2% vs. 0.4%, $P < 0.0001$), previous use of antibiotics (34.3% vs. 27.1%, $P = 0.001$), and wheezing (53.1% vs. 42.2%, $P < 0.0001$).

Children of lower socioeconomic status have more serious lower respiratory tract disease, whereas children with pneumonia of middle to high socioeconomic status have more allergic diseases (rhinitis, asthma) and wheezing. **Pediatr Pulmonol. 2002; 33:244–248.**

Key words: pneumonia; asthma; children; hospitalization; mortality; outpatients; rhinitis; socioeconomic status; lower respiratory tract disease; second-hand smoke; epidemiology.

INTRODUCTION

Pneumonia has been a frequent and serious human illness throughout recorded history.[1] It remains one of the leading causes of hospitalization and death during childhood in most developing countries.[2,3] Several differences can be observed between children with pneumonia in developing countries compared with patients in the developed world, such as incidence[4–6] and prevalence of various etiologic agents.[7–10] The incidence of childhood pneumonia is up to 10 times higher in poor areas of the world in comparison with developed and richer parts.[6] Evidence indicates that two-thirds of the children who die from pneumonia in developing countries have bacterial pyogenic infection, whereas viral infection could be found in only 23% of those patients.[7] On the contrary, in hospitalized Finnish children with pneumonia, evidence of bacterial purulent infection was found in 50% and of

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viral infection in 62%.[10] In American and Finnish outpatient studies of children, pneumonia was attributed to bacterial purulent infection in 27–37% and to viral infection in 20–25%.[8,9] Such a discrepancy may be partly attributable to differences in parents' socioeconomic and educational background, which may influence the time when parents seek medical assistance for their ill children. Several authors have demonstrated that such factors have an effect on child health.[11–13]

In Salvador, Northeast Brazil, there are very different living conditions based on socioeconomic status. The kind of access to health assistance, i.e., public or private, and the utilization of such services, reflect reliably a family's socioeconomic status. People who look for public healthcare are poor, and people who look for private medical assistance usually have private health insurance and are of middle to high socioeconomic status.

In Brazil, there is no previous report of the demographic and clinical characteristics of children with pneumonia coming from families of different socioeconomic backgrounds. The aims of this investigation are to provide such information and to assess the variables associated with the differences.

METHODS

Study Design and Population

We enrolled prospectively every child diagnosed with pneumonia from September 1997 to October 1999 at the Emergency Room (ER) of the Professor Hosannah de Oliveira Pediatric Center (PHOPC) and at the Pediatric ER of the Aliança Hospital (AH) in Salvador, Northeast Brazil. Demographic, social, and clinical data were collected on a standardized data entry form by the on-duty pediatrician. The diagnosis of pneumonia was based on findings of cough and tachypnea (WHO case definition criteria),[14] on crackles on auscultation, or on radiologically confirmed infiltrate. Chest X-ray was performed in the majority of the cases (93.2%), and it was read by the duty pediatrician during the ER visit. All patients were treated with antibiotics. All ER records were reviewed weekly, beginning in March 1998 at the PHOPC and in May 1998 at the AH. The data entry forms of those patients characterized as having pneumonia whose forms were not filled out by the ER physician at time of presentation were filled out retrospectively by three other pediatricians (32.2% [798/2,476] at the PHOPC and 44.8% [428/955] at the AH; overall, 35.7%; $P < 0.0001$). Both the primary physicians and the reviewers were trained in filling out the research form, and were blinded to the purposes of the study. Admission to hospital or death were registered after cross-reference with the computer file of the respective hospital.

ABBREVIATIONS

AH	Aliança Hospital
ER	Emergency room
NCHS	National Center for Health Statistics
PAHO	Pan American Health Organization
PHOPC	Professor Hosannah de Oliveira Pediatric Center
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization

Study Setting

The PHOPC is a public university hospital, located in a central area of Salvador, the capital of Bahia, Northeast Brazil, which has an estimated population of 2,800,000. The PHOPC serves children predominantly of lower socioeconomic status, living in Salvador and adjacent cities, who have public insurance. The AH is a general private hospital, located in a middle-class area of Salvador. Its Pediatric ER attends children from middle to middle-upper and high socioeconomic status, who usually have private insurance.

Data Analysis

Statistical analyses were performed by using SPSS 9.0. Malnutrition was defined as weight for age under -2 standard deviations (SD) by using NCHS-USA data.[15] Fever was defined as axillary temperature $> 37.5^{\circ}$C on arrival at the ER. A clinical score was created to assess for disease severity by summing the scores for the presence of each clinical variable studied (cough, ability to drink, fever, tachypnea, chest retraction, crackles, wheezing, and somnolence; each variable contributed a score of 1 when present; range, 1–8). Differences between the two hospital populations were assessed by Pearson's chi-square test or Fisher's exact test as appropriate. Means of continuous variables were compared by Mann-Whitney U-test. Confidence intervals (CI, 95%) were reported as mean differences. The statistical tests were two-tailed, with a significance level of $P < 0.05$. The study was approved by the institutional review board of each hospital and by the Ethics Committee of the Faculty of Medicine of the Federal University of Bahia.

RESULTS

Of 3,431 cases identified among 3,221 children, 2,476 were recruited at the PHOPC and 955 at the AH. The intervals between the separate episodes in patients with more than one infection were in all instances more than 1 month. Of all patients, 54.3% were males and 45.7% were females, and 10.0% reported daycare center attendance, 44.5% tobacco smoking in the household, and 28.7% the use of antibiotics for the present illness; 8.3% of parents had a university level of education. The median age of patients was 1.9 years (mean $\pm$ SD,

2.9 ± 2.8; range, 2 days–15.5 years), the mean score for severity was 3.3 ± 1.6, and the mean duration of hospitalization was 9.2 ± 10.7 days. Overall frequencies of several clinical characteristics were found: underlying illness (31.1%), inability to drink (4.0%), cough (97.3%), fever (42.4%), tachypnea (57.7%), chest retraction (43.6%), crackles (68.3%), wheezing (44.7%), somnolence (17.6%), malnutrition (11.7%), hospitalization (26.1%), and mortality (0.7%). Among children with preexisting illness, the frequency of asthma was 53.8%, rhinitis 2.6%, cardiopathy 13.0%, sickle-cell anemia 2.1%, gastroesophageal reflux 5.8%, neuropathy 3.8%, and genetic syndrome 3.5%. Chest X-rays were performed in 93.2%, and infiltrates were reported in 96.0% and classified as interstitial (24.7%), alveolar (51.0%), and mixed (interstitial-alveolar) (20.3%).

Table 1 and Figure 1 show the significant differences of demographic, social, and clinical aspects of children from each hospital. The mean differences for age, clinical score for severity, and duration of hospitalization were 2.3 years (95% CI, 2.1–2.5), 0.8 (95% CI, 0.6–0.9), and 4.7 days (95% CI, 2.4–6.9), respectively. No significant differences were found in the distribution of gender or in frequency of daycare center attendance, cough, inability to drink, chest retractions, or presence of radiological infiltrates, and in frequency of sickle-cell anemia, gastroesophageal reflux, neuropathy, and genetic syndromes.

TABLE 1— Demographic and Clinical Differences of Children With Pneumonia From Different Socioeconomic Status in Salvador, Northeast Brazil[1]

Characteristic	Hospital		*P*-value
	PHOPC	AH	
Age (years)			
Mean ± SD	2.2 ± 2.3	4.5 ± 3.1	< 0.0001
Median	1.4	3.7	
Range	0.006–13.6	0.07–15.5	
Severity score			
Mean ± SD	3.5 ± 1.5	2.7 ± 1.7	< 0.0001
Hospitalization Duration (days)			
Mean ± SD	10.9 ± 12.1	6.2 ± 7.0	< 0.0001

[1]PHOPC, Professor Hosannah de Oliveira Pediatric Center; AH, Aliança Hospital.

DISCUSSION

The results of this investigation indicate that the seriousness of pneumonia was different in both groups.

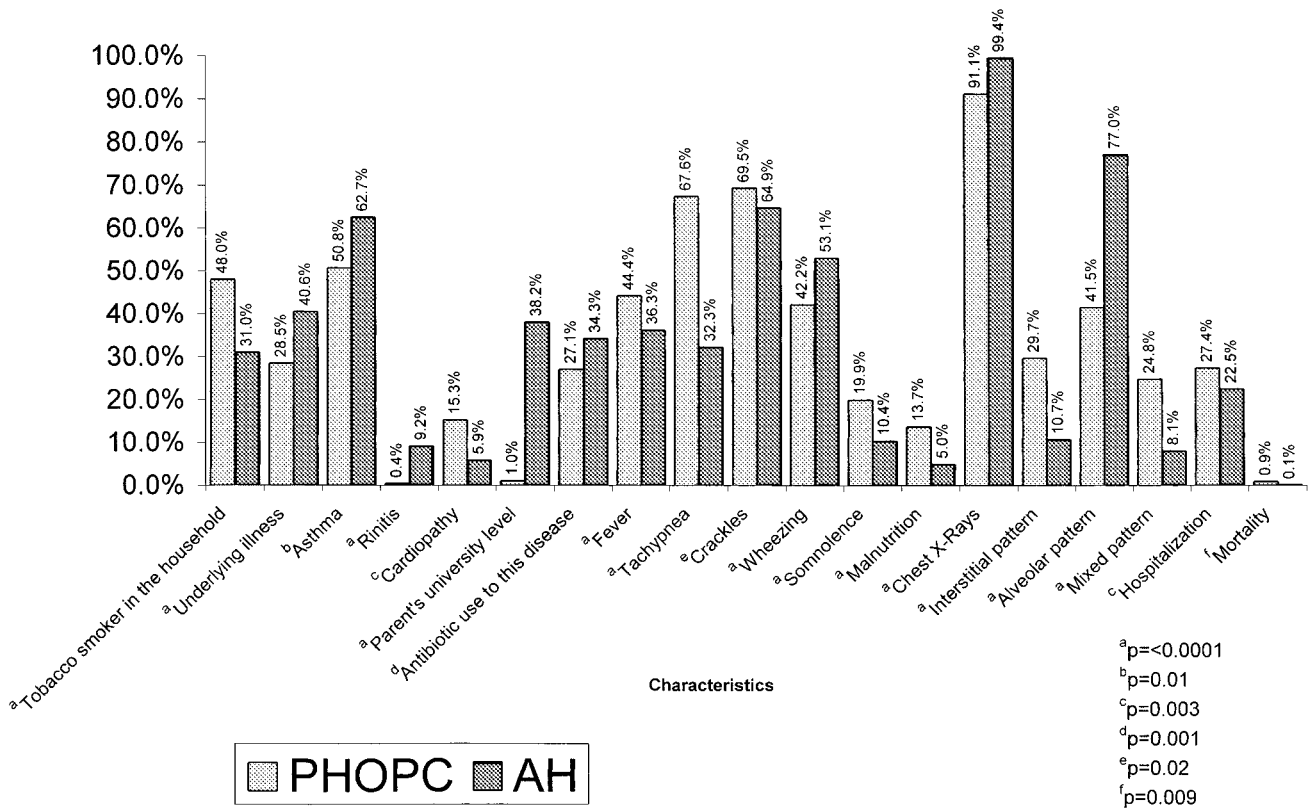

Fig. 1. Clinical and educational differences in children with pneumonia from different socioeconomic strata in Salvador, Northeast Brazil, from September 1997–October 1999. PHOPC, Professor Hosannah de Oliveira Pediatric Center; AH, Aliança Hospital.

Children from families of lower socioeconomic status were more severely ill, as they presented significantly higher frequencies of tachypnea and somnolence (Fig. 1). Moreover, they presented significantly higher scores for severity (Table 1) and frequencies of cardiopathy and malnutrition (Fig. 1). The different levels of seriousness in children from the two hospitals may be partly atributable to differences in underlying debilitative conditions, as well as to mean differences in age. Age is an effect modifier of pneumonia severity: the younger the child, the more severe the disease.[1] We observed a significant difference in the parents' university level of education (Fig. 1). This latter difference may also be partly responsible for the differences of disease severity at time of ER visit.[11–13] Factors such as hospital accessibility, characteristics of attending physicians, and parental awareness of warning signs may have a role in these results.[16]

Interventions to reduce this disparity in results may include improving levels of parental education and increased accessibility to healthcare, which are some of the goals of the Integrated Management of Childhood Illness (PAHO/WHO), designed to reduce childhood mortality in developing countries.[17] The differences in mortality and length of hospitalization between each group of children (Table 1 and Fig. 1) were significant, but these dissimilarities may have been influenced by different therapeutic interventions. The frequency of tobacco smoking in the household was strikingly higher among poor children (Fig. 1). Considering the hazardous effects of smoking on a child's health,[18] preventive programs about smoking should be considered. The significantly higher frequency of previous antibiotics use to treat the current disease among children from middle to high socioeconomic status (prior to ER visit) (Fig. 1) may reflect that self-medication is frequent among children with easy access to health assistance. There has been a strict association of previous use of antimicrobials and bacterial resistance.[19] Therefore, eduational programs about self-medication should also be considered.

The frequency of allergic chronic respiratory illnesses (asthma and rhinitis) and wheezing was greater in the children from middle to middle-upper and high socioeconomic status (Fig. 1). These findings may support the hygiene hypothesis of asthma[20] and are consistent with the results of studies comparing the prevalence of allergic and respiratory diseases in children from different parts of the former West and East Germany,[21,22] where very different socioeconomic living conditions prevailed. Another study showed a strong inverse relation between number of siblings and prevalence of hay fever in British children, and suggested that viral infections early in life may prevent the development of allergic sensitization.[23]

This was an observational descriptive study conducted under routine hospital ER conditions. Ethnic stratification was not performed because of a uniform racial mixture in Brazil in every socioeconomic stratum.[24] Height was not usually measured during the consultation in either ER. Thus malnutrition was defined by relating weight to age. Chest X-ray was not performed in 9.9% of patients at the PHOPC because a chest X-ray is not always feasible at this hospital. By comparing the radiological results reported in both hospitals, the radiological patterns were distinct (Fig. 1). Some of this discrepancy may be explained by interobserver variability in the interpretation of the X-ray films.[25]

These results confirm that children of lower socioeconomic status have more serious lower respiratory tract disease compared with children of middle to high socioeconomic status. This may influence the rates of hospitalization and death from pneumonia in developing countries. Further studies are needed to verify if there is a difference in the frequency of etiologic agents affecting children with pneumonia from different socioeconomic backgrounds.

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