



Respiratory morbidity in the first year of life of preterm infants discharged from a neonatal intensive care unit

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Abstract

Objective: The objective of this study was to verify the incidence of respiratory morbidity in the first year of life in very low birth weight preterm infants and also to compare the presence of respiratory morbidity in the first year of life according to neonatal risk factors.

Methods: This is a prospective cohort study. We studied preterm newborn infants weighing less than 1,500 g and with gestational age less than 34 weeks who were born between 1998 and 2000. During the first year of life, the infants received monthly medical follow-up and during each visit we evaluated the patients considering the presence of obstructive airway syndrome and/or pneumonia and/or hospital admission due to respiratory conditions. The incidence rate of respiratory morbidity in the first year of life was measured. Chi-squared test was used to compare proportions.

Results: The cohort was constituted of 97 preterm infants with mean birthweight of 1,113 g and mean gestational age of 28 weeks. The incidence rates of obstructive airway syndrome, pneumonia and hospital admission were 28, 36 and 26%, respectively. The incidence rate of respiratory morbidity was 53%. There was a significant difference between the incidence rates of respiratory morbidity among infants who had a prolonged use of oxygen (83%) and those who did not (43%).

Conclusion: More than 50% of the infants presented respiratory morbidity in the first year of life and there was a high percentage of pneumonia and hospitalization due to respiratory conditions. Infants who had a prolonged use of oxygen presented with higher respiratory morbidity incidence rate than infants who did not use oxygen for a long period.

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Introduction

Acute respiratory infections account for between 20 and 40% of pediatric hospitalizations and between 30 and 60% of health service consultations in the majority of countries.¹

In developing countries, acute respiratory infections are responsible for a third of deaths and half of hospitalizations in those under five years old,² and are a public health issue. Recent data³ from the Health Ministry reveal that in 2003, in the city of Rio de Janeiro, 134 of a total of 3,078 hospitalizations due to respiratory system diseases in children less than one year of age were as a result of asthma, 662 were because of acute bronchitis/acute bronchiolitis and 2,087 were because of pneumonia.

A variety of factors exacerbate respiratory diseases and contribute to increased hospitalization rates due to pneumonia. Among these, low birth weight, malnutrition, lack of immunization and social factors are cited.^{1,2}

Advances in the treatment and prevention of neonatal respiratory distress syndrome have made it possible for

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preterm infants to survive whose gestational age is often on the limits of viability. This increase in survival of very premature children appears to be associated with increased morbidity during infancy and it is respiratory pathologies that are the most common cause of rehospitalization once these babies have been discharged from the neonatal ward.

The literature indicates that children with gestational ages of less than 34 weeks are more often hospitalized for respiratory problems during the first two years of life than are full term children.^{4,5} One of the problems with the highest incidence is infections of the lower respiratory tract⁶ and wheezing, both associated or not with respiratory infections.

In our country there have been very few studies of post-neonatal respiratory morbidity of very low weight preterm infants.

The objective of this study was to verify the rate of respiratory morbidity incidence during the first year of life of preterm infants discharged from a public neonatal intensive care unit (NICU) in Rio de Janeiro and to test for differences in the incidence of respiratory morbidity related to neonatal risk factors.

Methodology

A prospective cohort study was the design adopted. All newborns were enrolled whose birth weights were less than 1,500 g and whose gestational ages were less than 34 weeks, who were born between January 1998 and August 2000 in a tertiary public hospital. Newborn babies (NB) were excluded if they were small for gestational age (SGA),⁷ if they had any genetic syndrome, malformation or congenital infection.

After discharge from the neonatal ward, the children were followed-up monthly at the At-Risk Neonate Follow-up Clinic at the *Instituto Fernandes Figueira* until they reached 12 months' corrected gestational age.

Data collection instrument

Data was collected on a form that was completed with information relevant to the research contained in medical records and/or provided by the mother.

Variables relating to the mother were: age, date of last menstruation, duration of gestation gauged by obstetric ultrasound (performed by the 20th week of gestation), type of delivery, family income and maternal education.

The following variables were recorded with respect of the NB: birth weight (g), sex, gestational age,⁸ Apgar score, duration of mechanical ventilation use, duration of oxygen therapy use, length of hospital stay, use of mechanical ventilation, apnea, respiratory distress syndrome, surfactant use, oxygen therapy use after 28 days postpartum, oxygen therapy use after 36 weeks' corrected age, corticoid use, presence of septicemia, pneumonia and persistent *ductus arteriosus*.

Gestational age was estimated from the date of last menstruation, or, when this date was uncertain, by obstetric ultrasound performed by 20 weeks' gestation. If neither of these data were available, gestational age was estimated by the method proposed by Ballard *et al.*⁸

Weight was classed as adequate or not for gestational age based on the criteria proposed by Lubchenco *et al.*⁷

Duration of oxygen therapy use was defined as the number of days for which oxygen was used at concentrations above 21% in order to maintain transcutaneous oxygen saturation above 92%.

In order to make comparisons with extant literature possible, extended oxygen use was recorded if oxygen dependency continued beyond 28 days of life.

Bronchopulmonary dysplasia (BPD) was defined as oxygen therapy dependence at 36 weeks of age corrected associated with abnormalities on x-ray.⁹

Septicemia was defined as the presence of a positive blood culture in association with clinical signs (lethargy and/or arterial hypotension and/or unsatisfactory peripheral perfusion and/or hypothermia and/or apnea); or clinical symptoms suggestive of systemic infection and/or abnormal leukocyte count with an increase in the proportion of immature forms.

Clinical assessment during the first year of life

After discharge, the babies were monitored monthly at the Follow-up Clinic by a pediatrician and their families were directed to contact the pediatrician in the event of any occurrence of respiratory conditions.

At each consultation a physical examination was performed in order to assess respiratory status and information was obtained from the baby's guardian on any intercurrent conditions during the periods between the scheduled appointments. They were asked about the presence of wheezing, about the need for bronchodilatory medication, about the need for emergency medical attention for respiratory causes, about chest x-rays, the need for hospitalization for respiratory causes and about the presence of coughing or sibilance.

The diagnosis of bronchiolitis was based on clinical findings: acute onset respiratory wheezing, signs of viral respiratory diseases: coryza, coughing or fever and respiratory difficulties. Laboratory tests to identify respiratory syncytial virus were not performed.

The family was requested to contact the pediatrician in cases requiring hospitalization at a different hospital so that contact could be made with the other institution.

At each consultation data obtained through anamnesis relating to each baby's respiratory problems after discharge, and also data obtained from the physical examination were recorded on both the medical record and form created for the research.

Respiratory morbidity was defined as the presence of at least one intercurrent respiratory condition.

Intercurrent respiratory conditions during the first year of life were defined as:

- obstructive airway syndrome: the presence of repetitive wheezing: the presence of two or more episodes of wheezing causing lack of air or respiratory difficulty,⁵ checked by means of pulmonary auscultation by the pediatrician, requiring bronchodilatory medication; and/or increased expiratory period ascertained by auscultation pulmonary; and/or chest x-ray showing evidence of hyperinflation. Hyperinflation refers to a chest x-ray with increased total lung capacity;¹⁰
- hospitalization due to respiratory problems- a hospital stay of more than 24 hours;²
- pneumonia: presence of respiratory dysfunction (respiratory problems, tachypnea, intercostal or subcostal retraction), crepitant rales and abnormality proven by x-ray.^{2,9,11} Chest x-rays were interpreted by a radiologist specialized in infants.

Informed consent to participation in the study was requested from one of the guardians of each child.

This project was approved by the Commission for Ethics in Research at the *Instituto Fernandes Figueira*.

Data analysis

The program Epi-Info, version 6.03,¹² produced by the World Health Organization in conjunction with the Centers for Disease Control and version 3.2.2 of Epi-Info¹³ were used to create the database analyze it. This study is part of a research project into follow-up care of at-risk NBs. The objective of this, the first article, is to present a description and a univariate analysis of certain characteristics that are considered to be risk factors for respiratory morbidity.

The main characteristics of the population were described by means of measurements of frequency, means, medians and their respective standard deviations.

The rates of incidence of intercurrent respiratory conditions (obstructive airway syndrome, pneumonia, hospitalization) and of respiratory morbidity were calculated after one year of life.

A statistical test was used to determine the difference between proportions (chi-square) and, when appropriate, Fischer's exact test. The level of significance statistical defined was 5%.

Results

During the study period, 179 NBs whose birth weights were less than 1,500 g and gestational ages were less than 34 weeks were admitted to the NICU. Twenty newborns (11.2%) died while in hospital and in four cases the children's guardians refused permission for their participation. Fifty-eight NBs were excluded for the following reasons: 41 NBs were small for gestational age, seven had genetic syndromes, seven had malformations and three NBs were born with congenital infections. Our sample therefore comprised 97 children .

Characteristics of the sample

The characteristics of the sample under study can be found in Table 1. Around 60% of the mothers had received ante-natal corticoid therapy. The mean number of prenatal appointments was four. On average the babies' mothers had attended school until the eighth grade. Family income (median) was R\$ 600, which equated to 4.6 times the minimum salary at the time. In 48% of families there were two or more children under 5 years old living in the same home. We found that 34% of fathers and/or mothers were smokers. We realized that this was a population of immature NBs, with almost half of their gestational ages being less than 28 weeks and around 29% of their birth weights below 1,000 g.

Of the 45 children who presented respiratory distress syndrome, 32 cases were of greater severity and required exogenous surfactant. Ventilatory support was used for 45% of the children, with the average period of mechanical ventilation use being 12 days. Septicemia occurred in 66% of the babies (Table 2).

Twenty-four of the 44 children who required mechanical ventilation, still needed oxygen therapy after 28 days of life and 10 were still reliant on oxygen therapy at 36 weeks of age corrected.

Corticoid therapy was needed for 10 NBs while they were in the high-risk ward, and in four cases these children developed BPD.

Around 40% of the children spent an extended period in the high-risk ward (greater than 60 days).

Intercurrent respiratory conditions during the first year of life

These babies were followed-up for an average period of 12 months. Each child was seen an average of 11 times during follow-up.

One child whose gestational age was 28 weeks and whose birth weight had been 1,230 g, died at 3 months due to pneumonia and septicemia.

All 97 children were followed-up and there were no losses from the study population.

Table 3 shows the main intercurrent respiratory conditions exhibited by the children during the first year of their lives. Fifty-two (53%) of the 97 children suffered at least one intercurrent condition (respiratory morbidity).

Bronchiolitis was diagnosed in 22 children (22.7%) and in 36.4 % of cases there was a need for hospital admission.

The factors listed below will be analyzed in isolation. It is known that respiratory morbidity is determined by the interaction of a number of different factors. Nevertheless, here the influence of certain factors will be described in isolation and a statistical model that allows for an analysis of their interactions will be the subject of a future paper.

Around 13% (three) of the 24 children who had extended oxygen use (beyond 28 days of life) presented bronchiolitis and hospitalization was necessary in all cases. Nineteen of the 73 children who did not receive

Table 1 - Characteristics of preterm newborns with birth weight < 1,500 g, appropriate for gestational age, and gestational age < 34 weeks (n = 97)

Characteristics of the sample under study		
Birth weight (g)	mean±SD	1,113±232.9
Gestational age (weeks)	mean±SD	28.5±2.3
5th min Apgar	median	9
Duration of mechanical ventilation use (days)	mean±SD	12±16
	median	3
Duration of oxygenotherapy (days)	mean±SD	24.7±30.5
	median	6
Length of hospital stay (days)	mean±SD	58.3±26.1
	median	51
Male	n (%)	47 (48.5)
NB's weight < 1,000 g	n (%)	28 (28.9)
NB's gestational age < 28 weeks	n (%)	42 (43.3)

SD = standard deviation; NB = newborn.

Table 2 - Occurrence of clinical problems during the neonatal period in appropriate for gestational age preterm newborns of very low weight and gestational age < 34 weeks

Clinical problems	n (%)
Apnea	65 (67)
Septicemia	64 (66)
Respiratory distress syndrome	45 (46.4)
Use of mechanical ventilation	44 (45.4)
Oxygen therapy use after 28 days postpartum	24 (24.7)
Persistent <i>ductus arteriosus</i>	21 (21.6)
Pneumonia	21 (21.6)
Oxygen therapy use after 36 weeks (bronchopulmonary dysplasia)	10 (10.3)

extended oxygen use had bronchiolitis. Only one of the 10 children with BPD was diagnosed as having bronchiolitis and was admitted to hospital.

Tables 4, 5 and 6 list the incidence of intercurrent respiratory conditions that occurred during the first year of life, classified by neonatal factors: extended oxygen use, use of mechanical ventilation and gestational age less than 28 weeks.

Table 3 - Intercurrent respiratory conditions exhibited by appropriate for gestational age preterm infants of very low weight and gestational age < 34 weeks during the first year of their lives

Intercurrent respiratory conditions	n of infants	%
Obstructive airway syndrome	27	27.8
Pneumonia	35	36.1
Hospital admission	25	25.8

Those children that were given exogenous surfactant presented significantly more respiratory morbidity (81%) during the first year of life than did children who were not given surfactant (40%).

Children who were remained in hospital for more than 60 days exhibited, during their first year of life, significantly higher rates of pneumonia (53 vs. 24%), wheezing (39 vs. 19%) and hospitalization (39 vs. 17%) than did those children who had not remained in hospital for a prolonged period neonatally.

Those children whose family incomes were less than twice the minimum wage did not exhibit differences in terms of respiratory morbidity when compared with children from families with larger incomes.

Discussion

This is one of the few studies in our country which relates the follow-up of a cohort of very low weight NBs. One of the most striking facts is that we were able to follow-up all 97

Table 4 - Incidence of intercurrent respiratory conditions that occurred during the first year of life of preterm infants of very low weight and gestational age < 34 weeks, appropriate for gestational age, according to the duration of oxygen therapy use

Intercurrent problem	Oxygen therapy after 28 days of life			Oxygen therapy at 36 weeks (BPD)		
	Yes (n = 24) n (%)	No (n = 73) n (%)	p	Yes (n = 10) n (%)	No (n = 87) n (%)	p
Morbidity respiratory	20 (83.3%)	32 (43.8%)	0.0007	8 (80%)	44 (50.6%)	0.07
Obstructive airway syndrome	13 (54.2%)	14 (19.2%)	0.0009	7 (70%)	20 (22.9%)	0.004
Pneumonia	15 (62.5%)	20 (27.4%)	0.0018	6 (60%)	29 (33.3%)	0.09
Hospital admission	10 (41.7%)	15 (20.5%)	0.04	3 (30%)	22 (25.3%)	0.5

BPD = bronchopulmonary dysplasia.

children from a low-income population for a period of 12 months without losing contact with a single subject.

In common with other studies¹⁴ our research found elevated incidence rates of respiratory problems and high

rates of hospital admission during the first year of life of the children under study. The sample included many very immature babies, with around 45% of the patients having gestational ages of less than 28 weeks and around 30% weights less than 1,000 g.

We chose the presence of wheezing as one of our measures of adverse respiratory status as being one of the most frequently used respiratory outcomes to be found in the literature and according to Elder *et al.* is a common finding during the first year of the lives of children born after less than 33 weeks' gestation.⁵ According to these authors, the adequacy of comparing reported wheezing rates is compromised due to the varying definitions of "wheezing" employed and the ages at which they are recorded. The methodology that we employed to confirm this variable, by means of pulmonary auscultation performed by a pediatrician and not from information provided by the mother, is in accord with the report by Elder *et al.*⁵ with respect of the definition of "wheezing". It is common that mothers will refer to other noises, such as those caused by a nasal obstruction, as being "wheezing", which may lead to an information bias and result in an overestimation of the number of children wheezing. We must, therefore, be alert to the possibility that rates in published literature that have been obtained by means of questionnaires filled out by parents may suffer from an information bias in this respect. We found that 27.8% of the children exhibited recurrent wheezing, in the majority of cases accompanied by chest x-rays revealing signs of hyperinflation.

Thomas *et al.*¹⁵ assessed extremely premature children (gestational ages of 23 to 28 weeks) during the first 6 months of their lives and identified 20% of the 185 children as exhibiting wheezing although these authors' follow-up period was shorter than ours which makes comparisons difficult.

Giffin *et al.*¹⁶ report that 45.3% of 86 preterm infants with birth weights of less than 1,500 g and or weights from 1,500 g to 2,000 g and a need for ventilation presented

Table 5 - Incidence of intercurrent respiratory conditions that occurred during the first year of life of preterm infants of very low weight and gestational age < 34 weeks, appropriate for gestational age, according to the use of mechanical ventilation during the neonatal period

Intercurrent problems	Use of mechanical ventilation during the neonatal period		p
	Yes (n = 44) n (%)	No (n = 53) n (%)	
Respiratory morbidity	32 (72.7%)	20 (37.7%)	0.00058
Obstructive airway syndrome	17 (38.6%)	10 (18.8%)	0.03
Pneumonia	23 (52.3%)	12 (22.6%)	0.0024
Hospital admission	17 (38.6%)	8 (15%)	0.0083

Table 6 - Incidence of intercurrent respiratory conditions that occurred during the first year of life of preterm infants of very low weight and gestational age < 34 weeks, appropriate for gestational age, according to the gestational age at birth

Intercurrent problems	Gestational age < 28 weeks at birth		p
	Yes (n = 42) n (%)	No (n = 55) n (%)	
Respiratory morbidity	25 (59.5)	27 (49)	0.3
Obstructive airway syndrome	16 (38.1)	11 (20)	0.04
Pneumonia	17 (40.4)	18 (32.7)	0.43
Hospital admission	14 (33.3)	11 (20)	0.13

wheezing during their first year of life while Elder *et al.*⁵ found 23%. Greenough *et al.*¹⁷ reported that 47% of the preterm infants they studied presented respiratory symptoms during their first year and even those children who did not require respiratory support during the neonatal period had an elevated prevalence of wheezing and coughing during the first year of life. Our result is similar to that of Elder *et al.*⁵ The methodology employed by Greenough *et al.*¹⁷ is possibly subject to bias since the presence of wheezing was determined only by means of maternal information and the results may have been overestimated.

We found that children with more severe cases of respiratory distress syndrome and who were given surfactant exogenous during the neonatal period, presented a greater incidence of wheezing during the first year of life than did children who were not given surfactant.

There are extant reports of children who developed BPD presenting respiratory symptoms and wheezing with greater frequency during childhood than those who had not developed BPD.¹⁸

Perez *et al.*¹⁴ describe having found a 41% incidence of wheezing among children with no BPD and of 86% among children with BPD (oxygen at 36 weeks), although their follow-up period continued until the second year of life.

De Boeck *et al.*¹⁹ found recurrent wheezing during the first year of life in 30% of children who did not have BPD and of 59% in children with BPD ($p < 0.04$). These authors defined BPD as the need for oxygen therapy at 28 days postpartum. In our study, children who were still on oxygen after 28 days presented more recurrent wheezing (54.2%) during the first year of life than did those who did not require extended oxygen use (19.2%). The same occurred with respect of the children in our cohort who developed BPD (70 vs. 22.9%). The use of oxygen at 36 weeks of age corrected has been considered^{9,14} to be more predictive of post-neonatal respiratory morbidity than oxygen use at 28 days postpartum.

We may suppose that, for children with BPD, the reduction in airway growth during the rapid postnatal phase of pulmonary growth may contribute to a disproportional level of reduced increase in airway luminal diameter with a resultant persistent increase in airway resistance which in turn can cause wheezing. In addition to this, we know that viral respiratory diseases can greatly increase the resistance of the smaller airways in children with BPD and contribute to the persistence of this elevated resistance leading to respiratory symptoms that are many times more severe.²⁰ In a follow-up study of 124 preterm infants with BPD, bronchiolitis was responsible for 14% of hospital admissions during the first year of life.²¹ Perez *et al.*¹⁴ report that the probability of hospitalization for bronchiolitis in children less than one year old and with gestational ages less than 32 weeks is estimated at 11 to 13%. In our study around 13% of children with extended oxygen use presented bronchiolitis and required hospital admission. Ten percent of the children with BPD presented bronchiolitis and were hospitalized. The rate of bronchiolitis in our sample of children with BPD is below that of certain reports in the literature. Bronchiolitis

diagnoses may have been underestimated in cases where sequential care of the viral infection took place at an institution other than the research location making it impossible to ratify the bronchiolitis diagnoses. On the other hand, the distinction between bronchiolitis and pneumonia is often unclear. Furthermore, with bronchiolitis chest x-rays will often show, in addition to hyperinflation, images that are interpreted either as atelectasis or infiltration, which makes correct diagnosis more difficult and contributes to an underestimation of bronchiolitis diagnosis.

A number of different authors have shown that children with BPD are more often hospitalized for childhood pulmonary problems than those without BPD^{4,6,22,23} and the highest number of hospitalizations appears to be concentrated within the first year of life.²¹ Smith *et al.*²³ analyzed data from preterm infants with gestational ages of less than 33 weeks with respect of hospital admission rates and in terms of risk factors for rehospitalization for any clinical cause during the first year of life of preterm infants with BPD (oxygen use at 36 weeks). They reported that children with BPD were rehospitalized twice as often (49%) than were children without BPD (23%) ($p < 0.0001$). No single factor was able to differentiate between those children with BPD who had been rehospitalized and those who were not rehospitalized, even when only those whose rehospitalization was due to respiratory causes were included.

In a study by Perez *et al.*¹⁴ 27% of the children without BPD were admitted to hospital whereas among those who did have BPD, hospital admission took place in 41% of cases. In the follow-up of children with gestational ages between 24 and 28 weeks²⁴ there was a difference in terms of hospitalization rates due to respiratory diseases and in the number of days in hospital up to 18 months age corrected between two groups of children given oxygen for extended periods (oxygen use beyond 28 days of life/use of oxygen at 36 weeks of age corrected) and children in a comparison group. Forty-eight percent of the children in the cohort required hospital admission. The children who were still on oxygen therapy at 36 weeks were in hospital for a longer period of time than were children who were still on oxygen at 28 days postpartum and also than the comparison group.²⁴ In our study hospital admission was recorded in 20.5% of the children who had not been given oxygen for an extended period and in 41.7% of those who had been on oxygen therapy for an extended period ($p = 0.04$). Of those children who did exhibit BPD, 30% had been admitted for respiratory causes, although when this was compared with the children without BPD, 25% of whom were admitted, there was no significant difference between the hospital admission rates.

The adoption of oxygen use beyond 28 days postpartum (extended oxygen use) as a severity measure allows for less rarefied distribution across the possible outcomes. The definition of BPD used as a prognostic measure adopted oxygen use at 36 weeks of age corrected. According to this definition 10 children were identified as suffering from BPD distributed asymmetrically across the intercurrent respiratory conditions and respiratory morbidity leading to highly rarefied

outcome categories with just three children in the case of hospital admission and 6 children in the case of pneumonia. This, in turn, prejudiced the calculation of the difference between the proportions of hospital admission and pneumonia.

Around 25% of the entire cohort that we followed were admitted to hospital during their first year of life. Palta *et al.*²⁵ found 24.3% of hospitalization for respiratory problems during the first 2 years of life among preterm infants with birth weights of less than 1,500 g. These results, while similar to ours used an age at outcome that was greater than ours which complicates comparisons. Of 2,256 preterm infants without BPD and with gestational ages of less than 33 weeks who were not given prophylaxis against respiratory syncytial virus, 15.1% were admitted to hospital for diseases of the lower respiratory tract.²⁶

Those children who exhibited one of the factors that can be related to greater neonatal respiratory disease severity (surfactant use, corticoid therapy use, neonatal pneumonia, hospital stay in the high-risk ward for more than 60 days, extended oxygen use, mechanical ventilation) were more often admitted during their first year of life than were those who did not exhibit these factors. Those children who were on mechanical ventilation presented significantly greater rates of respiratory morbidity, repeated wheezing, pneumonia and hospital admission during the first year of life than did those who were not put on ventilatory support (Table 5). This is in agreement with a number of studies that have shown that during mechanical ventilation pulmonary hyperdistension which can damage structural elements and stimulate the lungs into liberating multiple products that in turn trigger the inflammatory cascade. The cytokines generated by the lungs then amplify the response to the injury attracting peripheral leukocytes to the lungs creating conditions under which children become more susceptible to intercurrent respiratory conditions.²⁷

We included x-ray examination in our criteria for pneumonia diagnosis because clinical history and physical examination, while sensitive, are not very specific; a fact which could underestimate the true number of cases.² The x-ray examinations were interpreted by a radiologist specialized in infants. Few studies worldwide have confirmed pneumonia diagnosis with x-rays due to the logistic difficulties and elevated costs involved.²⁸ All 32 cases of pneumonia in our study were had the pneumonia diagnosis validated by x-ray examination.

Thirty-six percent of the children followed-up until the first year of age corrected exhibited pneumonia. Few studies have reported on pneumonia rates among preterm infants during infancy. Hack *et al.*,²⁹ with the objective of comparing the health of preterm infants with that of full term children found significant differences between their two groups with respect of pneumonia before 3 years of life, with preterm infants more often affected (8.4%) than full terms (1.4%). We encountered a rate that was far higher (36%) than did Hack *et al.*²⁹ and comparability is made difficult due to differences in the age groups included in the two studies. The low socioeconomic status, low birth weight, presence of

young siblings at home and congregations are all considered risk factors for respiratory infection and these factors are common in developing countries.³⁰ However, in a manner that we have verified, when studying patients of a low socioeconomic level, factors such as family income and the presence of young siblings does not appear to have contributed to the elevated rate of pneumonia and hospital admission in our sample. One possible explanation for the reduced pulmonary morbidity in the study performed by Hack *et al.*²⁹ may be the high level of mortality during the neonatal period (35%). Perhaps the less sick children survived and for this reason were at less risk of respiratory diseases after the neonatal period. During the period that we studied the mean mortality rate for babies weighing less than 1,500 g was 22%, which is much less than in the study cited above. The research referred to was also carried out in 1979 which should be taken into account as exogenous surfactant which reduces the severity of respiratory distress syndrome was not available.

Conclusions

More than 50% of the studied sample presented respiratory morbidity during the first year of life. The incidence of obstructive airway syndrome (28%) was comparable with that described in major studies in the area, although the incidence of pneumonia (36%) was greater.

Around 25% of the studied sample required hospitalization for respiratory diseases. Hospital admission rates are verified as being an important measure of the severity of respiratory diseases in a preterm population and are fundamental to planning health care services for high-risk children.

Those children who were on oxygen therapy for an extended period (beyond 28 days postpartum) presented significantly more respiratory morbidity during their first year of life than did those who were not given extended oxygen therapy. Preventative measures should be planned in an attempt to reduce the post-neonatal respiratory morbidity of these children. In contrast, assessing children who developed BPD we found statistical significance only with respect of wheezing.

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