

A PROSPECTIVE STUDY OF ACUTE RESPIRATORY TRACT INFECTIONS AMONG CHILDREN UNDER AGE OF 6 YEARS IN RURAL MAHARASHTRASmita M. Nimbannavar¹, Mahesh B. Bhagawati²**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: BACKGROUND: Acute respiratory tract infection (ARI) is major cause of morbidity and mortality in children under 5 years of age especially in developing countries. Hence the present study was undertaken to study the incidence and determinants associated with ARI. **AIMS:** To study the incidence and determinants of ARI in children aged less than 6 years. **SETTINGS:** The present study was conducted in rural setting of Pune district where in 118 children between 0 to 5 years were interrogated as per predesigned proforma. **METHODS:** All 118 children were followed up every month for a period of 1 year and interrogated for incidence and various risk factors. **STATISTICAL ANALYSIS:** Chi square test was used. 'P' value < 0.05 was taken as significant. **RESULTS:** A total of 199 episodes of ARI (174 of AURI & 25 of ALRI) were present among all children. Incidence rate of ARI, AURI, ALRI was 1.69, 1.47, 0.21 episodes/child/year. Malnourished children had higher incidence as compared to nourished children. (2 episodes/child/year Vs 1.50 episodes/child/year). Association was found between incidence of ARI and immunization status, seasonal variation and various environmental factors. **CONCLUSION:** The present study has identified incidence rate, various socio-demographic and environmental risk factors which can be tackled by effective education of mother, family & community and initiatives undertaken by government.

KEYWORDS: ARI, under five, incidence, risk factors.

INTRODUCTION: Children are supremely important asset of our nation. Their nurture and solicitude are our responsibility. Therefore health status of children is considered as an index of nation's development.⁽¹⁾ ARI represent one of the main health problems in children especially among the younger age group.⁽²⁾ According to World Health Organization (WHO), ARI is the major cause of morbidity and mortality in children under five years of age, with an estimated 1.6-2.2 million deaths globally.⁽³⁾ Among total population of age < 5 years, nearly 1/5th of total deaths are due to ARI.⁽⁴⁾

According to WHO (2004) estimates, respiratory infections caused about 9, 87, 000 deaths in India of which 9, 69, 000 were due to lower respiratory infections (ALRI), 10, 000 due to acute upper respiratory infections (AURI) and about 9, 000 due to otitis media.⁽⁵⁾ The aetiology of ALRI in developing countries is predominantly bacterial compared to non-bacterial in developed countries.^(6,7, and 8) These facts suggest that ARI related morbidity and mortality can be controlled by immunization, timely use of antibiotics and referral for proper case management.⁽⁹⁾

ARI are responsible for 20-30% of deaths amongst under-fives in developing countries (India, Pakistan, Nepal).^(10,11) ARI also results in 3-7 attacks of illness per year in India.^(12,13) Approximately 20-20% of ARI deaths occur below 2 months of age and 50-60% occurs in infants. ARI is a major priority that needs attention in global strategy on child survival. Adult average 2-4 colds and children average 3-8 colds per year.^(14,15)

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In view of constraints of financial and manpower resources, it may not be feasible to carry out national level studies on magnitude of the problem of ARI in children. Such surveys have to be carried out in small, defined populations of the community. Surveys undertaken in various parts of country are mostly cross sectional in nature and only give the state of morbidity as it existed at particular point of time. In contrast, longitudinal survey, though few in number, measure several continuous changes which occur in a community regarding sickness and thus give a better measure of magnitude of morbidity in relation to various factors.

The epidemiological data on magnitude of the problem and risk factors of ARI in rural area are scant. It is therefore necessary to develop a data base through studies on rural population. So this study was an attempt to estimate the incidence of ARI and various factors like nutrition status, immunization, socio-economic factors associated with it in rural field practice area of Medical College, Maharashtra

MATERIAL AND METHODS: The present study is a prospective cohort study conducted in a rural setting of Pune district which is a rural health training centre of Medical College. The study was conducted between January 2011 to December 2011. Primary occupation of villagers is agriculture. The village has a total population of 2455 people and 400 households with crude birth rate of 15.2/1000 population and crude death rate of 5.4/1000 population.

The study population consisted of all children < 5years of age, at the time of conduct of study. The data was collected by conducting house to house visits after line listing of the houses which included children less than 5 years of age. Houses were visited from one direction on each lane/street, taking the house numbers into consideration. The houses visited were marked on the doors to avoid duplication of data collected from an individual house.

In case of a locked house, it was ensured that the house was visited later to cover the missed child. All the children had at least one visit per month to record the episodes of ARI. Thus all children had a total of 12 visits. All the mothers of children were explained in detail about the purpose and methodology of the study. Informed consent was obtained.

Definition Followed: Acute respiratory infections- ARI included both upper and lower respiratory tract infections and were taken as any acute episode of running nose(cold), cough, ear discharge, hoarseness of voice, breathing difficulty or fast breathing with/without fever or chest in drawing.

Inclusion Criteria: All the children under 5 years of age whose parents consent to participate in the study.

Exclusion Criteria: Children who are not permanent residents of village and whose parents do not consent to participate in the study.

After taking verbal consent from mothers, data was collected using a pre-tested, pre-validated interview schedule. The questionnaire was structured in domains like personal particulars, socio-demographic details, demographic parameters, anthropometric measurements.

Details on ARI episodes was obtained by interviewing mothers on number of episodes between previous visit and present visit, duration of each episode, relevant symptoms like fever, cough, running nose, chest in drawing, rapid breathing, refusal of feeds, etc. was taken.

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A detailed anthropometric examination on height, weight, mid arm circumference. Complete anthropometry of all children was recorded twice, once at the start of the study and another at the end of study.

The weight of the child was recorded using electronic weighing machine and it was calibrated each time before weighing each child. Height (2-5 years) was recorded using Frankfurt plane. Malnutrition was graded according to IAP classification. Socio-economist status grading was done according to B G Prasad scale (for rural areas). History of immunization was elicited from parents and cross checked by verifying the documents wherever possible.

Details on housing, flooring, presence of windows, source of lighting, type of kitchen, family history of smoking, type of fuel used were obtained.

Statistical Analysis: The calculations were done by means of percentages and numbers. Statistical test for difference in proportions (Chi-square) was applied wherever required. 'p' value < 0.05 was taken as significant.

RESULTS: In this study, a total of 118 children were followed up for a period of 1 year. Majority of the children were in the age group of 13-24 months with male preponderance. Incidence was more among the age group of < 12 months with ARI episodes of 2.00 (± 1.53) episodes/child/year. ($p > 0.05$). Girl child had more number of episodes as compared to male child (< 0.05). Similarly incidence of ARI was more among the illiterate mothers and with low income. Incomplete immunization for age was significantly associated with higher incidence of ARI (1.75 Vs 1.25 episodes/child/year) (< 0.05).

Children who were nourished had lower incidence of ARI (1.60ep/ch/yr) as compared to malnourished children. Incidence increased with grade of PEM. (PEM Gr I- 1.81, GR II- 1.89, Gr III- 2). But the association between the incidence and malnutrition was found to be statistically not significant. Winter season witnessed higher number of ARI episodes as compared to summer, spring or rainy season. (Nov- 2.77, Dec- 2.93, Jan- 3.67, Feb- 3.13)

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Variables						
Socio-demographic Variables						
A.	Age Group	Number	Percentage (%)	No. of ARI episodes/child/year	No. of AURI episodes/child/year	No. of ALRI episodes/child/year
	<12 months	23	18.7	2.00±1.53	1.65 ± 1.58	0.35 ± 0.48
	13-24	35	30.5	1.81 ± 1.11	1.64 ± 1.09	0.17 ± 0.37
	25-36	13	11	1.67 ± 0.98	1.42 ± 0.99	0.25 ± 0.45
	37-48	26	22	1.42 ± 1.20	1.19 ± 1.02	0.23 ± 0.51
	49-60	21	17.86	1.48 ± 1.25	1.38 ± 1.28	0.10 ± 0.30
B	Sex					
	Male	73	62	1.48±0.98	1.22 ± 0.99	0.26 ± 0.46
	Female	45	38	2.04±1.50	1.89 ± 1.41	0.16 ± 0.36
C	Mothers Literacy					
	Illiterate	12	15.4	1.98±1.49	1.75±1.32	0.23±0.43
	Pri/Sec	52	66.6	1.88±1.27	1.53±1.28	0.33±0.52
	High School	9	11.5	1.57±1.11	1.33±1.11	0.24±0.43
	Grad/PG	5	6.5	0.67±1.23	0.67±1.15	-

Immunization						
1.	Complete for age	110	77.9	1.25 ± 0.70	1.14 ± 0.69	0.29 ± 0.48
2.	Incomplete for age	08	22.1	1.75 ± 1.25	2 ± 1.64	1.61 ± 1.68
Nutritional Status						
A.	At start of the study					
	Normal	81	68.6	1.60 ± 1.34	1.35 ± 1.29	0.25 ± 0.43
	Grade I	28	23.7	1.81 ± 0.83	1.56 ± 0.84	0.25 ± 0.44
	Grade II	08	6.9	1.89 ± 1.16	1.56 ± 1.33	0.33 ± 0.70
	Grade III	01	0.9	02 ± 0.00	2.00 ± 0.00	00
	Grade IV	00	00	00	00	00
B.	At end of the study					
	Normal	106		1.62 ± 1.16	1.36 ± 1.13	0.26 ± 0.46
	Grade I	9		2.29 ± 1.70	2.00 ± 1.73	0.29 ± 0.48
	Grade II	3		2 ± 2.00	-	-
	Grade III	0		-	-	-
	Grade IV	0		-	-	-

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Environmental Variables					
1.	Type of Floor	Number of Children	ARI	AURI	ALRI
			Ep/Child/year	Ep/Child/year	Ep/Child/year
	Mud	83	2.80±1.92	2.20±1.78	0.60±0.54
	Cow Dung	30	1.33±0.95	1.10±0.99	0.23±0.43
	Cement	05	1.75±1.23	1.49 ±1.23	0.25±0.46
2.	Presence of Windows				
	Present	92	1.65±1.15	1.42±1.15	0.23±0.44
	Absent	26	1.81±1.49	1.42±1.39	0.38±0.49
3.	Source of Lighting				
	Electricity	87	1.48±1.09	1.19±1.07	0.29±0.46
	Kerosene	31	1.76±1.27	1.51±1.23	0.25±0.46
4.	Type of Kitchen				
	Separate	40	1.60±1.21	1.33±1.11	0.24±0.43
	Non-separate	78	1.85±1.27	1.53±1.28	0.33±0.52
5.	Type of Housing				
	Pucca	41	1.88±1.47	1.61±1.46	0.27±0.44
	Kutch+Semipucca	77	1.58±1.08	1.35±1.01	0.23±0.45
6.	Family History of Smoking				
	Present	23	1.39 ± 0.89	1.22± 0.90	0.17 ± 0.38
	Absent	95	1.76 ± 1.29	1.47 ± 1.26	0.28 ± 0.47
7.	Type of Fuel used				
	LPG	31	1.64 ± 1.32	1.40 ± 1.21	0.26 ± 0.44
	Non-LPG	87	1.81 ± 1.32	1.45 ± 1.33	0.35 ± 0.56

Among the environmental variables, 70.3% had mud flooring as compared to cow dung (25.5%) and cemented (4.2%). The association between type of flooring and incidence of ARI was found to be statistically significant. Houses which used kerosene lamps as source of lighting had higher incidence of ARI (1.76) as compared to houses with electricity (1.48). 22% of houses had no windows and incidence was higher among in these houses (1.81) as compared to ventilated houses (1.61). This association was found to be statistically significant.

Houses using LPG as source of cooking had higher incidence (1.81) as compared to non-LPG source (1.64). Houses with no separate kitchen for cooking had higher incidence of ARI (1.85) as compared to houses with separate kitchen (1.60) ($p < 0.05$). Kaccha and semi-pucca houses had higher incidence of ARI as compared to pucca houses (1.88 Vs 1.58) ($p < 0.05$). Similarly incidence of ARI was higher among families with parental history of smoking (1.84) as compared to families with no history of parental smoking. (1.46). This was found to be statistically significant.

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DISCUSSION: The present study is a rural based longitudinal study where 118 children were followed up for 1 year. In the present study about 85% of mothers had some form of education while 15% were illiterate. There was association between education of mother and ARI morbidity.

This is similar to some studies who have found maternal illiteracy to be significantly associated with ARI morbidity. In the present study, total numbers of ARI episodes were 199 with an incidence of 1.69 episodes/child/year, while AURI and ALRI were 174 and 25 episodes with mean of 1.47 and 0.21 episodes/child/year respectively. A total of 87.44% of ARI episodes were AURI, and 12.56% were ALRI. Mean duration of AURI was 3.2 days and ALRI 6.2 days. Chhabra. P.et.al observed 87.5% of all episodes of ARI were AURI and remaining 12.5% were ALRI.⁽¹⁶⁾

Community based studies in India have observed that under-five children of urban areas suffer from 5-9 ep/ch/yr whereas in rural areas it is 1-3 ep/ch/yr. Similar incidence rate of ARI was reported by Narayan Muni (rural Mysore, 1990) as 2.01 ep/ch/yr.⁽¹⁷⁾ Highest incidence of ARI, AURI, ALRI was found in the age group < 12 months (2.00, 1.65, 0.35 ep/ch/yr) while the lowest incidence was found in the age group of 37-48 months. Similar observation was made by Chhabra, P et al. who observed higher incidence rate in first 2 years of life (3.0 and 3.1 ep/ch/yr).⁽¹⁶⁾ In the present study, girls had higher incidence of ARI as compared to boy (2.04, 1.89 & 0.16 Vs 1.48, 1.22 & 0.26).

The difference between incidence of ARI and sex was statistically significant. Similar finding was noted by Chhabra. P et.al.⁽¹⁶⁾ Children who were nourished well had lower incidence as compared to malnourished children. (1.60 Vs Gr I-1.81, Gr II-1.89, Gr III-2.0). Similar results were observed by Chhabra. P et. al., Shah Hemangini Kishore and Tupsi. T. E et.al.^(16,18,19) In the present study incompletely immunized children had higher incidence as compared to date immunized children. Similar findings were observed by Savitha MR, Anandhi et.al.^(20,21) In the present study, it was observed that highest incidence of ARI was found in winter season followed by rainy season. Similar results were also obtained in study conducted by Reddiah VP and Kapoor SK.⁽²²⁾

Environmental Factors: In the present study, the families which were using both kerosene as well as solid fuel for cooking, such children had higher number of ARI episodes as compared to those who were using only solid fuel and it was found to be statistically significant. The kerosene lamps used are a potential source of emissions of harmful particulate matter like polycyclic aromatic hydrocarbons, aliphatic hydrocarbons, nitrated hydrocarbons etc, which they are inhaled deep into lungs, leading to greater sensitivity of illness. Similar findings were observed by Savitha MR, Mitra NK, and others.^(16,23)

In the present study parental history of smoking had significant association with number of ARI. Savitha MR, Chhabra. P and Acharya, .et.al in their study observed similar findings.^(16,20,24)

Significant association was found between type of flooring and ARI morbidity. The reasons cited may be the mud floors normally tend to break up over a period of time and can cause dirt and these cannot be easily washed and dried and they retain the dampness.

This favors breeding of insects and harborage of dust in the cracks and crevices which are common in this flooring. Sikolia et.al and Savitha MR also observed similar findings. Poorly ventilated houses had higher number of ARI episodes. Good ventilation especially with access to sunlight reduces the likelihood of transmission of droplet infection which is the common mode of transmission for ARI.

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CONCLUSION: Though the study has identified incidence rates and various risk factors, prevention of ARI needs a holistic approach like improving the nutrition, immunization, sanitation, housing and various other factors. These are socio-economic development goals which need a long time to reach.

Immediate requirement is effective management at home level. As this study was conducted on small scale, similar study on large scale needs to be done for more reliable results.

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