Original Article

DOI: 10.7860/JCDR/2016/15509.7779

Community Medicine Section

Acute Respiratory Infections among Under-Five Age Group Children at Urban Slums of Gulbarga City: A Longitudinal Study

VINOD K. RAMANI[1], JAYASHREE PATTANKAR[2], SURESH KURALAYANAPALYA PUTTAHONNAPPA[3]

ABSTRACT

Introduction: Among all illness, Acute Respiratory Infections (ARI) account for 30-60% of paediatric outpatient attendance and 20-30% of hospital admissions.

Aim: To study the morbidity pattern of ARI among under-five-age group children and to assess the determinants.

Materials and Methods: A longitudinal cohort study was conducted for a one year period, comprising a cumulative sample of 400 children from 3 urban slums of Gulbarga city. History of nasal discharge, cough, fever, sore throat, breathing difficulty, any discharge from ear alone or in combination, was used in the recognition of an ARI episode. Respiratory rate >60/minute (<2 month infants), >50(2-11 months) and >40(1-5 years) in a child with cough, cold or fever singly or in combination was considered the criteria for recognition of pneumonia.

Results: Out of the 400 surveyed, ARI was detected among 109 children giving an incidence of 27.25%. Among these, Upper Respiratory Tract Infection (URTI) was found among 19.25% and Lower Respiratory Tract Infection (LRTI) among 8%. ARI was observed among 38.04% of infants, 37.84% of 2-3-year-old children, 36.87% of boys, 40.43% of children born to illiterate father's, 35.77% of SES class IV & 40.79% of SES class V, and 41.89% of children with family history of respiratory illness. All these data were found to be statistically significant.

High rates of ARI were also observed among 41.36% of children living in households with firewood fuel usage, 35.04% of children with pets in the household, 34.82% of children with delayed milestones, 53.85% of children with grade IV and 66.67% of children with grade V malnutrition. More episodes occurred during winter months of the year (Oct – Jan). During the follow-up phase of study done on a cohort of 112 children for a period of one year, an attack rate of 3.27 episodes/child/year was observed.

Conclusion: Community education programs should focus on addressing specific issues viz. identification of respiratory illness, simple case management, proper immunization practices, breast feeding of infants & nutrition of child and reduction of domestic air pollution.

Keywords: Attack rate, Risk factor, Under-five children

INTRODUCTION

Among children, Acute Respiratory Infections (ARI) constitutes a leading cause of morbidity and mortality. ARI accounts for 4 million of the 15 million child deaths in the world, annually. Globally, 30-60% of paediatric outpatient attendance and 20-30% of hospital admissions are due to ARI. Chronic illness like deafness, breathing difficulty and their subsequent disability among children, owe their origin to inadequately treated episodes of ARI [1].

In developing countries, close to 50% of all deaths in the community are among under-five age group children (WHO comprise 13% of the general population) [2]. Among under-fives, ARI cause specific mortality in 20-25%. On this basis, one million deaths among under-fives in our Country are due to ARI and most of these occur in infants [3]. Cause specific mortality due to ARI is 10 to 50 times higher in developing countries than developed countries [4]. In our country, 14.3% of deaths during infancy and 15.9% of deaths between 1-5 years of age are due to ARI [5]. In India, pneumonias are estimated to be responsible for 75% of ARI deaths [6].

Most common organisms known to cause ARI among children include bacteria such as *Staphylococcus aureus*, *Streptococcus pyogenes*, *Pneumococci, Haemophilus influenzae* & *Klebsiella pneumonia*. Viruses such as Adeno, Rhino, Corona & Influenza are also the common etiological agents [7]. Infection of any part of the respiratory tract and related structures is termed ARI. All infections <30 days duration are included. However, in case of middle ear infections, the duration of an acute episode is <14 days [1].

In developing countries like India, the triad of malnutrition, diarrheal diseases and ARI are the most common causes of illness and death among under-five age group children. The International consultation on control of ARI, December 1991 reported that there are links with environmental risk factors (viz., air pollution, overcrowding, etc) and childhood risk factors (viz., Low Birth Weight (LBW), malnutrition, etc). Many of these risk factors are amenable to corrective measures [8]. It has been reported that the problem of ARI is more in urban areas, slums in particular, compared to the rural areas [9].

AIM

This study was formulated with the objective of determining ARI morbidity among under-fives in urban slums, and to study the epidemiological factors responsible for same.

MATERIALS AND METHODS

The present study being longitudinal cohort in nature was carried out in a few urban slum areas of Gulbarga city, Karnataka state after obtaining clearance from the Institutional Ethical Review committee. The study population comprised of under-five age group children, and was conducted between the duration of August 2006 & July 2007.

Diagnostic Criteria of ARI:

- History of nasal discharge, cough, fever, sore throat, breathing difficulty, any discharge from ear alone or in combination was used in the recognition of an episode of ARI [7];
- An absence of symptoms for three days or more was the criterion used to differentiate one episode from another [1];

- Respiratory rate >60/minute (among <2 month infants), >50 (2-11 months) and >40 (1-5 years) in a child with cough, cold or fever, singly or in combination are the criteria for recognition of pneumonia [7];
- In a child with pneumonia, presence of chest in-drawing, cyanosis, loss of consciousness, inability to drink water and convulsions suggest severe pneumonia [7].

New births in houses already surveyed were not included in the study. During the house-to-house visit, the womenfolk were orally questioned regarding the same. Also, children who would have migrated or died were not included for the follow-up.

A sample of 400 children were included. This was calculated using the formula (n= 4pq/l^2), where 'p' is the Probability of occurrence (20%), 'q' is the probability of non-occurrence and 'L' is the allowable error (20% of p). The slums were selected using Simple random sampling procedure (Lottery method).

As per census data of 2001 conducted by the Census commissionarate of India [10], under-five children comprise 13% of the total population. Thus a sample of 400 could be derived from a population size of 3,076. Hence 3 slum areas viz., Indiranagar (870 population), Krishnanagar (1400 population) and Keerthinagar (830 population) comprising a total population of 3,100 were selected for the study. The under-five age group children in each of the three areas include 112 at Indiranagar, 182 at Krishnanagar and 108 at Keerthinagar.

Personal visits were made to the houses of all the subjects, children were examined and the parent/care-taker interviewed using the pre-tested proforma. Any subject with an ARI episode was enumerated in the proforma. Details regarding determinants of ARI and information of the episode were documented by the questionnaire method.

Standard case definitions were used for all the variables. Adequate housing status was determined by the presence of separate kitchen in the house, pucca roofing/flooring, and smoke outlets in kitchen and bathroom. Overcrowding was determined by the number of family members and the availability of rooms in the house (1 room for 2 people, 2 rooms for 3 people etc. Children <12 years of age were counted as ½ unit) [7].

For Knowledge, Attitude, Practice scoring, a cumulative score of ≥15 was graded as a 'good' score, followed by a 'fair' score of 9-14 and ≤8 was graded as a 'poor' score. 'Knowledge' was scored by asking questions to the informant regarding identification of symptoms of ARI, 'Attitude' was scored by asking questions on their perceptions regarding the illness and 'Practice' was scored by asking questions on access to healthcare.

Grade of malnutrition was assessed using the Indian Academy of Paediatrics classification [11]. If the observed score on height for age was ≤90% of the expected value, then the child was considered as stunted. For malnourished children, mid-arm circumference was also measured (>13.5 cm: normal, 12.5-13.5 cm: moderate and <12.5 cm: severely malnourished) [11].

For the socio-economic status variable, modified BG Prasad's socio-economic classification was adopted and modified as per All India Consumer Price Index (AICPI) for the month of August 2006 [12].

Follow-up Section of the Study

All the 112 children in Indiranagar slum area were considered for the follow-up. They were followed for one year (Aug 2006 – July 2007), by monthly visits. Given the logistical limitations, following children from the other two slums for a period of one year was not feasible. During each of these visits, mothers/caretakers were enquired about the number of episodes of ARI suffered by the child during the previous months. The mothers/caretakers were earlier trained in the recognition of symptoms of ARI viz., running nose, cough, and documentation of episodes. Thus the seasonal variation of ARI episodes was assessed, and the attack rate was calculated by analysing the annual cumulative incidence.

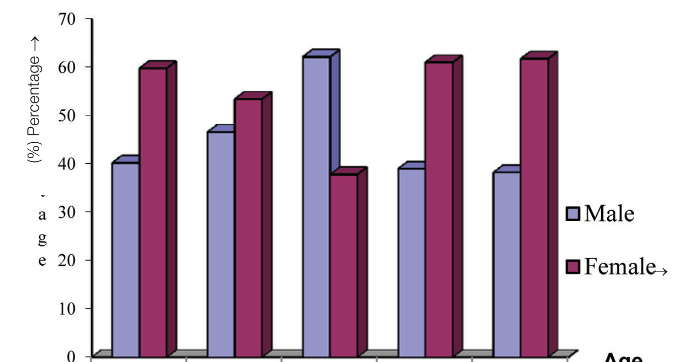
STATISTICAL ANALYSIS

Unadjusted odds ratio has been used to find the strength of relationship between the incidence of ARI and the various study parameters. For a few associations, chi-square test was also used. The statistical software 'Med-Calc' was used for the analysis of data.

RESULTS

The present study was undertaken by selecting 400 children, from three urban slums of Gulbarga city. The areas selected for the present study were characterized by a high rate of illiteracy, poor socioeconomic conditions and delayed utilization of medical facilities.

ARI was detected among 109 children. Hence the incidence rate of ARI in our study was 27.25%. URTI was found in 19.25% of the cases, and LRTI was diagnosed in the remaining 8%.



	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5
Male	40.22	46.58	62.16	38.98	38.24
Female	59.78	53.42	37.84	61.02	61.76

[Table/Fig-1]: Age and Sex-wise distribution of children.

[Table/Fig-1] depicts the sex-wise distribution of children as per each strata of age group.

[Table/Fig-2] lists the variables which show a significant association with the incidence of ARI. The incidence of ARI among the cohort when stratified by age, was found to be high among infants (rate=38.04%, OR=1.94, CI:1.18-3.18) and 2-3 year age group children (rate=37.84%, OR=1.84, CI:1.08-3.14). ARI incidence among boys was 36.87% (OR=2.41, CI:1.54-3.79), and among girls was 19.46% (undermined risk of 0.41). The rate was 40.43% among children born to illiterate father's (OR=1.98, CI:1.06-3.72). Among children from SES class IV and V, the rate was 35.77% & 40.79% respectively (OR: 1.71, CI:1.09-2.68 & OR: 2.17, CI:1.28-3.66).

The rate was found to be significantly high for the following variables: family history of respiratory illness (rate=41.89%), overcrowded households (rate=31.27%), inadequate housing status (rate=31.33%), firewood fuel using families (rate=41.36%), families rearing pets (rate=35.04%) and children with delayed developmental milestones (rate=34.82%). A significantly higher incidence of 53.85% and 66.67% was observed among children with type IV and V grade malnutrition respectively [Table/Fig-2].

Apart from the variables mentioned in [Table/Fig-2], the incidence of ARI showed equivocal association with the following variables: mother's education, order of child birth, number of children in the household, h/o respiratory tract illness, type of family, ventilation, type of flooring, frequency of floor cleaning, usage of kerosene lamps, indoor parental smoking, adequacy of antenatal care,

Sl. No.	Variable		ARI present		ARI absent		Statistics		Column % of the total variable group
			(n)	Row %	(n)	Row %	OR	95% CI	
1	Age	0-1 yr	35	38.04	57	61.96	1.94	1.18 – 3.18	23
		2-3 yr	28	37.84	46	62.16	1.84	1.08 – 3.14	18.5
2	Sex	Male	66	36.87	113	63.13	2.41	1.54 – 3.79	44.75
3	Father's education	Illiterate	19	40.43	28	59.57	1.98	1.06 – 3.72	11.75
4	SES	IV	49	35.77	94	64.23	1.71	1.09 – 2.68	34.25
		V	31	40.79	45	59.21	2.17	1.28 – 3.66	19
5	Family h/o respiratory illness	Disease present	31	41.89	43	58.11	2.21	1.35 – 3.88	18.5
6	Over crowding	Present	81	31.27	178	68.73	1.84	1.13 – 2.99	64.75
7	Housing status	Inadequate	73	31.33	160	68.67	1.66	1.06 – 2.63	58.25
8	Fuel used	Firewood	67	41.36	95	58.64	3.29	2.08 – 5.19	40.5
		LPG	16	9.58	151	90.42	0.18	0.08 – 0.28	41.75
9	Pet rearing	Present	41	35.04	76	64.96	1.71	1.07 – 2.72	29.25
10	Developmental milestones	Delayed	39	34.82	73	65.18	1.66	1.03 – 2.66	28
11	Malnutrition	IV	7	53.85	6	44.15	3.26	1.07 – 9.92	3.25
		V	4	66.67	2	33.33	5.5	1.0 – 30.4	1.5

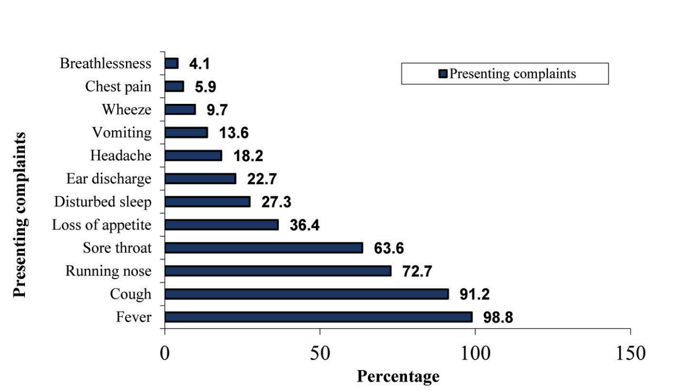
[Table/Fig-2]: Variables showing significant association with ARI incidence.

KAP study	ARI present		ARI absent		Total		OR	95%CI
	No.	%age	No.	%age	No.	%age		
Good (≥15)	5	20.83%	19	79.17%	24	6%	0.68	0.29-1.61
Fair (9-14)	28	24.78%	85	75.22%	113	28.25%	0.83	0.55-1.27
Poor (≤8)	76	28.9%	187	71.2%	263	65.75%	1.28	0.86-1.91
Total	109	27.25%	291	72.75%	400	100%	-	-

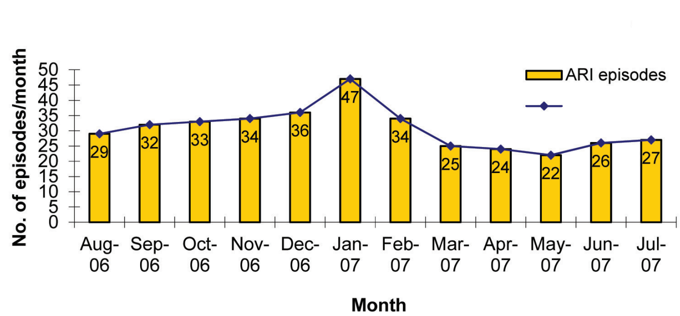
[Table/Fig-3]: Knowledge, Attitude, Practice assessment.
χ^2 = 1.21, p = 3.84, p>0.05.

delivery by cesarean section, pre-lacteal feeds, <6 months duration of exclusive breast feeding, weaning practices, immunization status, at-risk social customs, height for age and general physical examination. They have not been depicted in [Table/Fig-2], as none showed statistical significance. It is evident from [Table/Fig-3] that ARI incidence was 28.9% for children of Parents with a poor KAP score. It was 24.78% and 20.83% for children of Parents with fair and good KAP scores respectively. This association did not show any significance. The distribution of presenting complaints among ARI cases is as depicted in [Table/Fig-4].

A total of 367 episodes were recorded during the annual follow-up of the cohort group (112 children). Thus, an attack rate of 3.27 episodes/child/year was calculated. It is evident from [Table/Fig-5] that monthly episodes of ARI show a distinct seasonal variation. A large number were concentrated during the winter months viz., 33 episodes were recorded during the month of October, 34 in November, 36 in December and 47 during January.



[Table/Fig-4]: Distribution of presenting complaints among ARI cases.



[Table/Fig-5]: Monthly episodes of ARI among the 112 cohort of children.

DISCUSSION

The incidence of ARI and the various socio-demographic factors influencing its causation were studied. [Table/Fig-6]: Salient features of reviewed Literature [1-6,8,9,13-25]. This table provides salient information of relevant literature reviewed for the study.

ARI Incidence

In our study, the incidence of ARI was found to be 27.25%. Our study results could be compared with studies of Mitra NK, Murali madhav S et al., and Board on Science and Technology in International Development (BOSTID) researchers [Table/Fig-6] [1,13,26]. WHO reports that the incidence of ARI is similar in developed and developing countries [7].

In our study, URTI was found in 19.25% of children and LRTI in 8%. The results could be compared with studies viz., Acharya D et al., Chhabra P et al., Zaman K et al., [4,14,15].

WHO reports show the incidence of pneumonia in developing countries ranges from 20% to 30%. However, the range in developed countries was found to be 3% to 5%. BOSTID researchers found the incidence rates of LRI in developing countries ranges from 0.4 to 8.1 episodes per 100 child-weeks [26].

Sl. No.	Author	Year	Sample size	Study period	Periodicity of follow-up	Attack rate	Age group
1	NK Mitra [1]	1997	63	6 m	2 wk interval	Incidence density rate: 19.57(15.6-24.57)/ 100 person months. i.e. 1.17 episodes/child/ 6 months	Under 5 y
2	MP Singh [2]	1990	384	1 y	1 month interval	3.67 episodes/child/yr	Under 5 y
3	VP Reddaiah [3]	1986	5,078	1 y	1 month interval	3.67 episodes /child/yr	Under 5 y
4	Acharya D [4]	1996	91	1 y	2 wk interval	6.42 episodes/child/yr	Under 3 y
5	MR Savitha [5]	2005	104	6 m		Case-Control risk factor study	Under 5 y
6	VP Reddaiah [6]	1987	5,335	1 y	1 month interval	0.29 episodes/child/yr	Under 5 y
7	SK Kapoor [8]	1990	106			3.67 attacks/child/year KAP study	
8	Gupta KB [9]	1990	120	1 y	1 wk interval	2.5 episodes/child/year	Under 5 y
9	Murali madhav S [13]	1989	985		2 wk interval	33 episodes/ 100 under fives	Under 5 y
10	Chhabra P [14]	1990	366	6	2 wk interval	2.5 episodes/child/year	Under 5 y
11	K Zaman [15]	1997	696	1 y	4 day interval	5.5 episodes/child year	Under 5 y
12	A Biswas [16]	1999	112	1 y	2 wk interval	5.7±1.7 episodes/child/yr	Under 5 y
13	Arnold Monto S [17]	1974		6 y		5.5 episodes/child/year	Under 4 y
14	Rohit Banerjee [18]	2003	220	2 y	1 month interval	6.4 episodes/child/yr	Under 1 y
15	Pandey A [19]	1991	200	1 y	2 wk interval	5.9 episodes/child/year	Under 5 y
16	Thelma Tupasi E [20]	1988	~650	2 y	2 wk interval	3-4 episodes/child/ year	Under 5 y
17	BNS Walia [21]	1982	227	2 y	2 wk interval	1.3 episodes/child/year	Under 5 y
18	HN Bashour [22]	1989	1030	6 m	Every week	3.4 episodes/100 child days (~ >10epi / yr)	Under 5 y
19	WHO memo [23]					70-100 episodes/1,000 children	Under 5 y
20	E Fagbule [24]	1994	481	1 y	Once in 2 days	3 episodes/child/ year	2 - 60 m
21	AK Sharma [25]	1999	150	1 y	1 wk interval	6.11 episodes/child/ year	Under 5 y
22	Ramani VK (present study)	2006	400	1 y	Every month	Incidence rate: 27.25%, Attack rate: 3.27 episodes/child/yr	Under 5 y

[Table/Fig-6]: Salient features of reviewed literature [1-6,8,9,13-25]

In our study, the attack rate for the follow-up cohort of children was 3.27 episodes/child/year. This could be compared with studies conducted by Singh MP et al., SK Kapoor et al., Acharya D et al., Zaman K et al., Biswas A et al., Arnold Monto S et al., Banerjee Rohit et al., Pandey A et al., and Tupasi Thelma E et al., [2-4,15-20]. In contrast, a lower attack rate was found in studies conducted by Gupta KB et al., Chhabra P et al., and BNS Walia et al., [10,14,21]. A pneumonia attack rate of 0.29/child/year was reported in Reddaiah VP et al., study [Table/Fig-6] [6].

The higher ARI attack rate in our study could be because of prevalent environmental factors such as air pollution, and the localities being densely populated.

ARI Incidence with Age

In our study, age-specific incidence of ARI decreased with increasing age (except in the 2-3 year age group). The association was significantly higher for infants (OR=1.94) and for 2-3 year age group (OR=1.84) [Table/Fig-2].

ARI incidence was significantly higher among infants in studies viz., Mitra NK, Acharya D et al., Reddaiah et al., Arnold Monto S et al., and Tupasi Thelma E et al., study reported that the risk of acquiring ARI for infants was 1.8 times significantly higher than among 1-4 year children [1,4,6,17,20]. Zaman K et al., study also found that the incidence of URI was highest in 18-23-month-old children, followed by 6-11-month-old infants [15]. Singh MP et al., study showed a high rate for infants and for 4-5 year age groups [2]. A high ARI incidence among 2-3 year age groups was found in Mitra NK and Gupta KB et al., studies [1,9].

BOSTID researchers, Chhabra P et al., HN Bashour et al., and SC Dharmage et al., studies showed a similar pattern of decreasing ARI incidence rate with increasing age of children [14,15,22,27].

Maternal antibodies transmitted to infants may provide a source of protection against some viral agents responsible for ARI, in the first 6 months of life. Concurrent initiation of weaning may predispose nutritional deficiencies and subsequent susceptibility to most infections, including ARI. The high ARI incidence found in children of 2-3 year age group may be due to their greater exposure to environmental factors.

ARI Incidence with Sex

The present study showed a significantly higher susceptibility of boys (OR=2.41) to ARI, as compared with girls (OR=0.41) [Table/Fig-2]. Similar results were found in Reddaiah et al., Chhabra P et al., Arnold Monto S et al., (among <3-year-old), Banerjee Rohit et al., H.N. Bashour et al., and SC Dharmage et al., studies [6,14,17,18,22,27].

The probable reason could be that boys tend to spend more time outside their homes than girls, which makes them susceptible towards contracting infected aerosols from the atmosphere.

On the contrary, Acharya D et al., study reported similar incidence of ARI among both the sexes [4].

ARI incidence with Parental Education

In our study, the incidence of ARI decreased significantly with increasing educational level of the Father [Table/Fig-2]. Although the incidence was similarly high among illiterate mothers, statistical analysis did not show any significance.

In Singh MP et al., study, ARI incidence was found to be associated with maternal literacy status [2]. In Savitha MR et al., study, parental illiteracy was a significant risk factor [5]. On the contrary, higher rates among more educated families were found in Murali Madhav S et al., and Arnold Monto S et al., studies [13,14]. BOSTID researcher showed that the rates of infection are not necessarily higher among children of less educated mothers [26].

The significant association in our study with regard to father's education, could be due to the fact that father's in the Indian society are head's of the household and influence the general living condition of the family and the nutrition of the child. These factors have a direct influence on the morbidity of children.

ARI Incidence with SES

In our study, a significantly higher risk was found in children from SES class IV & V [Table/Fig-2]. Our results could be compared with Mitra NK, Savitha MR et al., Biswas A et al., Tupasi Thelma E et al., and Gregory Gardner et al., studies [1,5,16,20,28]. The association between ARI and lower socio-economic groups (SES class IV & V) could be due to factors which characterize the poor such as inadequate housing facilities, overcrowding, malnutrition, financial constraints, educational limitations and resulting ignorance.

In contrast, Murali madhav S et al., and Arnold Monto S et al., studies showed that mothers in higher socio-economic strata reported a higher incidence of ARI among their children [13,17]. The reason in these studies could be due to more accurate recall by service class mothers and others who were economically better placed.

ARI Incidence with Overcrowding

Presence of overcrowding was a significant risk factor for ARI in our study [Table/Fig-2]. This is important in the Indian context, where the traditional extended family system still exists. In our study population, 82.75% of the families belonged to SES classes III, IV & V. Thus small houses sheltered a large number of family members leading to overcrowding in 64.75% of the households. Our study results could be compared with Savitha MR et al., and SC Dharmage et al., studies [5,27]. In contrast, BOSTID researchers did not show an association for the variable overcrowding [26].

ARI Incidence with Family History of Respiratory Illness

In our study, a significant association was found between ARI incidence and family history of respiratory illness [Table/Fig-2]. Children tend to stay in close proximity to the family members, which makes them vulnerable to contract communicable diseases. Among other literature reviewed, not many have considered this variable.

ARI Incidence with Housing Status

A high incidence was found among children living in houses with inadequate status [Table/Fig-2]. Our results could be compared with Singh MP et al., Acharya D et al., and SC Dharmage et al., studies, all of which show an association between inappropriate housing status and incidence of ARI [2,4,27]. In our study area, 58.25% of the households had inadequate housing status. Absence of separate kitchen in the house, and inadequate kitchen and bathroom smoke outlets generate a lot of toxic products which accumulate indoors. This affects the local defenses of the respiratory tract of children, due to their longer indoor stay and increases their susceptibility to ARI.

ARI Incidence with the Type of Fuel Used

Our study showed a significant association between ARI and usage of firewood as fuel [Table/Fig-2]. However, LPG usage showed an undermined risk of 0.18 which can be compared with Ware JH et al., study [29]. Our study results conform with Singh MP et al., Acharya D et al., Savitha MR et al., Biswas A et al., Banerjee Rohit et al., BNS Walia et al., and studies from Lucknow, India and Nigeria [2,4,5,16,20,21,23,24].

The risk seems to be fairly strong because of the high daily concentrations of pollutants found in such settings and the large amount of time young children spend with their mothers, who would be involved in household cooking.

The health relevance of exposure to both indoor and outdoor pollution is explained by the micro-environmental model [23].

ARI Incidence with Pet Animals

Our study shows a significantly higher incidence of ARI among households with pet animals [Table/Fig-2]. SC Dharmage et al., study conformed similar results [27]. This association could be due to the allergic reaction from inhalation of fur of the pets.

ARI Incidence with Developmental Milestones

A significantly higher incidence was found among children with delayed developmental milestones [Table/Fig-2]. None of the other studies reviewed, addressed this association. Developmental milestones are an indicator of the physical, mental and psychosocial development of the child. Normal milestones are a determinant of the health status of the child. An unhealthy child with delayed milestones becomes susceptible to infections.

ARI Incidence with Under-Nutrition

Our study depicts a significantly higher incidence of ARI among grades IV & V malnourished children [Table/Fig-2]. Similar results were found with Mitra NK, Singh MP et al., Savitha M.R et al., BOSTID group, Biswas A et al., Pandey A et al., and Tupasi Thelma E et al., studies [1,2,5,16,19,20,26].

Thymolymphatic depletion can happen in malnourished children. This causes defective cell mediated immunity which leads to severe gram negative infections and sepsis. Thus the bactericidal action of leucocytes could be affected by the impairment of key enzymes and the qualitative abnormality of immunoglobulins [30].

Knowledge, Attitude, Practice Assessment

In our study, mothers with a poor score on KAP showed a higher incidence (28.9%) of ARI. Incidence was measured at 24.78% for mothers with a fair KAP score and 20.83% for mothers with good score [Table/Fig-3]. This could be compared with Kapoor SK et al., and V Kumar et al., studies [8,31].

In our study, the modern system of medicine was preferred by mothers. This is encouraging because the timely use of antibiotics enables recovery from pneumonia, which is mostly caused by bacteria in our community. Qualified indigenous practitioners may not be able to select and use appropriate allopathic antibiotics in adequate dosage for proper treatment of the disease. Consequently, the outcome may be unfavorable in many childrens [32].

Seasonal Variation of ARI Episodes

Our study shows a distinctly high number of ARI episodes (>30/month) during winter months (Oct-Jan), moderate number (>25/month) during rainy months (Jun-Sep) and an evident decline (>20/month) during the summer months (Feb-May) [Table/Fig-5]. Thus an attack rate of 3.27 episodes/child/year was calculated.

Our study results conform with Singh MP et al., Reddaiah et al., Reddaiah et al., Kapoor et al., Gupta K.B et al., and Zaman K et al., studies. [2,3,6,8,9,15] However, in Fagbule E et al., study, the peak of ARI infection correspond to the rainy and dry seasons of the year [24]. The higher incidence of respiratory infections during winter months may be due to the proliferation of viruses, and low environmental temperature forcing the family members to live indoors and increasing opportunities for the spread of droplet infections.

LIMITATIONS

There could be a possibility of under-enumeration, because episodes that may have occurred in between the monthly visits may not have been reported by mothers.

We used a questionnaire method to assess the risk factors. Hence some misclassification of the exposure may have occurred.

Risk estimation was done using unadjusted odds ratio. Further, the significant factors could have been analysed in a logistic regression model, to specifically quantify the association.

CONCLUSION

The variation in the incidence of ARI reported between ours and other studies could be due to the relative difference in the definition of ARI. In our study, an episode of ARI was defined by the existence of at least one symptom.

Mothers should be explained that cold weather is a supportive causal factor for ARI than a predisposing factor, and also the association with eating banana is a wrong taboo. They should be informed about health promotion measures such as clearing the child's nose, providing warmth in cold weather, and increasing moisture in air (e.g., hanging wet clothes in room) to soothe the upper respiratory passages of the sick child.

Future relevance: Increased global awareness regarding ARI has culminated in the initiation of a standard strategy of case identification using simple clinical signs and symptoms, and empiric antibiotic treatment. These are included in the case management approach promulgated by WHO [23]. Community education programmes should focus on specific issues such as: avoiding restriction of feeds, identification of respiratory illness, access to healthcare, proper immunization practices, hygiene, breast feeding of infants and nutrition of child, and about reducing domestic air pollution.

ACKNOWLEDGEMENTS

Dr Prashanth HL Associate Professor, Department of Community Medicine, Shimoga Institute of Medical sciences, Shivamogga, India.

Dr.Shilu Cherian, Associate Professor, Department of Community Medicine, Sri Devraj Urs Institute of Medical sciences, Kolar, India.

Dr.Umesh S, Assistant Professor, Central Institute of Psychiatry, Ranchi, India.

REFERENCES

[1] Nilanjan MK. A longitudinal study on ARI among rural under fives. *Indian Journal of Community Medicine*. 2001;26:8-11.
[2] Singh MP, Nayar S. Magnitude of Acute Respiratory Infections in under five children. *Journal of Communicable diseases*. 1996;28(4):273-78.
[3] ReddaiahVP, Kapoor SK. Acute respiratory infections in rural underfives. *Indian J Paediatr*. 1988;55:424-26.
[4] Acharya D, et al. Acute respiratory infections in children: A community based longitudinal study in south India. *Indian Journal of Public health*. 2003;47:7-12.
[5] Savitha MR, et al. Modifiable risk factors for acute lower respiratory tract infections in children. *Proceedings from Karnatatka State Paediatrics conference*, 2005 Dec 29-30; Gulbarga, India.
[6] Reddaiah VP, Kapoor SK. Epidemiology of Pneumonia in rural underfives. *Indian J Paediatr*. 1990;57:701-04.
[7] Park K. Textbook of Preventive and Social Medicine. 18th Ed. Jabalpur: Banarsidas bhanot publishers; 2005.350 pp.
[8] Kapoor SK, Reddaiah VP, Murthy GVS. Knowledge, Attitude and Practices regarding Acute Respiratory Infections. *Indian J Paediatr*. 1990;57:533-35.
[9] Gupta KB, Walia BNS. A longitudinal study of morbidity in children in a rural area of Punjab. *Indian J Paediatr*. 1980;47:297-301.
[10] Available at: www.censusindia.gov.in/Census_Data_2001/India_at_glance/broad.aspx, last accessed on 14-12-15.
[11] Ghai OP. Essential Paediatrics. 6th Ed. New Delhi: Dr. O.P. Ghai, 2005.44 pp, 102 pp, 352 pp.
[12] Kumar P. Social classification – need for constant updating. *Indian Journal of Community Medicine*. 1993;18(2):60-61.
[13] Madhav Murali S, et al. A study of two-weekly incidence of ARI in under-five children of rural area of Alwar (Rajasthan). *J Com Dis*. 1990;22(4):243-46.
[14] Chhabra P, et al. Magnitude of acute respiratory infections in underfives. *Indian Paediatrics*. 1993;30:1315-18.
[15] Zaman K, et al. Acute respiratory infections in children: A community based longitudinal study in rural Bangladesh. *Journal of Tropical Paediatrics*. 1997;43:133-36.
[16] Biswas A, et al. Risk factors of Acute respiratory infections in underfives of urban slum community. *Indian J of Public Health*. 1999;43(2):73-75.
[17] Monto Arnold S, Ullman BM. Acute Respiratory Illness in an American Community – The Tecumseh Study. *Journal of American Medical Association*. 1974;227(2):164-69.
[18] Rohit B, et al. The study of frequency, risk factors and protective role of breastfeeding against acute respiratory tract infections in infants under one year of age: a community based, prospective, longitudinal, observational study. *Proceedings from Karnataka State Paediatrics Conference*, 2005 29-30; Gulbarga, India.
[19] Pandey A, Chakraborty AK. Undernutrition, Vitamin A deficiency and ARI morbidity in Underfives. *Indian Journal of Public Health*. 1996;40(1):13-14.
[20] Tupasi Thelma E, et al. Determinants of Morbidity and Mortality due to Acute Respiratory Infections: Implications for Intervention. *The Journal of Infectious Diseases*. 1988;157(4):615-22.
[21] Walia BNS, et al. Socio-economic and ecologic correlates of Acute Respiratory Infections in pre-school children. *Indian Paediatrics*. 1988;25:607-11.
[22] Bashour HN, Webber RH, Marshall TF. A community based study of Acute respiratory infections among preschool children in Syria. *Journal of Tropical Paediatrics*. 1994;40:207-13.
[23] A programme for controlling acute respiratory infections in children: Memorandum from a WHO meeting. *Bulletin of the World Health Organization*. 1984;62(1):47-58.
[24] Fagbule E, et al. Acute Respiratory Infections in Nigerian Children: Prospective Cohort Study of Incidence and Case Management. *Journal of Tropical Paediatrics*. 1994;40:279-82.
[25] Sharma AK, Reddy DCS, Dwivedi RR. Descriptive epidemiology of acute respiratory infections among under five children in an urban slum area. *Indian journal of public health*. 1999;43(4):156-59.
[26] BOSTID researchers. The Epidemiology of Acute Respiratory Tract Infection in Young Children: Comparison of findings from several developing Countries. *Reviews of Infectious Diseases*. 1990;12(8):S870-87.
[27] Dharmage SC, Rajapaksa LC, Fernando DN. Risk factors of acute lower respiratory tract infections in children under five years of age. *Southeast Asian Journal of Tropical Medicine and Public Health.* 1996;27(1):107-10.
[28] Gregory G, Frank AL, Taber LH. Effects of social and family factors on viral respiratory infection and illness in the first year of life. *Journal of Epidemiology and Community Health*. 1984;38:42-48.
[29] Ware JH, et al. Passive smoking, gas cooking, and respiratory health of children living in six cities. *Am Rev Respir Dis*. 1984;129:366-74.
[30] Smith KR, et al. Indoor air pollution in developing countries and acute lower respiratory infections in children. *Thorax*. 2000;55:518-32.
[31] Kumar V, et al. Child care practices in the management of acute respiratory infections. *Indian Paediatrics*. 1984;21:15-20.
[32] Reddy ML, Sadashiv HS. A study of nutritional risk factors and plasma zinc levels in children with acute lower respiratory infections. *International Journal of Pharma and Bio-sciences*. 2014;4(2):120.

PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Department of Community Medicine, Sapthagiri Institute of Medical Sciences, Bangalore, India.
2. Professor, Department of Community Medicine, Khaja Banda Nawaz Institute of Medical Sciences, Bangalore, India.
3. Scientist D, National Institute of Animal Nutrition & Physiology, Bangalore, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Vinod K. Ramani,
#393, I bk, II cr, III st, 14 Mn, Basaveshwaranagar, Bangalore-560079, India.
E-mail: vinod_ramani@lycos.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: Jul 03, 2015
Date of Peer Review: Sep 17, 2015
Date of Acceptance: Feb 29, 2016
Date of Publishing: May 01, 2016