Original Research Article

Modifiable risk factors for acute lower respiratory tract infections in hospital admitted children between 2 months to 5 years of age

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Abstract

Introduction: Acute respiratory infections (ARI) are known to cause morbidity and mortality from time immemorial. Acute respiratory infections (ARI) are the most important single cause of global burden of disease in young children and the largest single cause of mortality. **Objectives:** 1.To identify various modifiable risk factors for acute lower respiratory tract infections (ALRI) in children aged 2 months to 5 years of age. 2.To identify the type of acute lower respiratory tract infections (ALRI) in hospitalized children between 2 months to 5 years of age. **Methodology:** A hospital-based Case-Control Study was conducted between July 2012 to June 2013 in Department of Pediatrics, Assam Medical College & Hospital, Dibrugarh among 300 cases and 300 controls. **Results:** Among Socio demographic profile Parents illiteracy, incomplete immunization for age, overcrowding and family history of ARI. were significant independent risk factors for ALRI. Among nutritional risk factors low birth weight, lack of breast feeding, anemia and malnutrition were significant independent risk factors for ALRI. Among environmental risk factors absence of separate kitchen was significant independent risk factor for ALRI. **Conclusion:** The independent risk factors for ALRI are parental illiteracy, lack of immunization, and overcrowding, family history of ARI, low birth weight, lack of breast feeding, anemia, malnutrition and absence of separate kitchen.

Key words: ALRI, AURI, Acute respiratory infections, Modifiable Risk factors

Introduction

Every year Acute Respiratory Infection in young children is responsible for an estimated 3.9 million death worldwide. About 90% of ARI deaths are due to pneumonia which is usually bacterial in origin. The incidence of ARI is similar in developed and developing countries. However incidence of pneumonia in developed countries may be as low as 3-4 per cent, its incidence in developing countries range between 20 to 30 per cent. This difference is due to high prevalence of malnutrition, low birth weight and indoor air pollution in developing countries[1].

In India, in the states and districts with high infant and child mortality rates, ARI is one of the major causes of death. Hospital records from states with high infant mortality rates show that up to 13% of inpatient deaths in pediatric wards are due to ARI. The proportion of death due to ARI in the community is much higher as many children die at home [2]. The reason for high case fatality may be that children are either not brought to the hospitals or brought too late. Various studies have shown association between various risk factors and increased occurrence of ALRI the risk factors involved are low birth weight, indoor air pollution, lack of breast feeding, incomplete immunization, overcrowding, under nutrition, lack of maternal education, male sex, anemia, pre term delivery, increased birth order, and vitamin A deficiency [3].

Many of these risk factors are amenable to corrective measures. Therefore, knowledge of these risk factors related to acquisition of ALRI will help in prevention, through effective health education of the community and appropriate initiatives taken and will definitely reduce the burden of disease to the community. Very few steps have been taken in this part of country to reduce the modifiable risk factors associated with acute lower respiratory tract infection in children and very few studies have been taken in this regard.We,

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therefore, undertook this study to identify the modifiable risk factors for ALRI to help in prevention of ALRI through effective health education of the community.

Objectives

1. To identify various modifiable risk factors for acute lower respiratory tract infections (ALRI) in children aged 2 months to 5 years of age.

2. To identify the type of acute lower respiratory tract infections (ALRI) in hospitalized children between 2 months to 5 years of age.

Methodology

The present hospital-based case-control study was conducted in Department of Pediatrics, Assam Medical College & Hospital, Dibrugarh. Three hundred children between 2 months to 5 years of age who were admitted with clinical diagnosis of ALRI as per WHO criteria from July 2012 to June 2013 were taken as cases.

Three hundred controls included in the study were age and sex matched healthy children attending immunization clinic during the study period for immunization. Approval for study was passed from the Institutional Ethics Committee. Informed consent was taken by the parents/ guardians of both cases and controls before collecting data.

Inclusion criteria: Children with ALRI from 2 months to 60 months.

Exclusion criteria

1. Children less than 2 months and more than 60 months were excluded.
2. Children with a clinical diagnosis of Bronchial Asthma.
3. Children with any underlying chronic illnesses like tuberculosis, congenital heart disease.

For both cases & controls a detailed history and physical examination was done according to a pre-designed Proforma to elicit various potential modifiable risk factors for ALRI.

Modifiable risk factors were divided into sociodemographic, nutritional and environmental risk factors. Classification of ALRI was done based on severity of ALRI into pneumonia, severe pneumonia and very severe pneumonia.

A detailed history of relevant symptoms and past history of similar complaints was taken. Immunization history was elicited from parents and was verified by checking the documents wherever available.

Socioeconomic status was recorded according to modified kuppuswamy scale of social classification.

Birth weight of child was recorded and history of breastfeeding and age of starting of complementary feeding was recorded. Dietary intake of child prior to current illness was calculated by 24-hour dietary recall method.

History of smoking by various family members and mode of lighting, and cooking fuel used was recorded. A detailed examination of each child was done. Respiratory rate and heart rate were measured for 1 minute, when the child was quiet.

A detailed anthropometry was done and malnutrition was graded according to Indian Academy of Pediatrics Classification. Child was examined for pallor. Signs of vitamin A deficiency were recorded.

Socio-demographic variables: Family History of Respiratory Tract Infection in preceding two weeks.

Parental illiteracy, Immunization Status, and Socio-economic status: as per Modified Kuppuswamy Scale of social classification [4].

Nutritional variables: Low Birth Weight, Malnutrition, Lack of Breast Feeding, Anemia, Signs of Vitamin A deficiency.

Environmental factors: Family History of Smoking, Type of Fuel Used, mode of lighting, separate kitchen

Statistical analysis: Data was recorded on a predesigned proforma and managed on excel spread sheet. Association of each of the categorical variables with ALRI was assessed by univariate logistic regression and variables showing statistically significant association were considered as potential risk factors for ALRI. Only variables that were found to be significantly associated with ALRI in univariate analysis at 5% level of significance were included in the multiple logistic regression model to identify the factors independently associated with ALRI.

Data analysis was performed using SPSS 16.0 software. In this study p value less than 0.05 was considered as statistically significant.

Results

In our study majority of children were infants with their age distribution comparable between cases and controls. 187 (62.33%) cases and 194 (64.67%) controls were infants between 2-12 months of age, 80 (26.67%) cases and 87 (29%) controls were children between 12-36 months of age and 33 (11%)cases and 19 (6.33%) controls between 36-60 months of age.179 (59.67%) of cases and 171 (57%) of controls were males while 121 (40.33%) cases and 129 (43%) of controls were females.

In our study pneumonia was present in 47 (15.67%) cases, severe pneumonia in 209 (69.67%) cases, and very severe pneumonia in 42 (14%) cases. Table 1

Table-1: Clinical diagnosis.

Clinical Diagnosis	ALRI Cases	
	number	***(%)***
Pneumonia	47	15.67
Severe Pneumonia	209	69.67
Very Sever Pneumonia	42	14.00
Total	**300**	**100.00**

Socio-demographic variables: Family history of acute respiratory infection was present in 34 (11.33%) cases as compared to 12 (4%) controls which was highly significant (OR 3.07, p <0.001). In our study 181 (60.33%) mothers were illiterate in cases as compared to 62 (20.67%) in control group which was found to be highly significant (OR 5.84, p < 0.001).

In our study 183 (61%) fathers were illiterate in cases as compared to 58 (19.33%) in control group which was found to be highly significant (OR 6.53, p value < 0.001).

Incomplete immunization for age was associated with 127 (42.33%) cases as compared to 39 (13%) controls which was highly significant (OR: 4.98, p <0.001).

Overcrowding was associated with 218 (72.67%) cases as compared to 106 (35.33%) controls which was highly significant (OR: 4.87, p < 0.001)
We found 283 (94.33%) cases were from upper lower and lower class as compared to 71 (23.66%) controls which was highly significant (OR 53.69 , p <0.001).

Nutritional variables: Low birth weight was associated with 89 (29.67%) cases as compared to 28 (9.33%)controls which was highly significant (OR 4.38 p <0.001). birth weight ≥ 2.5 kg was present in 191 (63.67%) cases as compared to 263 (87.67%) controls. In our study birth weight of 20 (6.67%) cases and 9 (3%) controls was not known and were excluded from analysis. Breast feeding for less than 4 months was given to 59 (19.67%) of cases as compared to 18 (6%) of controls which was highly significant (OR 3.94, p < 0.001). Breast feeding for more than 4 months was given to 162 (54%) cases as compared to 190 (63.33%) controls. Breast was continued in 79 (26.33%) cases of less than 4 months of age as compared to 92 (30.67%) controls and was excluded from analysis.

Anemia was present in 193 (64.33%) cases as compared to 31 (10.33%) controls which was highly significant (OR 15.65, P < 0.001).
Presence of malnutrition in ALRI cases was found to be highly significant (OR 16.32, p <0.001). Vitamin A deficiency was present in 10 (3.33%) cases as compared to 3 (1%) controls which was not significant (OR 3.41, p 0.064).

Environmental variables: Kerosene lamp was used for lighting houses of 117 (39%) cases as compared to 85 (28.33%) of controls, electricity was used in houses of 183 (61%) cases as compared to 215 (71.67%) controls. use of kerosene lamp for lighting houses in cases was significantly associated with ALRI (OR 1.62, p 0.006).
Outcome from univariate analysis: In our study vitamin A deficiency was not significantly associated with ALRI in univariate analysis. Table 2

Tabl-2: factor associated with ALRI in univariate logistic regression model.

Parameters	Case *n (%)*	Control *n (%)*	Univariate Logistic Regression	
			OR (95% CI)	p-value
Mother Literacy				
◆ Literate	119 (39.7)	238 (79.3)	Reference	
◆ Illiterate	181 (60.3)	62 (20.7)	5.84 (4.06-8.39)	<0.001
Father Literacy				
◆ Literate	117 (39.0)	242 (80.7)	Reference	
◆ Illiterate	183 (61.0)	58 (19.3)	6.53 (4.51-9.44)	<0.001
Immunization Status of Incomplete Age	172 (57.3)	261 (87.0)	Reference	
◆ Absent	128 (42.7)	39 (13.0)	4.98 (3.31-7.48)	
◆ Present				<0.001
Over crowding				
◆ Absent	82 (27.3)	194 (64.7)	Reference	
◆ Present	218 (72.7)	106 (35.3)	4.87 (3.44-6.88)	<0.001
Socioeconomic Class				
◆ Middle class	17 (5.7)	229 (76.3)	Reference	
◆ Lower class	283 (94.3)	71 (23.7)	53.6 (30.7-93.73)	<0.001
Family History of ALRI				
◆ Absent	266 (88.7)	288 (96.0)	Reference	
◆ Present	34 (11.3)	12 (4.0)	3.07 (1.56-6.05)	0.001
Birth Weight				
◆ < 2.5 kg	89 (29.7)	28 (9.3)	4.38 (2.75-6.96)	<0.001
◆ ≥ 2.5 kg	191 (63.7)	263 (87.7)	Reference	
Breast Feeding				
◆ ≥ 4	162 (54)	190 (63.3)	Reference	
◆ < 4	59 (26.7)	18 (8.7)	3.94 (2.23-6.70)	<0.001
Anemia				
◆ Absent	107 (35.7)	269 (89.7)	Reference	
◆ Present	193 (64.3)	31 (10.3)	15.6 (10.08-24.31)	<0.001
Malnutrition				
◆ Absent	124 (41.3)	276 (92.0)	Reference	
◆ Present	176 (58.7)	24 (8.0)	16.3 (10.14-26.28)	<0.001
Vitamin A Deficiency				
◆ Absent	290 (96.7)	297 (99.0)	Reference	
◆ Present	10 (3.3)	3 (1.0)	3.41 (0.93-12.53)	0.064

Factor associated with ALRI in multiple logistic regression models: The variables showing significant association with ALRI in univariate logistic regression analysis were subjected to multiple logistic regression model to determine the significant independent risk factors for ALRI.

Table 3. In multiple logistic regression mothers illiteracy was significant independent risk factor for ALRI (OR 4.87, P <0.001). Fathers illiteracy was also significant independent risk factor for ALRI (OR 4.88, p <0.001). Other significant sociodemographic independent risk factors were incomplete immunization for age (OR 3.54, p 0.007) and overcrowding (OR 2.54, p 0.017).

Table-3: Factor associated with ALRI in multiple logistic regression model.

Parameters	Multiple Logistic Regression	
	OR (95% CI)	p-value
Mother Literacy: ◆ Literate ◆ Illiterate	 Reference 4.87 (2.14-11.09)	 <0.001
Father Literacy: ◆ Literate ◆ Illiterate	 Reference 4.88 (2.19-10.90)	 <0.001
Immunization Status of Incomplete Age: ◆ Absent ◆ Present	 Reference 3.54 (1.41-8.87)	 0.007
Over crowding: ◆ Absent ◆ Present	 Reference 2.54 (1.18-5.49)	 0.017
Family History of ALRI: ◆ Absent ◆ Present	 Reference 5.72 (1.04-31.36)	 0.045
Birth Weight: ◆ < 2.5 kg ◆ ≥ 2.5 kg	 3.03 (1.09-8.41) Reference	 0.033
Breast Feeding: ◆ <4 ◆ >4	 4.92 (1.72-14.09) Reference	 0.003
Anemia: ◆ Absent ◆ Present	 Reference 16.33 (6.81-39.14)	 <0.001
Malnutrition: ◆ Absent ◆ Present	 Reference 28.17 (9.79-81.07)	 <0.001

Among nutritional risk factors low birth weight (OR 3.03, p 0.033), lack of breast feeding (OR 4.92, p 0.003), anemia (OR 16.33, $p < 0.001$) and malnutrition (OR 28.17, $p < 0.001$) were significant independent risk factors for ALRI.

Discussion

In our study majority of children were infants with their age distribution comparable between two groups (62.33% in cases and 64.67% in controls), which goes in accordance with previous studies. Broor S *et al* (2001) found 62.5% of cases and 66.9% of controls were infants[5]. Savitha *et al* found 62.5% of cases and 74.04% of controls were infants [6].

Immaturity of immune mechanism may be the major reason for infants being susceptible for ALRI.In present study 59.67% of patients were male and 40.33% of patients were female with sex distribution comparable between cases and controls. Broor S *et al* found 73.1% of cases were males and 26.9% of cases were female [5]. Savitha *et al* found 64.42% of cases were male and 35.58% of cases were female [6].

In our study pneumonia was present in 15.67% of cases, severe pneumonia in 69.67% of cases and very severe pneumonia in 14% of cases. Our findings were similar to study conducted by Savita *et al*. They found pneumonia in 12.51% of cases, severe pneumonia in 82.69% of cases and very severe pneumonia in 4.8% of cases [6].

In our study family history of ARI was found to be risk factor for development of ALRI in children. Broor S *et al* also found family history of ARI as risk factor for ALRI in children [5]. They also showed that upper respiratory tract infection in mother and siblings was independent risk factor for ALRI in cases. Savitha *et al* found family history of ARI in 8.6% of cases as compared to none in the controls [6].

Mother's illiteracy was also found to be independent risk factor for ALRI (OR 4.87, p <0.001). Broor S *et al* found 34.8% of mothers were illiterate in cases as compared to 19.6% of controls [5].

Mahalanabis D *et al* also found maternal illiteracy as risk factor for ALRI doing univariate analysis but did not found maternal education as significant risk factor in logistic regression analysis [7]. Savitha*et al* also found mothers illiteracy as risk factor for ALRI, with 63.46% of illiterate mothers in cases as compared to 19.23% in controls which was significant (p 0.001) [6].

Father's illiteracy was also found to be independent risk factor for ALRI (OR 4.88, p < 0.001). Broor S *et al* found 17.4% of fathers were illiterate in cases as compared to 6.1% of controls.

They did not found fathers illiteracy as significant risk factor for ALRI[5]. Mahalanabis D *et al* also found fathers illiteracy as risk factor for ALRI doing univariate analysis but did not found fathers illiteracy as significant risk factor in logistic regression analysis [7]. Savita *et al* also found fathers illiteracy as risk factor for ALRI with 59.62% of illiterate mothers in cases as compared to 25% in controls which was significant (p <0.001)[6].

Incomplete immunization for age was also found to be independent risk factor for ALRI (OR 3.54, p 0.007). Broor S *et al* also found incomplete immunization for age as independent risk factor for ALRI with 70.2% of cases were incompletely immunized for age as compared to 49.2% of controls (OR 2.85 p 0.000)[5].

Fatmi Z *et al* found incomplete immunization for age as risk factor for ALRI using multivariate logistic regression analysis (OR 2.2) [8].

Overcrowding was also found to be independent risk factor for ALRI (OR 2.54, p 0.017) Victoria CG *et al* found that after adjustment of sociodemographic and environmental factors the presence of three or more children under five years of age in household was associated with a 2.5 fold increase in pneumonia mortality. [9] Banerji A *et al* also found overcrowding as risk factor for ALRI (OR 2.5)[10].

In our study patients from lower socioeconomic class were at increased risk of developing ALRI. Mahanabis D *et al* also found low socioeconomic status as risk factor for ALRI [7]. Similar results were found by Savita *et al*who found 59.6% of cases were from lower socioeconomic class as compared to 25% of controls[6].

Cunha AL *et al* also found lower socioeconomic status as risk factors for ALRI even after adjusting for other risk factors like nutritional status and overcrowding [11].

Low birth weight was also found to be independent risk factor for ALRI (OR 3.03, p 0.033). Dharmage SC *et al* also found low birth weight as risk factor for ALRI [12].

In our study lack of exclusive breast feeding was found as risk factor for ALRI. Cesar JA *et al* found that infants who were not breast fed were 17 times more likely than those being breast fed to be admitted to hospital for pneumonia[13].

Broor S *et al* found lack of exclusive breast feeding as risk factor for ALRI with 27.4% of cases had lack of exclusive breast feeding as compared to 13.5% in control group [5].

Banerji A *et al* found that non breast fed children had 3.6 fold increase risk of being admitted for ALRI [10].

Anemia was also found to be independent risk factor for ALRI (OR 16.33, p < 0.001)

Savita *et al* also found anemia as risk factor for ALRI with 76.92% of cases were anemic as compared to 6.7% of controls [6]. Mourad S *et al* found anemia in 32% of cases as compared to 16% of controls[14]. Increased incidence of ALRI in anemic patients may be due to decreased immunity of the host.

Malnutrition was also found to be independent risk factor for ALRI (OR 28.17, P < 0.001). Broor S *et al* found severe malnutrition in 59.9% of cases as compared to 40% of controls [5].

They also found severe malnutrition as independent risk factor for ALRI. Mahalanabis D *et al*found low weight for age was associated with more than threefold increase in risk of pneumonia [7].

Wedid not find Vitamin A deficiency as risk factor for ALRI. Savitha *et al* also did not find vitamin A deficiency as risk factor for ALRI [6].

Use of kerosene lamp for lighting houses was not found as independent risk factor for ALRI (OR 0.40, p 0.075). Savitha *et al* found in their study use of kerosene lamp for lighting houses as risk factor for ALRI with 36.54% of cases had kerosene lamp as mode of lighting in their houses as compared to 2.88% of controls [6].

Conclusion

The present study identifies many modifiable risk factors for ALRI-

1. The significant socio-demographic risk factors are parental illiteracy, lack of immunization, overcrowding, low socioeconomic status and family history of ARI.
2. The significant nutritional variables are low birth weight, lack of breast feeding, anemia and malnutrition.
3. The significant environmental risk factors are use of kerosene lamp for lighting, use of fuel other than LPG for cooking, absence of separate kitchen and family history of smoking.

On multiple logistic regression analysis the independent risk factors for ALRI are parental illiteracy, lack of immunization, overcrowding,low birth weight, lack of breast feeding, anemia, malnutrition.

Effective health education of community, better mother and child health care, reduction of indoor air pollution, promotion of exclusive breast feeding, appropriate nutritional supplements and complete immunization for age will help in deceasing morbidity and mortality from ALRI.

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Contribution details.

	Pintu K Agarwal	Jayaraj Patil
Concept	yes	yes
design	yes	yes
Literature search	yes	
Data acquisition	yes	
Data analysis	yes	yes
Statistical analysis	yes	yes
Manuscript preparation	yes	yes
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Guarantor		yes

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