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Socio-Demographic Determinants and Nutritional Status in Relation to Recurrent Pneumonia in Infants and Young Children

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Abstract **Original Research Article**

Introduction: Pneumonia is a severe acute lower respiratory infection that poses a major risk to worldwide public health, with high rates of morbidity and mortality in children under five. The risk factors for childhood pneumonia are sociodemographic status (age, domicile, occupation, educational attainment, monthly income, and family size) and malnutrition in lower-income nations. Therefore, this study aimed to determine socio-demographic determinants and nutritional status associated with recurrent pneumonia among children under five years old. ***Methods:*** This was a prospective study conducted in the Department of Paediatrics at Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh during the period from January 2022 to June 2022. In our study, we included 50 children aged 2 months to 5 years with recurrent pneumonia admitted to Bangladesh Shishu Hospital & Institute within the study period. ***Result:*** The mean age was 19.0±15.7 months. Male patients were predominantly 33 (66.0%) whereas females were 17 (34.0%). Cough was presented in all patients, followed by respiratory distress (78.0%), fever (66.0%), and reluctant to feed (10.0%). Family number of feeding members 6-10 were found in 29 (58.0%) patients. Smoking by any family member was found in 28 (56.0%). Exclusive breast feeding was found in 18 (36.0%) patients. Among all children with pneumonia, most (56%) were malnourished and 44% were well-nourished. ***Conclusion:*** Our study shows that there was an increase in the prevalence of recurrent pneumonia within cases with extended family members, with a history of parental smoking, underweight, malnutrition, and low socio-economic status.

Keywords: Socio-Demographic Determinants, Nutritional Status, Recurrent Pneumonia, Infants.

INTRODUCTION

Pneumonia is a severe acute lower respiratory infection that poses a major risk to worldwide public health, with high rates of morbidity and mortality in children under five [1]. Pneumonia is the main cause of death for children under five in developing countries [2]. More than nine million children under five die each year globally, with pneumonia being the cause of more than three million of those deaths [3–4]. Approximately 90 to 95 percent of these deaths occur in developing countries. [5,6].

Pneumonia in children under five causes a reduction in lung function over time, which manifests in maturity [7]. The infection results in swelling and a buildup of pus or fluid in the lungs' alveoli. Oxygen may find it more difficult to enter the bloodstream as a result. Moderate to severe symptoms of pneumonia include chills, fever, coughing, and trouble breathing [8,9]. This infectious disease is caused by bacteria, viruses, and fungi. Gram-negative bacteria and group B streptococcus are the most common pathogens in neonates, although viruses are usually the most common pathogen in babies [10]. Viral pneumonia is frequently caused by human metapneumovirus, respiratory syncytial virus, adenovirus, rhinovirus influenza, parainfluenza, and SARS-CoV-2 [11,12]. On the other hand, bacterial pneumonia is often caused by Streptococcus pneumoniae (Pneumococcus) [13]. Fungal pneumonia is also frequently caused by Coccidioidomycoses [14,15].

Imaging techniques such as a chest X-ray and computed tomography scan, blood tests, pulmonary function testing with a spirometer or oximeter, surgical lung biopsies, and bronchoscopies are used to diagnose pneumonia [16]. Pneumonia in children less than five years old can progress and could be fatal if it is not treated appropriately or promptly. Infants and toddlers under five years old account for the majority of pneumonia-related deaths [17]. Pneumonia claimed the lives of 740,180 children under five globally in 2019. Children aged 1 to 5 accounted for 22% of all deaths, while children under five accounted for 14% [18]. More than 800,000 children under five die from pneumonia each year, including around 153,000 infants who are particularly vulnerable to infection [19]. The risk factors for childhood pneumonia differ in lower-income nations. Sociodemographic status (age, domicile, occupation, educational attainment, monthly income, and family size) is one of the risk factors for pneumonia [20, 21]. Regardless of their age, everyone may get pneumonia. Due to their undeveloped respiratory systems and weakened immune systems, infants and toddlers under two are particularly susceptible to severe infections [22]. The risk of pneumonia in children is influenced by family income through complete immunization status, nutritional status, and adequate physical housing [23]. Although family overcrowding is considered a risk factor for illness, little is known about the mechanism of respiratory infection transmission in children living in overcrowded families [24]. Mothers' health care, treatment, and prevention practices are influenced by their level of education. Mothers with little education, for instance, frequently mistake pneumonia for a normal cold [25].

Numerous initiatives aimed at reducing the global burden of pneumonia-related mortality have been given priority. These include improving nutrition and breastfeeding rates, reducing indoor air pollution, decreasing housing overcrowding, improving access to antibiotics, improving care-seeking behavior and referral processes, and improving the quality of case management [26, 27].

Recurrent pneumonia in children is currently a major challenge for pediatricians in developing countries. It leads to frequent hospitalizations and raises morbidity and mortality among children in hospitals. Early detection, prevention, and appropriate treatment are therefore crucial.

Therefore, this study aimed to determine socio-demographic determinants and nutritional status associated with recurrent pneumonia among children under five years old.

METHODOLOGY & MATERIALS

This was a prospective study conducted in the Department of Paediatrics at Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh during the period from January 2022 to June 2022. In our study, we included 50 children aged 2 months to 5 years with recurrent pneumonia admitted to Bangladesh Shishu Hospital & Institute within the study period.

These are the following criteria to be eligible for enrollment as our study participants: a) Patients aged 2 months to 5 years; b) Children diagnosed with recurrent pneumonia; c) Children with radiological evidence of pneumonia; d)Parents who were willing to let their children participate were included in the study And a) Children who had a history of prolonged mechanical ventilation during the neonatal period; b) Children with known case of bronchial asthma were excluded from our study.

Data Collection: Data was collected using a structured questionnaire containing all the variables of interest. The questionnaire was finalized following pretesting. Data was collected from the legal guardians by interview and by physical examination of the child and from investigation reports. The radiologic interpretation was done by the Radiology Consultant of the Department of Radiology and Imaging, Bangladesh Shishu Hospital & Institute. After collection, data editing and clearing were done manually and prepared for data entry.

Statistical Analysis: All data were recorded systematically in preformed data collection form. Quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Statistical analysis was performed by using SPSS 24 (Statistical Package for Social Sciences) for Windows version 10. The study was approved by the Ethical Review Committee of Bangladesh Shishu Hospital & Institute.

RESULTS

Table 1: Distribution of the study patients by socio-demographic characteristics (n=50)

Parameters	Frequency	Percentage
Age (months)		
≤6	6	12.0
7-12	21	42.0
13-24	10	20.0
25-36	4	8.0
37-48	5	10.0

Parameters	Frequency	Percentage
49-60	4	8.0
Mean±SD	19.0	±15.7
Range (min-max)	3.0	-60.0
Sex		
Male	33	66.0
Female	17	34.0
Family income (Taka)*		
Low-income (≤7400 TK)	5	10.0
Lower-middle (7401-29000 TK)	31	62.0
Upper-middle (29001-89920 TK)	14	28.0
Mean±SD	21220.0	±14532.9
Range (min-max)	4500	-70000
Consanguinity		
Present	10	20.0
Absent	40	80.0

*World Bank Data Team. New World Bank country classification by income level: 2021-2022. Available from: https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2021-2022 (Accessed : 1-7-2021).

Table 1 shows that the majority of 21 (42.0%) patients belonged to the age group 7-12 months, the mean age was 19.0±15.7 months. Male patients were predominantly 33 (66.0%) whereas female 17 (34.0%), male: female ratio was 1.9:1. Majority 31 (62.0%) patients came from lower middle-income group families. Consanguinity was found in 10 (20.0%) patients.

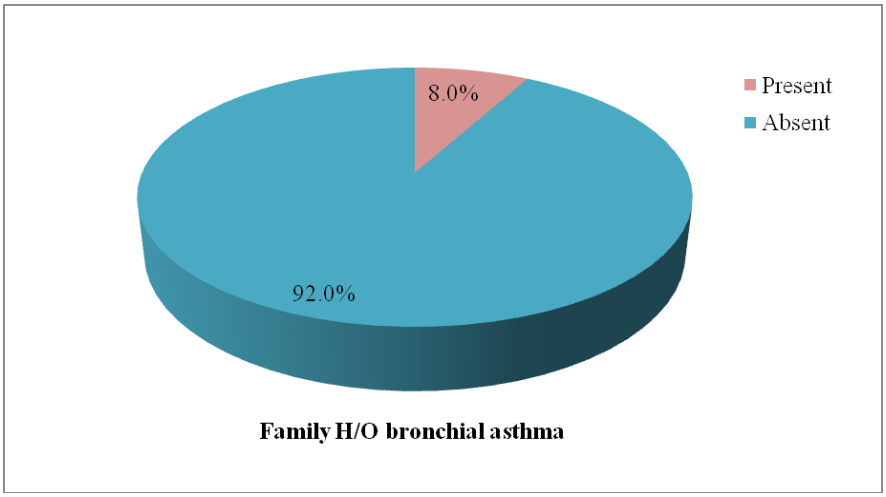

Figure 1: Distribution of the study patients according to family H/O bronchial asthma (n=50)

The pie chart shows that a family history of bronchial asthma was found in 4 (8.0%) patients.

Table 2: Distribution of the study patients according to socio-economic background (n=50)

	Frequency	Percentage
Number of family members		
≤5	19	38.0
6-10	29	58.0
>10	2	4.0
Smoking by any family member		
Yes	28	56.0
No	22	44.0

Table 2 shows that 29 (58.0%) patients had a family of 6-10 members, followed by 38% who had ≤5 family members, and only 4% had more than 10 members in the family. Smoking by any family member was found in 28 (56.0%) cases.

Table 3: Distribution of the study patients according to feeding status (n=50)

	Frequency	Percentage
Exclusive breastfeeding (up to 6 months)		
Yes	18	36.0
No	32	64.0
Complementary feeding		
Adequate	15	30.0
Inadequate	30	60.0
Not started	5	10.0
Feeding technique/position		
Sitting	22	44.0
Supine	28	56.0

Table 3 shows that exclusive breast feeding (up to 6 months) was found in 18 (36.0%) patients and inadequate feeding was 30 (60.0%). The majority of 28 (56.0%) patients were feeding technique/position by supine.

Table 4: Distribution of the study patients according to anthropometry (n=50)

Anthropometry	Frequency	Percentage
Birth weight		
Average	32	64.0
LBW	18	36.0
Present weight (kg)	7.4±3.0	
Range (min-max)	3.5-19.0	

Table 4 shows that average birth was found in 32 (64.0%), low birth weight 18 (36.0%). The mean present weight was 7.4±3.0 kg.

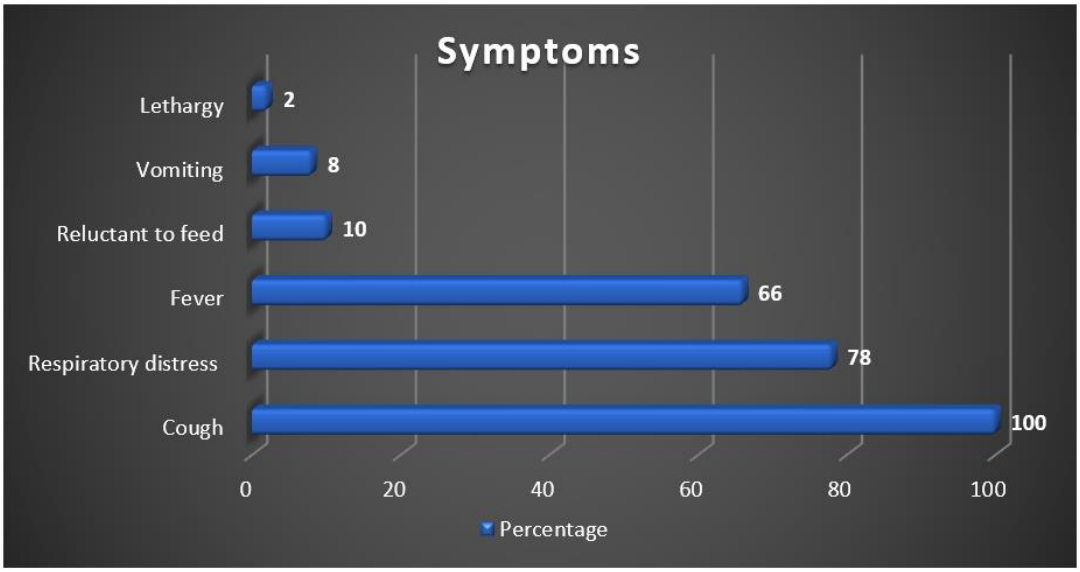

Figure 2: Distribution of the study patients according to symptoms (n=50)

Figure 2 shows that cough was presented in all patients, followed by respiratory distress (78.0%), fever (66.0%), reluctance to feed (10.0%), vomiting (8.0%), and lethargy (2.0%).

Table 5: Distribution of the study patients according to blood culture, chest x-ray echocardiography (n=50)

Blood culture	Frequency	Percentage
No growth	46	92.0
Organism isolated	4	8.0
Klebsiella pneumoniae	2	4.0
Pseudomonas	1	2.0
Streptococcus	1	2.0

Chest x-ray	**Frequency**	**Percentage**
Bronchopneumonia	36	72.0
Consolidation	7	14.0
Aspiration pneumonia	2	4.0
Collapse	2	4.0
Collapse & consolidation	1	2.0
Hyperinflation	2	4.0
Echocardiography	**Frequency**	**Percentage**
Normal	33	68.8
Abnormal	15	31.3
Atrial septal defect (ASD)	4	8.3
Ventricular septal defect (VSD)	6	12.5
Pulmonary HTN	1	2.1
Patent ductus arteriosus (PDA)	2	4.2
VSD + ASD	1	2.1

Table 5 shows no growth was found in 46 (92.0%) and organized isolated was 4 (8.0%). Among them, *Klebsiella pneumoniae* was found in 2 (4.0%) children, followed by *Pseudomonas* (2.0%), and *Streptococcus* (2.0%). Among chest x-ray findings, bronchopneumonia was found in 36 (72.0%) cases, followed by consolidation (14.0%), aspiration pneumonia (4.0%), collapse (4.0%), collapse and consolidation (2.0%), and hyperinflation (4.0%). Echocardiography was done in 48 patients, among them normal was 33 (68.8%), and abnormal was 15 (31.3%). Atrial septal defect (ASD) was found in 8.3% of cases, followed by ventricular septal defect (VSD) was 12.5%, and patent ductus arteriosus (PDA) was 4.2%.

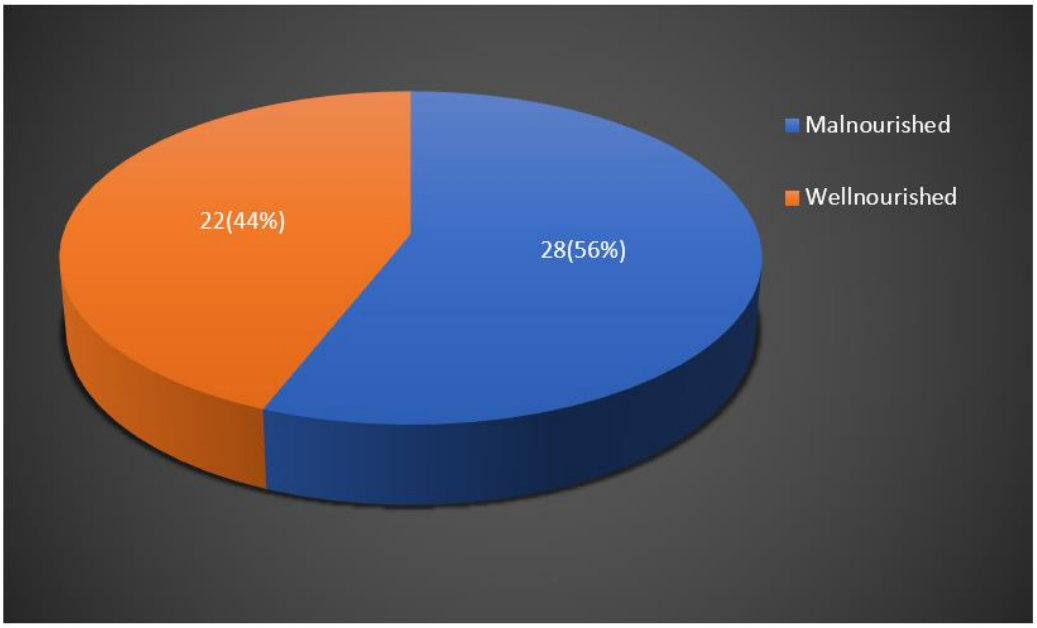

Figure 3: Distribution of the study patients according to nutritional status (n=50)

Figure 3 shows that among all children with pneumonia, most of them (56%) were malnourished and 44% of them were well nourished.

DISCUSSION

In this study, the mean age was 19.0±15.7 months. A study conducted by Mahmoud and Ahmed reported that the mean age of recurrent pneumonia patients was 14.8±9.7 months [28]. El–Saied *et al.*, found a mean age of 3.91 ± 0.40 years [29]. Capanoglu *et al.*, revealed the mean age was 10.37±6.45 months [30]. Another study done by Hossain *et al.*, showed that the mean age of their study was 3.0 ±2.8 years [31].

The present study observed that male patients were predominant (66.0%). Similar studies conducted by Mahmoud and Ahmed (68%), Hossain *et al.*, (60%), and El–Saied *et al.*, also found a male predominance of 68%, 60% & 65.5% respectively [28,29,31].

This study showed that number of family members 6-10 was found in 29 (58.0%) patients. Smoking by any family member was found in 28

(56.0%). A study done by El–Saied *et al.*, showed that all cases had more than 5 family members [29]. Capanoglu *et al.*, reported an overcrowded household (≥5 household members) was 11.3% and exposure to cigarette smoke was 11.8% [30]. Patria *et al.*, documented that exposure to cigarette smoke was 37.7%, which was supported by my study [32].

In this current study, it was observed that exclusive breast feeding (up to 6 months) was found in 18 (36.0%) patients and inadequate feeding was 30 (60.0%). El–Saied *et al.*, revealed that breastfeeding was found in 48.18% and formula-fed 51.81% [29]. Patria *et al.*, had observed that breastfeeding >3 months was found in 58.4% [32]. Another study done by Capanoglu *et al.*, reported that breastfeeding ≥6 months was found in 9.0% and <6 months 7.3% [30]. The above-mentioned studies finding were almost similar in this study.

The present study observed that the average birth was found in 32 (64.0%), and low birth weight in 18 (36.0%). The mean present weight was 7.4±3.0 kg. Patria *et al.*, reported that normal birth weight (<2500 g) was 82.8% and low birth weight was 17.2% [32].

Our study showed that overcrowding families, parents' smoking habits, rural residency, low family income, and unavailability of adequate medical care were all associated with the risk of recurrent pneumonia among the studied cases. Previous studies have shown that children whose parents smoke have a higher risk of contracting severe pneumonia and being hospitalized [33,34].

According to a study conducted in India, children's pneumonia is linked to lower socioeconomic level (SES), inadequate breastfeeding, low birth weight, and younger age [35]. Lack of breastfeeding was found to be a significant risk factor for pneumonia in our investigation. According to earlier research, not breastfeeding raises the chance of developing serious pneumonia and lower respiratory tract infections by 1.5 to 2.6 times [36].

However, knowing a person's family financial history may be more important than the current state of the economy in predicting the health of their offspring [37]. Azab *et al.*, confirmed that higher complication and mortality rates existed among low SES (group 1) compared with high SES (group 2) ($P < 0.05$) [37]. These results are concordant with an earlier study conducted by Wood *et al.*, who found an increased relative risk (RR 2.3 95% CI: 1.4–4.0) for lower social class quintiles and pneumonia mortality [38]. Similar research conducted in Bangladesh indicates that, in addition to intercountry differences, there are also notable differences within countries. For instance, children who live in rural regions, come from the poorest households or have mothers with lower educational attainment are more likely to die from severe pneumonia [39].

In the current study, most of the children (56%) were malnourished and 44% of them were well nourished.

Previous studies revealed that being malnourished increases the risk of pneumonia episodes [40].

Limitations of the study

Our study was a single-center study. We took a small sample size due to our short study period, so it doesn't represent the whole community. After evaluating those patients, we did not follow up with them for the long term and did not know other possible interference that may happen in the long term with these patients.

CONCLUSION AND RECOMMENDATIONS

In our study, we found that recurrent pneumonia is a threatening problem for developing countries like ours and it can be presented by symptoms like cough, fever, tachypnea, and respiratory distress. Regarding risk factors for recurrent pneumonia, our study shows that there was an increase in the prevalence of recurrent pneumonia within cases with a history of parental smoking, underweight, malnutrition, and low socio-economic status. Public health measures against these sociodemographic risk factors should be taken and identified as priorities to help reduce the global burden of deaths from recurrent pneumonia among Bangladeshi children.

So further study with a prospective and longitudinal study design including a larger sample size needs to be done to validate the findings of our study.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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