Original Article

Risk correlates of acute respiratory infections in children under five years of age in slums of Bankura, West Bengal

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ABSTRACT

Background: Acute respiratory infections (ARI) are the leading cause of mortality and morbidity globally in children under five years of age. **Objective**: To find out prevalence and risk factors of ARI among under five children. **Methods**: A population based analytical cross-sectional study was conducted in the urban slums of Bankura, West Bengal on the prevalence of ARI and feeding practices, nutrition and immunization among 152 children under five years of age. **Results**: Overall prevalence of ARI was 44.73 percent; 43.47 percent male and 45.78 percent female were affected with ARI; half of the infants suffered from ARI (51.21%), it was 45.71 percent in 13- 24 months age groups; with increasing age, prevalence of ARI gradually decreased. ARI was seen in 45.76 percent of exclusively breast fed children and 57.89 percent in children with breast feeding less than six months; in bottle fed children ARI prevalence was 47.82 compared to 44.18 percent in breast-fed. Risk of ARI is almost equal in normal participants and undernourished children. ARI cases were seen among 38.73 percent of completely immunization in comparison to 80.00 percent of partially-immunized children (***X^2=4.97, p=0.026)***. **Conclusion**: The present study had identified a high prevalence of ARI in children less than five years of age. In our study population, ARI was significantly associated with immunization status, but not with feeding practices and nutritional status of the child.

Keywords: *Acute respiratory infections, Nutrition, Immunization, Under-five children*

Acute respiratory infections (ARI) are the leading cause of under-five morbidity for an estimated just about two million childhood deaths globally [1]. ARI contributes to one-fifths of all under-five deaths in developing countries which is around 12 million every year [2]. It is estimated that Bangladesh, India, Indonesia, and Nepal together account for 40 percent of the global ARI mortality. ARI is responsible for about 30-50 percent of visits to health facilities and for about 20- 40 percent of admissions to hospitals [3]. In developed countries also physicians frequently encounter ARI in children [4]. In Indian slums, ARI constitutes more than two-third of all childhood illness [5]. Childhood ARI is a significant public health problem in India, although robust epidemiological data are not available on its incidence. Higher risk is seen among young infants, malnourished children, non-exclusively breastfed children, and those with exposure to solid biomass fuel use [6-7].

Studies in developing countries have identified numerous risk factors e.g. overcrowding, nutritional factors, and parental smoking. Because of major differences in living conditions and environmental exposures, the certainty of these factors remains controversial [8-11]. Population in the urban slums is a heterogeneous conglomerate of all caste, creed, and religion with a diversified lifestyle. In addition, the risk factors for childhood ARI is also present in respect to feeding practices, nutritional and immunization status. With this background, the study was undertaken in urban slums of Bankura in West Bengal to elicit the prevalence and risk factors of ARI among under-five children.

METHODS

A population based analytical cross-sectional study was undertaken in the urban slums of Bankura, West Bengal for one month in children under five

years of age. Ward no.15 (of Lokepur) of Bankura Municipality was randomly selected for the study with four slums in the mentioned ward from the list of slums under Bankura Municipality. Two slums (50%) were selected randomly namely Bakultala & Kadmapara slums. Total enumeration of under-five children was done for the above study thus sample size came to 152. Under-five children residing in the selected study area (Bakultala & Kadampara slums) were included in the study. Children with chronic respiratory ailments and whose caregivers did not give consent were excluded from the study.

The data collection tool was an interview schedule that was developed at the institute with the assistance from the faculty members and other experts of Department of Community Medicine, Bankura Sammilani Medical College. The questionnaire was pretested on mothers of 20 under-five children born in the slums other than the selected slums living in same study area to check its comprehensibility and acceptability. By initial translation, back translation, re-translation followed by pilot study, the questionnaire was custom-made for the study. Necessary approval was obtained from Institutional ethical committee. Cooperation from the Anganwadi workers was obtained for recruiting the study participants. The respondents were the caregivers of the children. So, all the caregivers were explained the purpose of the study and were ensured strict confidentiality. Written informed consents were taken from respective caregiver prior to the study.

The principal investigator collected the data using the interview technique by house to house visit in selected slums. Children below five years were surveyed, with an average of seven to eight children per day. Then the pre-designed, pre-tested, semi-structured questionnaire was used to collect the data regarding socio-demographic, economic, feeding practices, morbidity of infant and children. History of ARI at the time of interview or within last two weeks recall period was asked. Socio-economic status (SES) of the family was determined by modified Kuppuswamy's scale, according to price index 2012 [12].

All efforts were made to collect the correct age of the child on the basis of information from caregivers, age of other siblings, birth certificate, Immunization cards/Mother and child protection card and other available medical records. The nutritional status was assessed and graded on the basis of expected weight for age, by plotting in growth chart as classified by Indian Academy of Pediatrics. The weight of the children was measured with a standardized weighing scale (bathroom scale) with minimal clothes and bare foot. When the child was unable to stand, the weight of the child with the caregiver was taken and then the weight of caregiver was deducted to get the weight to nearest 500 g.

Operational Definitions:

Acute respiratory infections: Children with any one or combinations of symptoms and signs like cough and cold, running or blocked nose, sore throat, rapid breathing, noisy breathing, or chest in-drawing. A new episode was taken as one occurring in an individual who had been free of symptoms for at least three consecutive days or more as per WHO (1997) definition of ARI [13].

Immunization status: Immunization status of the participants were obtained from immunization cards and for the evaluation of the immunization status, the criterion described by Narain was followed [14]. Completely immunized children were those who received three doses of each of DPT, OPV and Hepatitis-B vaccine administered between 6 weeks to 9 months at an interval of 4 weeks, plus one dose of BCG, plus one dose of Measles within 1 year of life. Partial immunization was considered in children who received one or more doses but not complete doses of the above mentioned vaccines within one year of their life.

Feeding Practices: Exclusive breast feeding was considered in children who received only breast milk from birth to 6 months of age while top fed children received cow's or other animal's milk or reconstituted infant milk formula after birth.

Nutritional status: The nutritional status was assessed and grading of malnutrition was calculated on the basis of expected weight for age, by plotting in Growth Chart, as classified by Indian Academy of Pediatrics [15] i.e. 1) 80-100% - Normal 2) 71-80% - Grade I 3) 61-70% - Grade II 4) 51-60% - Grade III 5) <50% - Grade IV.

The principal investigator personally contacted health care providers, Anganwadi workers in the

respective ward and appraised the findings of the research with remedial measures. The study findings were also shared with caregivers of study participants, as morbidity of ARI in study population was high so emphasis was given for utilization of locally available services like timely vaccination and regular growth monitoring in Anganwadi Centres as well as early initiation of breast feeding, and exclusive breast feeding for six months. Concept of Baby Friendly Hospital Initiative was also discussed.

The collected data were entered into MS-Excel spread sheets for analysis. The statistical analyses were done using Graph Pad In Stat version 3 software. Percentages and Chi square tests were used in this study to analyze epidemiological variables.

RESULTS

The study population consisted of 152 children aged less than 5 years from a heterogeneous group in terms of caste, occupation, and income. 83 (54.60%) were female while 69 (45.40%) children were male. Majority (26.97%) were in age group of less than one year and highest prevalence of ARI (51.21%) in that group followed by in 13-24 months group (45.71%). Overall prevalence of ARI was 44.73 percent; females affected more (45.78%) than males (43.47%). As the children grew older, the prevalence of ARI gradually decreased **[Table 1].** Children born of the scheduled caste and scheduled tribes were 97.37 percent in our study. Highest number of families belonged to upper-lower socio-economic class according to modified Kuppuswamy scale.

Table 1: Distribution of ARI among study participants

Age in month	Male			Female			Total n (%)	ARI in age group (%)
	Present n (%)	Absent n (%)	Total (%)	Present n (%)	Absent n (%)	Total n (%)		
0-5	4(57.14)	3(42.86)	7(10.14)	5(62.5)	3(37.5)	8(9.64)	15(9.86)	60.00
6-12	5(45.45)	6(54.55)	11(15.94)	7(46.67)	8(53.33)	15(18.08)	26(17.11)	46.15
13-24	7(46.67)	8(53.33)	15(21.74)	9(45.00)	11(55.00)	20(24.09)	35(23.03)	45.71
25-36	3(42.86)	4(57.14)	7(10.15)	4(44.44)	5(55.56)	9(10.85)	16(10.52)	43.75
37-48	8(44.45)	10(55.55)	18(26.08)	9(42.85)	12(57.14)	21(25.30)	39(25.66)	43.58
49-59	3(27.27)	8(72.73)	11(15.95)	4(40.00)	6(60.00)	10(12.04)	21(13.82)	33.33
Total	30(43.47)	39(56.53)	69(100)	38(45.78)	45(54.22)	83(100)	152 (100)	44.73

ARI was seen 45.76 percent in exclusive breast fed children and 57.89 percent in children with breast feeding less than six months (RR=1.05). Again in bottle fed children, ARI was 47.82 percent compared to 44.18 percent in non-bottle fed children (RR=1.08). In the present study, risk of ARI was almost equal in normal and undernourished children. ARI cases were seen among 38.73 percent of completely immunization and 80.00 percent of partially-immunized children (RR=2.06) **[Table 2].**

DISCUSSION

In our study, overall prevalence of ARI was 44.73 percent and children aged less than one year were mostly affected and with increasing age prevalence of ARI gradually decreased. In a study from Delhi, 14.6 percent of children surveyed had an attack of ARI in preceding 2 weeks [16]. A cross-sectional study from Brazil reported that ARI in under-five children was 25.6 percent, among which 76.4 percent had upper and 23.6 percent lower respiratory infections; no associations in respect to nutritional status or passive smoking in the family [17]. A study from Zambia reported that 6.9 percent of under-five children had ARI in the last 2 weeks; age and sex of child were significantly associated [18]. Another study reported that among under-five children prevalence of ARI was 49.8% where hospitalization was required in 7.6% of cases [19]. A comparable study in a rural community in

Bangladesh reported that the prevalence of ARI in the community was 58.7 percent; mean of ARI episodes was less than two/child/year [20]. Another community-based study from rural Delhi reported 12.1 percent prevalence of ARI among under-five children that declined with increasing age; the incidence was 2.5 episodes/child/year [21]. A cross sectional study from Ahmadabad reported that prevalence of ARI was 22 percent. Age group of 4-5 years were mostly affected (47.3%) [22]. A community-based study from Karnataka reported 6.42 episodes of ARI/child/year; the incidence of pneumonia was significantly higher among infants [23]. An epidemiological study carried out in West Tripura reported that the incidence of pneumonia was 16/1000 children in urban area with highest incidence in infancy [24]. A community-based study from Maharashtra reported 3.67 episodes of ARI/child/year [25]. A study conducted by Islam et al showed 26.22 percent prevalence of ARI [26].

Table 2: Correlates of ARI among the study participants

Correlates	ARI Present n (%)	Absent n (%)	Total	Statistical analysis
Exclusive Breast Feeding				
For 6 months	54 (45.76)	64 (54.24)	118	***X2=0.541, df=1, p=0.462***
Less than 6 month	11 (57.89)	8 (42.11)	19	
Bottle Feeding				
Yes	11 (47.82)	12 (52.18)	23	***X2=0.009, df=1, p=0.924***
No	57 (44.18)	72 (55.82)	129	
Immunization Status				
Completely Immunized	55 (38.73)	87 (61.29)	142	***X2=4.97, df=1, p=0.026***
Partially Immunized	8 (80.00)	2 (20.00)	10	
Nutritional status (weight for age)				
Normal	46 (45.54)	55 (54.46)	101	***X2=0.115, df=1, p=0.734***
Underweight	21 (41.17)	30 (58.80)	51	

Among all participants in our study, females were more affected with ARI (45.78%) than males (43.47%). The study from Zambia observed that in the under-five children ARI was significantly associated with sex of child [18]. Bangladesh study reported that ARI in the rural community was 14.9 and 14.4 percent in males and females respectively [20]. Researchers concluded in the community-based study in a rural area of Delhi that among under-fives ARI episodes had no difference between sexes [21]. Female children were affected more with ARI (27.35%) than males (25.69%) [26]. A hospital based study from Delhi reported that sex of the child was not documented to be significant risk factors of ARI [27].

In the present study, ARI was seen 45.76 percent in exclusive breast fed children and 57.89 percent in children with breast feeding less than six months (RR=1.05). In bottle fed children ARI was present in 47.82 percent cases in comparison to 44.18 percent in breast-fed children (RR=1.08). A study conducted by Bipin *et al* showed that occurrence of ARI was higher in children of mothers who continued breast feeding for upto 3 months (40%) as compared to breastfeeding upto 6, 9 and 12 months (29.7%, 27.2% and 30.4% respectively) [28]. Shatha *et al* showed that breastfeeding provides protection against ARI, as formula fed infants were found to have 2.7 times higher risk of ARI [29]. Arifeen *et al* from Bangladesh showed that as compared to exclusive breastfeeding in first few months of life, partial or no breastfeeding was associated with 2.23-fold higher risk of infant deaths resulting from all causes and 2.40- and 3.94-fold higher risk of deaths attributable to ARI and diarrhea, respectively [30]. Maria *et al* in a population-based survey showed that 27 percent of LRTI hospitalizations could have been prevented each month by exclusive breastfeeding and 25 percent by partial breastfeeding [31]. Duijts *et al* conducted a population-based cohort study from fetal life onward in Netherlands and showed that as compared to never-breastfed infants, those who were breastfed exclusively until the age of 4 months and partially thereafter had lower risks of URTI, LRTI, and GI infections until the age of 6 months and of LRTI between 7 and 12 months of age [32]. Etiler *et al* showed that infants who were

breast-fed during first 4 months of life had 1.37, 1.41 and 1.35-fold fewer ARI episodes than those who were fed with formula or cow's milk in addition to breast milk, liquid or solid foods in addition to breast milk, and no breast milk respectively. Also, ARI risk was 1.28-fold higher in infants who weaned before the age of 6 month [33].

Our study reflected that undernourished children had an almost equal risk of ARI as compared to normal participants. The study from Brazil reported that ARI was not associated with the nutritional status in under-five children [17]. Researchers from Bangladesh reported that prevalence of ARI in rural community was higher when malnutrition (63 *vs*. 37%) was a risk correlate [20]. Similar studies from Delhi [21], Ahmadabad [22], West Tripura [24], and Maharashtra [25] also reported significant association of ARI with malnutrition. A study from rural Delhi reported that annual ARI incidence was 3.27 episodes per child in moderate to severely malnourished children. LRTI was more associated with adverse nutritional status than URI [34].

Unimmunized kids were found to be at an increased risk for ARI in our study (RR=2.06). ARI was noted in 80% of unimmunized children which was statistically significant **(α2=4.97, df=1, p=0.026**). This is in collaboration with other studies conducted in Assam [26], Delhi [27] and West Tripura [24]. Bipin *et al* showed direct correlation between immunization status and occurrence of ARI (9.1% in fully immunized vs. 33.7% in unimmunized children [28]. A hospital-based prospective study conducted in Kolkata found that no/partial immunization was a significant risk factor for ARI [35].

ARI is still a public health problem killing millions of our future citizens. The study would be an eye-opener for further research in resource poor health care settings. The risk factors identified would help the planners and program managers to select and plan approaches in curbing the menace in North eastern states. However, due to diversity of slum population and their living conditions in different parts of India, the findings cannot be generalized. Further, it could have been better if other related risk variables like type of family, housing condition such as ventilation, overcrowding, parental current smoking habit, location of kitchen, fuel used for cooking as well as literacy status of parents could be included in the study. Therefore, there is a need to carry out extensive multi centric studies involving both rural and urban areas to identify all the risk factors precipitating ARI, so that preventive program becomes more successful in India.

CONCLUSION

The present study had identified a high prevalence of ARI among under-fives. In our study population, ARI was significantly associated with immunization status, but not with feeding practices and nutritional status of the child. It also pointed out various socio-demographic, nutritional, and environmental modifiable risk factors which can be tackled by effective education of the community.

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REFERENCES

1. Madhi SA, Klugman KP. Acute Respiratory Infections. Chapter 11. In Jamison DT, Feachem RG, Makgoba MW, et al, eds. Acute Respiratory Infections. Disease and Mortality in Sub-Saharan Africa, 2nd Ed. Washington DC: World Bank; 2006. NCBI Bookshelf. [cited 21 May 2014].Available http://www.ncbi.nlm.nih.gov/books/NBK2283/
2. WHO. Division of Child Health and Development: The Management of childhood illness in developing countries; Rationale for an integrated strategy. Geneva: Switzerland: WHO (IMCI information); 1997.
3. Vashishtha VM. Current status of tuberculosis and acute respiratory infections in India. Much more need to be done. Indian Pediatr. 2010;47:88-9.
4. Frese T, Klauss S, Herrmann K, Sandholzer H. Children and adolescents as patients in general practice - The reasons for encounter. J Clin Med Res. 2011;3:177-82.
5. Rahman MM, Shahidullah M. Risk factors for acute respiratory infection among the slums Infants of Dhaka city. Bangladesh Med Res Counc Bull. 2001;27:55-62.
6. Mathew JL, Patwari AK, Gupta P, Shah D, Gera T, Gogia S, *et al.* Acute respiratory infection and pneumonia in India: A systemic review of literature for advocacy and Action: UNICEF-PHFI series on newborn and child health, India. Indian Pediatr. 2011;48:191-218.
7. Dhimal M, Dhakal P, Shrestha N, Baral K, Maskey M. Environmental burden of acute respiratory infection and pneumonia due to indoor smoke in Dhading. J Nepal Health Res Counc. 2010;8:1-4.
8. Azizi BH, Zulkifli HI, Kasim MS. Protective and risk factors for acute respiratory infections in hospitalized

urban Malaysian children: A case control study. Southeast Asian J Trop Med Public Health. 1995;26;280-5.
9. Campbell H, Armstrong JR, Bypass P. Indoor air pollution in developing countries and acute respiratory infection in children. Lancet. 1989;1:1012.
10. Vathanophas K, Sangchai R, Raktham S, Pariyanonda A, Thangsuvan J, Bunyaratabhandu P, *et al*. A community-based study of acute respiratory tract infection in Thai children. Rev Infect Dis. 1990;12:S957-65.
11. Weber MW, Milligan P, Hilton S, Lathi G, Whittle H, Mulholland EK *et al*. Risk factors for seven respiratory syncytial virus infection leading to hospital admission in Children in the Western Region of The Gambia. Int J Epiodemiol.1999; 28(1):157-162.
12. Kumar N, Gupta N, Kishore J. Kuppuswamy's socioeconomic scale: updating income ranges for the year 2012. Indian J Public Health. 2012;56(1):103-4.
13. Acute Respiratory Infections and its Control (in Under Five Children). Directorate General of Health Services, National Institute of Communicable Diseases, Government of India, 22-Sham Nath Marg, Delhi 110 054, March 1991.
14. Narain JP. Epidemiology of acute respiratory Infections. Indian J Pediatr. 1987; 54(2):153-60.
15. Ghai OP, Gupta P, Paul VK. Nutrition and macronutrient disorders. 6th ed. Essential Pediatrics. New Delhi: revised reprint;2005:p.101-6.
16. Gupta N, Jain SK, Ratnesh, Chawla U, Hossain S, Venkatesh S. An evaluation of diarrheal Diseases and acute respiratory infections control programmes in a Delhi slum. Indian J Pediatr. 2007;74:471-6.
17. Duarte DM, Botelho C. Clinical profile in children under five year old with acute respiratory tract infections. J Pediatr (Rio J). 2000;76:207-12.
18. Siziya S, Muula AS, Rudatsikira E. Diarrhoea and acute respiratory tract infections prevalence and risk factors among under five children in Iraq in 2000. Ital J Pediatr. 2009;35:8.
19. Botelho C, Correia AL, da silva AM, Macedo AG, Silva CO. Environmental factors and hospitalization of under five children with acute respiratory infection. Cad Saude Publica 2003;19:1771-80.
20. Rahman MM, Rahman AM. Prevalence of acute respiratory tract infection and its risk factors in under five children. Bangladesh Med Res Counc Bull. 1997;23:47-50.
21. Chhabra P, Garg S, Mittal SK, Satyanarayan L, Mehra M, Sharma N. Magnitude of acute respiratory infections in under five. Indian Pediatr. 1993;30:315-9.
22. Prajapati B, Talsania N, Sonaliya KN. A study on prevalence of acute respiratory tract infections (ARI) in under five children in urban and rural communities of Ahmedabad District, Gujarat. Natl J Community Med. 2011;2:255-259.
23. Acharya D, Prasanna KS, Nair S, Rao RS. Acute respiratory infections in children: A community based longitudinal study in south India. Indian J Public Health. 2003;47:7-13.
24. Deb SK. Acute respiratory disease survey in Tripura in case of children below five years of age. J Indian Med Assoc. 1998;96:111-6.
25. Singh MP, Nayar S. Magnitude of acute respiratory infections in under five children. J Commun Dis. 1996;28:273-8.
26. Islam F, Sarma R, Debroy A, Kar S, Pal R. Profiling acute respiratory tract infections in children from Assam, India. J Glob Infect Dis. 2013;5:8-14.
27. Broor S, Pandey RM, Ghosh M, Maitreyi RS, Lodhi R, Singhal T, *et al.* Risk factors for severe acute lower respiratory tract infection in under five children. Indian Pediatr. 2001;38:1361-9.
28. Prajapati B, Talsania N, Lala MK, Sonaliya KN. A study of risk factors of acute respiratory tract infection (ARI) of under five age group in uban and rural communities of Ahmedabad district, Gujarat. Health Line. 2012;3(1):16-20.
29. Al-Sharbatti SS, Al-Jumaa LI. Infant feeding patterns and risk of acute respiratory infections in Baghdad/Iraq. Italian Journal of Public Health. 2012;9(3):7534-9.
30. Arifeen S, Black RE, Antelman G, Baqui A, Caulfield L, Becker S. Exclusive Breastfeeding Reduces Acute Respiratory Infection and Diarrhea Deaths Among Infants in Dhaka Slums. Pediatrics. 2001;108(4):E67.
31. Maria A. Quigley, Yvonne J. Kelly, Sacker A. Breastfeeding and Hospitalization for Diarrheal and Respiratory Infection in the United Kingdom Millennium Cohort Study. Pediatrics. 2007;119(4):e837-42.
32. Liesbeth Duijts, Vincent W. V.Jaddoe, Albert Hofman, Henrie¨ tte A. Moll. Prolonged and Exclusive Breastfeeding Reduces the Risk of Infectious Diseases in Infancy. Pediatrics. 2010;126(1):e18-25.
33. Etiler N, Velipasaoglu S, Aktekin M. Incidence of acute respiratory infections and the relationship with some factors in infancy in Antalya, Turkey. Pediatr Int. 2002;44:64–69.
34. Chhabra P, Garg S, Mittal SK, Chhabra SK. Risk factors for acute respiratory infections in under fives in a rural community. Indian J Matern Child Health. 1997; 8:13-7.
35. Das PK, Saha JB, Basu K, Lahiri S, Sarkar GN. Some clinic-epidemiological aspect of bronchiolitis among infants and young children- A hospital based study. Indian J Public Health 2003; 47:66-71.

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