Prevalence of acute respiratory infections among under five children in a rural area of Kozhikode district, Kerala

Binsu Vijayan¹, Dhilmon T. L.²*, Liaquat Roopesh Johnson²

INTRODUCTION

The world has made substantial gains in child survival over the past two decades. However, progress has been uneven both across and within countries. Today, fewer children less than 5 years of age are dying – 16,000 in 2015 every day compared with 35,000 in 1990. Most child deaths are caused by diseases that are readily preventable or treatable with proven, cost-effective and quality-delivered interventions. Infectious diseases and neonatal complications are responsible for the vast majority of under-five deaths globally. Despite this advancement, major preventable diseases continue to kill young children.¹

Acute respiratory infections (ARI) in young children are responsible for an estimated 3.9 million deaths worldwide every year. About 90 percent of the ARI deaths are due to pneumonia which is usually bacterial in origin. While the 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 percent. This difference is due to high prevalence of malnutrition, low birth weight and indoor air pollution in developing countries.²
It is estimated that at least 300 million episodes of ARI occur in India every year, out of which about 30 to 60 million are moderate to severe ARI. While every 6th child in the world is Indian, every 4th child who dies, comes from India. Hospital records from states with high infant mortality rate 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.

Childhood ARI is thus an important public health problem in India and a multiple of social and environmental factors are linked with ARI morbidity and mortality. Studies in developing countries have identified poverty, overcrowding, low birth weight, poor housing conditions, passive smoking and lack of access to preventive (including immunization) and curative services as risk factors.

ARIs are a major public health problem among children in Kerala. Even though Kerala accounts for only 2.7% of India’s population, 17.5% of total cases of ARI reported in India during 2014 were from Kerala. However, community based surveys for finding out the prevalence and various factors associated with ARI are very few. Knowledge about factors related to ARI in children can contribute to interventions that can reduce the burden of disease. In view of the above, this study was conducted to estimate the prevalence of ARI and study selected factors among the under five children in a rural area of Kozhikode.

**METHODS**

This community based cross sectional study was conducted from June 2015 to June 2016 in Kunnamangalam panchayat of Kozhikode district, which has a population of 38,208. Considering a prevalence of 26.22, relative precision of 20% and design effect of 1.39, the final minimum sample size was calculated to be 375.7

Children from zero to 60 months age residing in the study area for the preceding 6 months in the study area were eligible for inclusion in this study. Those whose caregivers gave written informed consent were included. Eligible children who were unavailable on multiple occasions were excluded. Cluster sampling method was employed, with clusters being at the level of electoral wards. Of the 23 wards in the panchayat, 10 were selected by draw of lots. Cluster size was 40. Within each cluster, systematic random sampling was performed to identify study subjects. Where there were two or more eligible children in a single household, one was selected by draw of lots.

Information regarding ARI episode and certain associated factors like socio demographic factors, family details, birth details, immunization details, environmental factors, morbidity and treatment details were obtained using a pretested semi-structured questionnaire.

For the purpose of this study, ARI was defined as the presence of one or more of the following, with or without fever, in the two weeks preceding the study: cough, cold, running or blocked nose, sore throat, rapid breathing, noisy breathing, ear ache, ear discharge (in all children), stops feeding and or drinking for at least two hours (in children less than 2 months). overcrowding was assessed based on the per capita floor space area of the living room.

The study protocol was approved by the Institutional Research Committee and Institutional Ethics Committee of Government Medical College, Kozhikode. Data were analyzed using SPSS statistical software version 18. The prevalence of under nutrition of children was assessed using z-scores with the help of WHO Anthro software version 3.2.2, by calculating the weight/age (underweight) and height/ age (stunting) and weight/height (wasting). ARI in the study population was measured in terms of prevalence. Bivariate analysis was performed to assess the factors associated with ARI. Logistic regression analysis was used to determine the association of ARI with suspected risk factors.

**RESULTS**

A total of 386 subjects participated in the study, of which 196 (50.8%) were boys and 190 (49.2%) were girls. The mean age of study subjects was 31.9±15.7 months. The 3–4 years age group accounted for the largest proportion (23.8%) of study subjects (Table 1). Hindus constituted the majority 221 (57%), followed by Muslims 159(41%) and Christians 62(16%). According to modified Kuppuswamy socio economic scale, 163 (42.2%) families belonged to lower middle socio economic class, 142 (36.8%) to the upper middle class, 56(14.5%) to the upper lower class and 25 (6.5%) to the upper class families.

| Age (in completed months) | Male (n=196) | Female (n=190) | Total (n=386) |
|---------------------------|-------------|---------------|--------------|
| N (%)                     | N (%)       | N (%)         |
| 0–11                      | 29 (14.8)   | 29 (15.3)     | 58 (15.0)    |
| 12–23                     | 36 (18.4)   | 37 (19.5)     | 73 (18.9)    |
| 24–35                     | 41 (20.9)   | 38 (20.0)     | 79 (20.5)    |
| 36–47                     | 49 (25.0)   | 43 (22.6)     | 92 (23.8)    |
| 48–60                     | 41 (20.9)   | 43 (22.6)     | 84 (21.8)    |

Table 1: Age and gender distribution of the study population.
A larger proportion of children 208 (53.9%) belonged to nuclear families followed by 127 (32.9%) from three generation and the rest 51 (13.2%) from joint families. Parental education status was similar, with 48.6% of fathers and 50.3% of mothers having received a high school education. A large proportion 327 (84.7%) of mothers were home makers. Majority 330 (85.5%) of fathers had studied up to class 10th generation and the rest 51 (13.2%) were illiterate. Overcrowding was present in 92 (23.8%) households. Inadequate ventilation was noted in 164 children (42.5%) households; and an absence of cross-ventilation was noticed in 130 (33.7%). Of the 55 (14.2%) instances where a family member smoked tobacco, 36 (65.4%) study subjects reported smoking inside the house. Only 70 (18.1%) children had pets in their house. Although 368 (95.3%) children had a kitchen inside the house, smoke outlet was not present in the houses of 123 (33.4%) children. LPG (295 (76.5%)) and firewood (91(23.5%)) were the primary cooking fuels. Of the 176 children eligible to attend anganwadi/preschool, only 140 (79.5%) children were enrolled.

The prevalence of ARI in the study population was 31.9% (Figure 1). Male children had a slightly higher prevalence of acute respiratory infection 64(32.7%) compared to females 59 (31.1%). The two commonest symptoms were cold (78%) and cough (56.1%) respectively. Most often (39.8%), children presented with two symptoms of ARI. The Mean (SD) number of episodes of ARI in the preceding 6 months was 2.01 (1.07), while the mean (SD) duration of illness was 4.31 (2.37) days.

The significant socio demographic risk factors were higher age of children, families other than nuclear
families, lower socioeconomic status, mothers who were housewives, higher family size and higher number of siblings (Table 2 and 3).

The significant nutritional risk factors were underweight, stunting, wasting and not receiving Vitamin A supplementation (Table 2). The significant environmental risk factors were smoking by a family member inside the house, overcrowding, absence of smoke outlet, presence of pets, inadequate ventilation and cross ventilation (Table 2).

On logistic regression analysis, younger age group and nuclear family were found to be significant independent protective factors for ARI (Table 4).

Table 3: ARI in relation to age in months, family size and number of siblings.

| Variables           | ARI | t test value | P value |
|---------------------|-----|--------------|---------|
| **Present (Mean±SD)** |     |              |         |
| **Absent (Mean±SD)** |     |              |         |
| **Age in months**   | 36.22±14.19 | 29.93±15.99 | 3.72    | <0.001* |
| **Family size**     | 5.28±1.95 | 4.71±1.63 | 3.03    | 0.003*  |
| **Number of siblings** | 0.90±0.72 | 0.70±0.71 | 2.52    | 0.012*  |

*P value less than 0.05 was considered as significant.

Table 4: Risk factors associated with ARI- multivariate analysis.

| Variables           | Level          | Adjusted odds ratio | 95 % CI    | P value |
|---------------------|----------------|---------------------|------------|---------|
| **Age group**       | <1 year        | 0.48                | 0.26-0.90  | 0.02*   |
|                     | ≥1 year        | 1                   |            |         |
| **Type of family**  | Nuclear        | 0.10                | 0.02-0.60  | 0.01*   |
|                     | Others         | 1                   |            |         |
| **Socioeconomic status** | Upper          | 0.70                | 0.11-4.53  | 0.71    |
|                     | Lower          | 1                   |            |         |
| **Smoking place**   | Inside the house | 3.97               | 0.77–20.51 | 0.10    |
|                     | Outside the house| 1                   |            |         |
| **Underweight**     | Present        | 1.59                | 0.33–7.62  | 0.56    |
|                     | Absent         | 1                   |            |         |
| **Pets**            | Present        | 1.40                | 0.31–6.34  | 0.66    |
|                     | Absent         | 1                   |            |         |
| **Fuel**            | Wood           | 1.13                | 0.97–1.30  | 0.11    |
|                     | LPG            | 1                   |            |         |

*P value less than 0.05 was considered as significant.

DISCUSSION

The overall prevalence of ARI in this study was 31.9%. This is similar to the prevalence of 27% and 26.2% reported by Islam et al and Sharma et al and respectively. However, it is considerably lower than the prevalence of 59.1% reported by Kumar et al from Puducherry. These differences may be explained by differences in timing and duration of the studies. While the present study was conducted over a full calendar year, the study by Kumar was conducted over five winter months. In this study, cold (78%) and cough (56.1%) were the commonest symptoms of ARI. This is consistent with Kumar et al, who also reported the same. However, Bipin et al reported cough as the predominant symptom, followed by nasal discharge. This variation in presentation may be on account of cultural differences in the use of terminology to describe ‘cold’. Unless specifically asked for as a separate symptom, people generally use the term ‘cold’ to describe nasal congestion and discharge. While the present study distinguished between the two terms, it is likely the same is not true of the other study. If so, the predominant symptoms would be cough and cold- the same as in other studies.
Despite a slightly higher prevalence of ARI among male children in this study, the difference was not statistically significant. This is consistent with the findings of Sharma et al and Goel et al, but in contrast to the findings of Islam et al, who reported a higher prevalence of ARI among female children.7,12,14 Three studies all from developing region, also report an association between male sex and ARI, indicating the relationship between sex and ARI requires further investigation.15-17

In this study, ARI was significantly less in nuclear families compared to other types of families, which is in contrast to the findings of Islam et al, where ARI was more in nuclear families.7 The difference is probably on account of the study setting- that study was conducted in slums of Guwahati, and likely a function of overcrowding than family type.

In the present study, mean family size of children with ARI (5.28) was found to be significantly higher compared to family size of children without ARI (4.71). This is consistent with Singh and Nayar, who report that the incidence of ARI is closely associated with higher family size.19 Given that the mean number of siblings is a proxy for family size, it, too was significantly higher in children with ARI compared to children without ARI in our study. Lower socioeconomic status (which is associated with larger family size) was therefore significantly associated with ARI in our study. Similar results were found by Savitha et al and Cunha et al even after adjusting for other risk factors like nutritional status and overcrowding.19,20

CONCLUSION

The prevalence of ARI was 31.9%, with male children having a slightly higher prevalence than female children. Younger age and membership in a nuclear family had a significantly protective influence on occurrence of ARI.

ACKNOWLEDGEMENTS

The authors acknowledge the faculty members of Department of Community Medicine, Government Medical College, Calicut for supporting and guiding to successfully carry out this study. The authors also thank the parents/guardians/caretakers of the children for their active participation in the study and sharing their valuable experiences.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. World Health Organization. Levels and Trends in Child Mortality: Report 2015: Estimates Developed by the UN Inter-Agency Group for Child Mortality Estimation (IGME). Available at: https://www.un.org/en/development/desa/population/publications/mortality/child-mortality-report-2015.asp Accessed on 26 April 2018.
2. Taksande AM, Yeole M. Risk factors of Acute Respiratory Infection (ARI) in under-fives in a rural hospital of Central India. JPNIM. 2015;5(1):e050105.
3. Bipin P, Nitiben Talsania 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. National J Community Med. 2011;2(2):255-9.
4. Temani K, Mayenger A, Bairwa AL. Assessment of prevalence of acute respiratory tract infection and risk factors in under five children in anganwadi of Kota city. Indian J Child Health. 2016;3(3):234-7.
5. Sebastian SR. Epidemiology of acute respiratory infections among under-fives in a rural community of Trivandrum district, Kerala. Int J Community Med Public Health. 2018;5:3459-63.
6. Central Bureau of Health Intelligence, National Health Profile 2015, DGHS, Ministry of Health and Family Welfare, New Delhi. Available at: http://www.cbihdhis.nic.in/writereaddata/mainlinkfile/NHP-2015.pdf Accessed on 2 August 2016.
7. 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.
8. George B. Sample size estimation and power calculation—a guide to biomedical researchers. Pulmon. 2013;15(3):25-34.
9. WHO AnthroPlus for personal computers Manual: Software for assessing growth of the world’s children and adolescents. Geneva: WHO, 2009.
10. Johnson LR, Karunakaran UD. How to Choose the Appropriate Statistical Test Using the Free Program Statistics Open For All ( SOFA ). Ann Community Heal. 2014;2(2):54–62.
11. Guru Raj MS, Shilpa S, Maheswaran R. Revised socio-economic status scale for urban and rural India – Revision for 2015. Available at: http://www.socioeconomica.info/xmlui/bitstream/handle/11171/169/11.%20Gururaj%20e%20al..pdf?sequence=1. Accessed on 26 April 2018.
12. Sharma D, Kuppusamy K, Bhoorasamy A. Prevalence of acute respiratory infections (ari) and their determinants in under five children in urban and rural areas of Kancheepuram district, South India. Annals Trop Med Public Health. 2013;6(5):513.
13. Kumar SG, Majumdar A, Kumar V, Naik BN, Selvaraj K, Balajee K. Prevalence of acute respiratory infection among under-five children in urban and rural areas of puducherry, India. J Natural Sci Biol Med. 2015;6(1):3.
14. Goel K, Ahmad S, Agarwal G, Goel P, Kumar V. A Cross Sectional Study on Prevalence of Acute Respiratory Infections (ARI) in Under- Five
15. Shah N, Ramankutty V, Premila PG, Sathy N. Risk factors for severe pneumonia in children in south Kerala: a hospital-based case-control study. J Tropical Pediatr. 1994;40(4):201-6.
16. Fonseca W, Kirkwood BR, Misago C. Factors related to child care increase the risk of pneumonia among children living in a poor community in northeast Brazil. J Trop Pediatr. 1997;43:123-4.
17. Dharmage SC, Rajapaksa LC, Fernando DN. Risk factors of acute lower respiratory tract infections in children under five years of age. Southeast Asian J Trop Med Public Health. 1996;27:107-10.
18. Singh MP, Nayar S. Magnitude of acute respiratory infections in under five children. J Commun Dis. 1996;28: 273-8.
19. Savitha MR, Nandeeshwara SB, Kumar MP, Raju CK. Modifiable risk factors for acute lower respiratory tract infections. Indian J Pediatrics. 2007;74(5):477-82.
20. Cunha AL. Relationship between acute respiratory infection and malnutrition in children under 5 years of age. Acta Paediatrica. 2000;89(5):608-9.

Cite this article as: Vijayan B, Dhillon TL, Johnson LR. Prevalence of acute respiratory infections among under five children in a rural area of Kozhikode district, Kerala a. Int J Community Med Public Health 2019;6:2666-71.