Original Article

Burden of Pneumococcal infections among under five children

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ABSTRACT

Background
Pneumonia is the leading cause of death for children under 5 years of age in Bangladesh. Therefore, it is important to know the impact of *Streptococcus Pneumonia* to avert under 5 deaths in Bangladesh.
Objective
The study was to assess the magnitude of Pneumococcal infections among under 5 children in a tertiary level hospital in Bangladesh.
Methods
It was a cross-sectional study among under 5 children who were admitted in Dhaka Shishu Hospital with respiratory infections. Purposive sampling strategy was followed and 101 children with respiratory infections were selected as required sample size for the current study. Socio-demographic characteristics, location of kitchen and nature of fuel used by the respondents, nutritional status, weight, weight for age, duration of suffering and respiratory rate of the patients were analyzed in relation to Pneumococcal infections. .
Results
Around 30% of the sample respondents had Pneumonia, 17% had Severe Pneumonia, 26% had been affected by Meningitis and the rest had been suffering from Sepsis. Mother's higher education level had been linked up with the reduction of Pneumonia ($p < .05$). Additionally, mean difference of Nature of fuel used for cooking ($p = .005$), weight ($p = .001$) and weight for age ($p = .001$) were significantly differ among children with pneumococcal and non-Pneumococcal infection groups.
Conclusion
Educational status of the parents should be improved regarding overcrowding, smoke particularly during cooking and the nature of fuel. Again interventions like improved weight, weight for age and nutritional status under 5 children should be considered at a priority basis

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INTRODUCTION

Streptococcus pneumoniae (pneumococcus) causes a variety of respiratory illnesses. More than 25% of community acquired bacterial pneumonia in children is attributable to *S. pneumonia* in developing countries[1]. Pneumococcal disease probably causes 1-2 million deaths in children < 5 years of age every year, mostly in developing countries[2]. Most deaths are associated with meningitis[3,4] or pneumonia[5,6] which also result in other serious complications, chronic sequelae and substantial direct and indirect costs[7] . Acute Respiratory Infection (ARI) has been shown to be the important known cause of death in children in Bangladesh[8].

Pneumonia is the leading cause of death for children under 5 years of age in Bangladesh[9]. While *Streptococcus pneumonia* is likely the cause of at least 30% of episodes of severe pneumonia, *S. pneumoniae* is not widely recognized as a priority public health problem in Bangladesh. Blood cultures are not done routinely, so the importance of pneumococcus may not be consistently recognized.[10] With the advent and availability of a highly effective vaccine to prevent pneumococcal diseases, this knowledge gap will serve as a substantial barrier to optimal use of this prevention mortality. Therefore, the study aimed to explore the burden of illness related to *Streptococcus pneumoniae* in a tertiary level hospital among under 5 children. The findings would address the knowledge gap and provide a means to define the impact of *Streptococcus pneumoniae* in ways that will be important to decision makers and stakeholders

METHODOLOGY

The present study utilized a descriptive, cross-sectional research design involving self-report questionnaires (focused on socio-demographic information, location of kitchen, physical and nature of fuel using for cooking) filled by the attendants of the patients. Since different medical and demographic terms can have multiple-layered meanings - operational definition of important research variables like Pneumonia, Severe Pneumonia, Meningitis, Sepsis, Illness episode, Illiteracy, Monthly family income was postulated.

Under 5 children who were admitted in Dhaka Shishu Hospital with respiratory infections were selected as the study population by using purposive sampling mechanism. The researchers of the study explained the purpose of the study to the parents of the admitted children and asked them to join into the study. Parents of 101 children with respiratory infections were agreed to participate in the study and, therefore, the purposive sampling strategy was utilized to select the sample for this study. The period of data collect was between March 2006 and June 2006. For collecting data, the researchers had used a structured questionnaire and a structured check list. The questionnaire had no open-ended question and face to face interview with parents were done. In order to check out the effectiveness of the questionnaire a pre-testing of the questionnaire was conducted. Blood and Cerebrospinal Fluid (CSF) culture were done to confirm the streptococcal infection.

Apart from using descriptive statistics, *t*- test was used to see whether the mean difference between two groups (Pneumococcal and non-pneumococcal disease patients) was statistically significant or not. The differences were considered as significant at a p value of <0.05. The SPSS-12 software was used for the analysis of the data. Tables were prepared by using the Microsoft Windows 2007 software.

RESULTS

A total of 101 children aged under 5 were included in this study. Out of 101 participants around 30% of the sample respondents had Pneumonia, 17% had Severe Pneumonia, 26% had been affected by Meningitis and the rest had been suffering from Sepsis. As per the laboratory findings, 23 children had blood culture positive and 18 children had CSF culture positive. The age distribution of the under 5 children with respiratory infections was very symmetric and the mean age of the children was 27.8 months. The gender distribution of the

under 5 children with respiratory infections was also very symmetric – a depiction that the chosen sample was adequately representative. Around 70% of the mother (of the under 5 children with respiratory infections) was below 25 years of age and for the fathers the representative cluster was between 25-39 years. The occupational distribution of the fathers was very symmetric, even though majority of them belonged to the impoverished segment (around 70% having monthly income of less than taka 5000 per month) and all the mothers were housewives. The distribution of the respondent's number of living children (under 5 years and above 5 years) was very symmetric. Finally, as per the nutritional status, only 25.32% of the children were well nourished.

There was no statistical difference between father's education level and pneumococcal infection between Pneumococcal and Non Pneumococcal group. However, it was evident from the statistical analysis that there was a strong statistical difference between mother's education level and pneumococcal infection between Pneumococcal and Non Pneumococcal group ($p < .05$). Mother's education exerts greater role in preventing children's Pneumonia than the case with other respiratory infections (Table 1).

Table1: Distribution of respondents by level of education

Educational level	Pneumococcal		Non Pneumococcal		P-Value
	Frequency	Percent	Frequency	Percent	
Father					
Illiterate	4	17.4	6	7.7	.163
Had education	19	82.6	72	92.3	
Total	23	100	78	100	
Mother					
Illiterate	8	34.8	12	15.4	.043
Had education	15	65.2	66	84.6	
Total	23	100	78	100	

It was evident from the *t*-test that there were no statistical difference between family income level and pneumococcal infection between Pneumococcal and Non Pneumococcal group. Number of living rooms and pneumococcal infection was also not found to be significant. (Table 2)

Table 2: Distribution of respondents by monthly income and number of living rooms in the household

	Pneumococcal		Non Pneumococcal		P-Value
	Frequency	Percent	Frequency	Percent	
Monthly Family income (BDT)					
Up to 5000	16	69.6	48	61.5	.482
More than 5000	7	30.4	30	28.5	
Total	23	100	78	100	
No. of Living Room					
1 Room	14	60.9	45	57.7	.785
2-3 Rooms	9	39.1	33	42.3	
Total	23	100	78	100	

There was no statistical difference of pneumococcal infection and location of kitchen in the household. However, nature of fuel used for cooking differed among the pneumococcal and non pneumococcal groups. Almost half (47.8%) of the children's family in pneumococcal group used different sources of fuel other than gas where as in non pneumococcal group, 80.8% used gas for household cooking. The statistical test found strong correlation between nature of fuel using for cooking and pneumococcal status among the children ($p= .005$) (Table 3).

Table 3: Distribution of respondents by location of the kitchen and the nature of fuel used for cooking

	Pneumococcal		Non Pneumococcal		P-Value
	Frequency	Percent	Frequency	Percent	
Location of kitchen					
Separate	14	60.9	60	76.9	.257
Inside Home	9	39.1	18	23.1	
Total	23	100	78	100	
Nature of fuel using for cooking					
Gas	12	52.2	63	80.8	.005
Other	11	47.8	15	19.2	
Total	23	100	78	100	

Majority of children who are under weight (≤ 6.0 kg), 13 out of 16 children, were suffering from pneumococcal infection. The mean weight,

weight for age between Pneumococcal and Non Pneumococcal groups found to be statistically significant (Table 6).

Table 4: Distribution and comparison of weight, weight for age between pneumococcal and non-pneumococcal children

	Pneumococcal	Non Pneumococcal	t-value	Df	P-Value
Weight (kg)	n (%)	n (%)			
≤ 6.0	13 (56.5)	3 (3.8)	5.54	99	.001
6.1 - 12.0	7 (30.4)	45 (57.7)			
>12.0	3 (13.1)	30 (38.5)			
Mean ± SD	6.7 ± 3.7	11.2 ± 3.4			
Weight for age (%)					
≤ 60	20 (87.0)	27 (34.6)	4.82	99	.001
>60	3 (13.0)	51 (65.4)			
Mean ± SD	60.9 ± 79.6	79.6±60.9			

The mean age of pneumococcal group was quite low, almost half of non pneumococcal group (15.8 ± 15.1 vs 31.3 ± 17.0) and the difference was statistically significant (p= .001). In case of mean respiratory rate, pneumococcal group had higher respiratory rate than the non pneumococcal group (55.3±9.8 vs 50.8±8.6) and the difference was also statistically significant (p <.05).

Table 5: Distribution and comparison of age and respiratory rate between pneumococcal and pneumococcal children

Age (months)	Pneumococcal (%)	Non Pneumococcal (%)	P-Value
1-11 months	13 (56.5)	9 (11.5)	.001 .036
12-24 months	4 (17.4)	24 (30.8)	
25-36 months	4 (17.4)	15 (19.2)	
37-48 months	1 (4.3)	12 (15.4)	
49-59 months	1 (4.3)	18 (23.1)	
Mean ± SD	15.8 ± 15.1	31.3 ± 17.0	
Respiratory rate (min)	55.3±9.8	50.8±8.6	

DISCUSSION

Streptococcal infection is a problem affecting the hospitalized patients both in many developing countries. In developing countries like Bangladesh no emphasis has yet been given in this field.[10] In the present study, an attempt was made to explore the pattern of pneumonic infections caused by *Streptococcus Pneumonia* in large hospitals of Dhaka city.

Mother's education had been linked up with the reduction of Pneumonia – educational status of the parents should be improved regarding overcrowding, smoke particularly during cooking and the nature of fuel. Greater weight, weight for age plays greater role in preventing children's pneumonia than the case with other respiratory infections. Similarly, higher age and lower respiratory rate plays more significant role in preventing children's Pneumonia than the case with other respiratory infections and vice versa. Therefore, intervention towards improved weight, weight for age and nutritional status under 5 children should be considered at a priority basis. The case management protocol of respiratory infection and pneumonia in particular needs to be implemented more effectively in secondary and primary level hospitals to minimize its burden in tertiary level.

The study was limited to only one tertiary level hospital; the findings may not be generalized for the entire population of Bangladesh. The relatively small sample size and purposeful selection of the study place is expected to produce few biases in the results of the study undertaken. Despite the limitations of this study, the findings will provide opportunities to define burden of pneumococcal diseases more precisely within communities among under 5 children. It will be useful for reliably extrapolating to larger populations within Bangladesh and for comparing with other settings. The findings of this study can, also, be considered as a basis towards tertiary care management of pneumonia to understand the burden of pneumococcal infections among under 5 children.

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