Original Research Article

Epidemiologic pattern of respiratory diseases among hospitalized pediatric patients in Khulna, Bangladesh

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ABSTRACT

Background: High burden of acute respiratory infections (ARIs) with a significant rate of mortality is notable in developing countries including Bangladesh. Despite the frequent reports of ARIs, the exact prevalence and spectrum of ARIs in this country is unknown even at subnational level. The aim of the study was to determine of current spectrum of respiratory diseases of children in Bangladesh.
Methods: The current study analyzed 2993 pediatric patients admitted form June 2019 to January 2020 into Khulna Shishu Hospital, Khulna, Bangladesh using a quantitative interpretative approach.
Results: A total of 1382 patients (46.17%) were admitted because of ARIs and were predominately male children (65.77%). Among different ARIs, hospitalization was mainly due to lower tract respiratory infections (LRTI) and the prevalent cases of ARIs could be classified into undifferentiated ARI (20.92%), pneumonia (14.84%) and LRTI other than pneumonia and bronchitis (9.02%), bronchitis (1.40%). Mortality rate was observed 2.51%, although the highest rate of mortality (65%) was recorded among the infant age groups.
Conclusions: This study showed the risk group and risk factors of developing severity in ARIs leading to a high hospitalization rate due to ARIs among children in Bangladesh. More such studies at national level are required to develop proper combating strategy to decrease the mortality and the morbidity associated with ARIs in the country.

Keywords: Respiratory diseases, Acute respiratory infection, Lower tract respiratory infection, Pneumonia, Bronchitis, Khulna

INTRODUCTION

Child mortality is a global public health concern, while approximately 8.1 million deaths are reported every year among children below the age of 5 years including 40% of deaths occurring within the first 23 days of birth.[1] According to a report by UNICEF, the death rate per thousand is about 37 among live-born term neonates.[2] This scenario is even worse for children from developing countries like Bangladesh, where about 10% of the total population is under five years old and most of them inflicted with diverse health related issues.[3] Besides, the highest percentages of morbidities, the children of Bangladesh were attributed to different respiratory diseases, among which acute respiratory infection (ARI) is one of the prevalent diseases causing the highest morbidity and mortality.[2,4] Also, ARI is estimated as the prevalent cause of infant death in the country, causing about 25% of child mortality alone.[5] ARI affects both upper and lower parts of the respiratory system and can be categorized based on the part of the respiratory system affected into either the upper respiratory tract infection (URI) denoting acute infections of airways from the nostrils to the larynx including paranasal sinuses and the middle ear, or the lower respiratory tract infection (LRI) involving infections of trachea up to bronchioles and alveoli. LRI includes different severe forms of respiratory diseases such as life-threatening pneumonia and bronchitis.[6]

Evidence suggests that in 1997-2001, ARIs including pneumonia were major contributors to hospitalization (40%) among under-five children at primary public care facilities in rural Bangladesh.[7] On the other hand, other self-limiting respiratory diseases raise concerns over decreased work capacity and even the development of complications leading to the increased risk of early death.[5] Children in rural areas of the country were reported to experience the devastating effects of ARI, as the awareness among the guardians about the symptoms and the management are below standard.[8,9]

However, high ARI burdens were reported in several sub-national studies from other South Asian countries including India (59.1% in 2013-2014, Puducherry), while the infection rate was higher for Bangladesh (72% in 2001, urban slums of Dhaka). Also, ARI-attributed mortality rates were found to be high in Nepal (20-30%) and Pakistan (20-30%).[10-13] While despite the notable improvement in achieving Millennium Development Goals (MDGs) by reducing the under-five mortality rate by 74% from 1990 to 2015, the prevalence of ARIs among children under-five years of age in Bangladesh was reported 39.8 per 1000 children. [14,15] A report of ICDDR, B 2003, estimated that ARIs including pneumonia still remain the major causes of morbidity among the children in Bangladesh. On the other hand, lower respiratory infections accounted for 2.74 million deaths in 2015, making LRTI the fifth leading cause of death and the leading infectious cause of death worldwide.[14] Among LRTIs, pneumonia and especially bronchitis are prevalent among children with clinical symptoms of LRTI characterized by coughing and breathing rapidly.[16] About 3 million deaths of young children and infants were reported because of pneumonia and lower respiratory tract infection in 2012, while in 2000, about 156 million episodes of clinical pneumonia were recorded, among which 8.7% required hospitalization.[17,18] Although the Global burden of diseases study (2020) reported a significant decrease in the LRTI incidences, the current rate is far from satisfactory leading to high child mortality.

So, considering the impacts of ARI on children health in Bangladesh, this study was designed to determine the current detailed spectrum of respiratory diseases among hospitalized children in Khulna municipality to analyze the ARI burden with possible morbidity and mortality in the country.

METHODS

Study design

This 7-months retrospective surveillance study included Khulna Shishu Hospital, the renowned pediatrics hospital in Khulna city, Bangladesh. The clinical data records of pediatric patients admitted to the hospital from 1 June 2019 to 31 January 2020 were collected for analysis. The data included information about the disease diagnosed, outcome (death/recovery) as well as the demographic characteristics (age, gender, etc).

Inclusion criteria

Collected data were processed and sorted according to different demographic characteristics of patients including gender, age, and disease. Only the patients data regarding respiratory diseases were selected for analysis. The collecting data were categorized into five age groups according to WHO guidelines: neonate (0-30 days of age), infant (1 month-2 years of age), young child (2-6 years of age), child (6-12 years of age) and adolescent (12-18 years of age). The mortality rate along with other factors were analyzed to determine the relationship between respiratory diseases and its demographic characteristics of patients.

Exclusion criteria

Patients with symptom rather than respiratory diseases were excluded from this study. Apart from this no exclusion criteria were considered for this study.

Data analysis

The data of the patients were collected from the hospital and entered into the Microsoft excel. Different analysis was performed with the same software.

RESULTS

During the 7 months study period, a total of 2993 pediatric patients were admitted after being affected by more than 70 different diseases including both respiratory and non-respiratory diseases. Of those, respiratory diseases were the most frequent being present in 1382 out of 2993 cases (46.17%).

Data showed that the age of the patients admitted ranged from 1 hour to 13 years old which were classified into five major groups according to WHO. Among those age groups, the majority of the patients fell under the category of infants (58.90%) followed by neonate (18.51%) and young child (15.68%) (Table 1). Besides, male children were more frequently affected than female children (1922 males vs 1071 females) (Table 1). Thirty-seven children died of respiratory diseases which was the single major cause of death among a total of 75 deaths after hospitalization. Pneumonia was the major cause of mortality (37.33%) followed by ARI and LRTI (8.00% and 4.00% respectively) (Table 1). Among all those respiratory diseases, ARI had the highest number of incidents (626) which is followed by pneumonia (444), LRTI (270) and bronchitis (44). Infant age group was dominant and in all respiratory diseases had the highest number of cases. Neonates were mostly found to be affected by pneumonia whereas, in case of ARI, young child had the significant number of patients after infants. For rest of the two diseases LRTI and bronchitis, only a slight difference in the number of patients were recorded between neonates

and young child. However, last two age groups child and adolescent, had the lowest possible number of patients and even in case like bronchitis, no patients were found from these age ranges (Figure 1). In each of the respiratory related cases, male patients outnumbered their counterparts. A sum of 411 male patients were found to be affected by respiratory diseases compared to 215 females. The number of male patients were almost double than the female patients in all respiratory diseases excluding the LRTI.

Table 1: Demographic characteristics of hospitalized patients.

| Demographic characteristics		Hospital-admitted patients		Respiratory diseases (%)
	Group	Individuals	Percentage (%)	
Gender	Male	1922	64	909/1922 (47.29)
	Female	1071	36	473/1071 (44.16)
Age	Neonate (0-30 days)	554	18.51	218/554 (39.35)
	Infant (1 month-2 years)	1763	58.90	1007/1763 (57.12)
	Young child (2-6 years)	469	15.68	124/469 (26.44)
	Child (6-12 years)	183	6.11	31/183 (16.94)
	Adolescent (12-18 years)	24	0.80	2/24 (8.83)
Outcome	Recovered	2918	97.49	1347
	Deaths	75	2.51	37
	a. ARI (undifferentiated)	6	8	
	b. Pneumonia	28	37.33	
	c. LRTI (other than pneumonia and bronchitis)	3	4	
	d. Bronchitis	0	0	
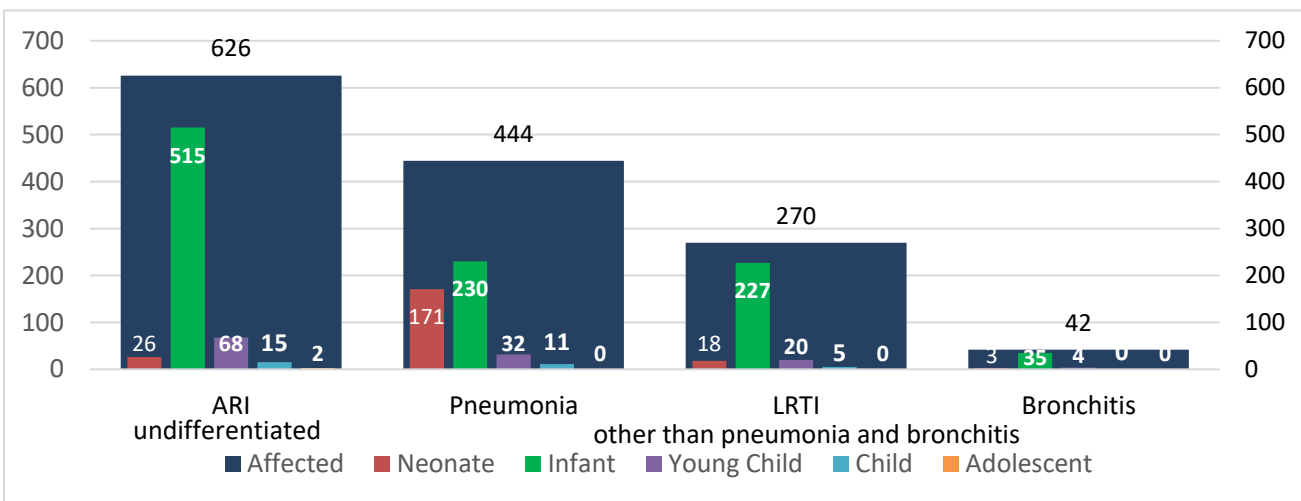
Figure 1: Disease spectrum showing the frequencies of different respiratory diseases among the hospital admitted children.
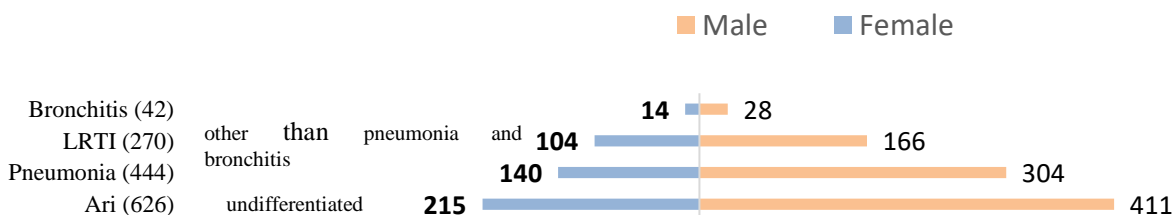

Figure 2: Gender predisposition to respiratory diseases.

Figure 1 depicts that ARI undifferentiated was the most prevalent of all respiratory diseases followed by pneumonia, LRTI other than pneumonia and bronchitis and bronchitis respectively. Infants were the most susceptible to these respiratory diseases. In case of ARI undifferentiated and LRTI other than pneumonia and bronchitis, young children were the 2nd most prevalent groups, while pneumonia affected neonates mostly compared to young children.

Figure 2 depicts gender predisposition to respiratory diseases among hospitalized pediatric patients. Hospitalized children were prevalently male compared to female children (909 males vs 473 females). Also, this gender ratio was valid for each respiratory disease category. Besides, the incidences among male patients were almost two times higher than female patients except for LRTI (other than pneumonia and bronchitis).

DISCUSSION

This retrospective hospital-based surveillance study was one of the first studies to evaluate the burden of pediatric respiratory diseases in Bangladesh. This study showed that the hospitalization rate was highest for respiratory diseases among children in Khulna, while ARI alone contributed for 20.92% of the total pediatric patients being admitted during the time frame. Among the hospitalized children, infant age group was prevalent. Besides, this age group was most susceptible to all four categories of the respiratory diseases in this study. Other respiratory diseases such as pneumonia, LRTI and bronchitis also prevailed at higher incidences. But this inclination to respiratory diseases might be due to the period of time when the data was collected, as seasonal variation is considered a potential predictor of the respiratory disease prevalence.[19] Several studies from Bangladesh and other developing countries reported a surge in the respiratory disease frequency during winter and monsoon season, likewise the data we collected during winter. [8,20-22] However, approximately 3.5% of the global disease burden is caused by ARIs, while it has previously been found to cause up to 30% of pediatric admissions in developing countries including Bangladesh.[18,23,24] Besides, the prevalence of ARI among the children below the age of five was reported 28-39.3% in Malaysia, while this study reported 20.92% ARI cases among all age groups of pediatric patients responsible for 40.94% of the total respiratory diseases.[25] Besides, male predisposition to ARI was suggested previously, which was also consistent with our findings.[9] We found approximately 1% of death diagnosed due to ARI. In our study, we found around 9.02% of LRTI diseases among all kind of respiratory diseases while another study showed that the LRTI occurred in children only 4% and the highest incidence of observation with LRTI in infants those are below the age of 6 months. During their study period they were found 2 deaths caused by LRTI among the 27 admitted children.[8] Similarly, we also found that the highest prevalence of this diseases mostly occurred among the infants and around

4.0% of death which was the lowest percentage of death caused by LRTI. A study conducted among 3484 children those were clinically diagnosed by respiratory disorder showed that the percentage of bronchitis and pneumonia patients were 21.4% and 11.5% respectively while in our study this percentage showed different figure that about 1.40% and 14.84% respectively.[26] Most notably, we did not found any death caused by bronchitis during the survey period.

On the contrary, in our study the death outcomes were found in significantly higher amount of pneumonia for other respiratory diseases for instance ARI and LRTI. In terms of mortality, pneumonia ranked first within the period of time. Not only for this region but also around the globe, it is responsible for higher amount of child death. In India, it causes approximately 28% death among the age of 1-15 month, while in this study, the highest percentage of death in child those age group ranged from 6 to 12 years and it was the second highest prevalence among respiratory diseases according to the number of patients.[27]

It was reported that ample of different socio-economic conditions and other factors such as age of the child, household income, household condition, parental education, and other factors are associated with diseases outcome.[28] In case of this study, factors like age and gender were also significant. Male children were found to be more susceptible to these infectious common diseases as they had more access to outside of their home and mixing up with other children than their counterparts. Age was another most significant factor. Children from 1 month to 2 years, were found to be more susceptible to all respiratory diseases and lower amount of disease incidents were witnessed among the older patients as their immune system were more developed than their younger counterparts.

With a mission of strengthening the health system in Bangladesh, primary and secondary health care services were made more available in rural and urban areas.[29] Despite this notable improvement, skilled worker in medical sector and seeking care from health facilities remain low (42%).[30] It has been expected that medical facilities will be increased as well as different mass awareness programs will be organized from time to time so that people can be more conscious about childhood diseases and the overall child mortality and morbidity rate can be reduced.

Limitations

The limitation of this study that we did not had any knowledge about the microbiological profile of the patients. So, the etiological agents of the above diseases may show a great impact on the prevalence of respiratory diseases. Most of the bacterial and viral agents are major risk factor to cause above diseases. One the other hand patients who had other diseases and low weight are mostly vulnerable for theses respiratory disease. So, the patients'

medical history also makes great impact on respiratory diseases prevalence that are rarely found in this study.

CONCLUSION

Child mortality and morbidity has already become a major health concern globally. Being immunologically more vulnerable to infectious diseases, children in developing countries are at higher risk of diverse infections, especially the respiratory diseases because of their mode of transmission. Developing countries including Bangladesh are struggling to cope with this child health risk, more surveillance and epidemiological studies should be encouraged to identify the risk factors and thus to devise an effective prevention and treatment strategy. Different health related program based on the improvement of child health should also take into account. Air pollution is also a major issue in response to respiratory diseases so everyone should aware to minimize this pollution as well as other factor to mitigate these diseases prevalence so that we can make ensure to have a healthy generation in future.

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