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Dr. Smitha Yadav JS
Department of Community Medicine VIMS Ballari, Karnataka, India

Dr. Geethalakshmi RG
Department of Community Medicine SSIMS & RC Davangere, Karnataka, India

Correspondence
Dr. Smithayadav JS
Department of Community Medicine VIMS Ballari, Karnataka, India

A cross-sectional study on the prevalence of acute respiratory infection and its association with factors indicating indoor air pollution among under-five children in rural Davangere, Karnataka

Dr. Smithayadav JS and Dr. Geethalakshmi RG

Abstract
Introduction: Globally ARI account for 4 million deaths in under five children, In India ARI (pneumonia) accounts for 19% of under-five mortality. There are several risk factors which influence ARI in children like birth order, low birth weight (<2.5 kg), immunisation status, sub-optimal breastfeeding, nutritional status of a child, lower economic status, housing conditions, fuel used for cooking, maternal illiteracy.
Objective: To assess the prevalence of ARI and determine the association of factors indicating indoor air pollution with ARI among under five children in rural area of Davangere, Karnataka.
Methodology: A cross sectional study was conducted among under-five children in rural area, Davangere. Sample size was calculated to be 400 based on the prevalence in previous study Systematic random sampling method was applied. House to house visit was done to collect information. History of ARI within last 2 weeks was taken to calculate prevalence of ARI.
Results: The prevalence of ARI among under-five children was found to be 45.5%. The risk of ARI was significantly associated with wood as fuel for cooking.
Conclusion: In order to decrease ARI, use of LPG as fuel for coking to be promoted.

Keywords: acute respiratory infection, Under-five children, indoor air pollution, fuel used for cooking

1. Introduction

Children under five years of age (Under five children) contribute to 10.7% of the total Indian population [1]. WHO defines children as those aged between 0-14 years. They contribute to 26% of the world population and 28.4% of India's population [2].

Under five children form one of the vulnerable group of population and care of their health is very important in framing countries future economy and development. UNICEF considers under-five mortality rate as the best single indicator of social development and well-being, as it reflects income, nutrition, health care and basic education of the country [3].

Acute respiratory infections (ARI) may cause inflammation of the respiratory tract anywhere from nose to alveoli, with a wide range of combination of symptoms and signs [4].

Overall Prevalence of ARI among Under five children in India is 2.7%, in Karnataka, it is 1.2% and in davangere district, it is 1.1%. In the rural part of India, Karnataka and davangere the prevalence of ARI is 2.9%, 1.3%, and 0.7% respectively [5-7]

There are several risk factors which influence ARI in children like birth order, low birth weight (<2.5 kg), immunization status, sub-optimal breastfeeding, nutritional status of a child, lower economic status, housing conditions like overcrowding, poor ventilation, fuel used for cooking, maternal educational status [8, 9]

In India, most of the population is integrated into a rural area and therefore there is a need to have knowledge of these risk factors related to the acquisition of ARI, as it will help in its prevention, through community health education.[10] With this background, the present study was conducted in a rural field practice area of a medical college in Davanagere, to assess the prevalence of ARI and factors influencing the same among under-five children.

Objective

1. To assess the prevalence of ARI among under-five children in rural area of Davangere, Karnataka.
2. To determine the association of ARI with cooking fuel in a rural area of Davangere, Karnataka.

Materials and Methods

Study design: A Cross-sectional study.

Study setting: All villages covered under rural field practice area of SSIMS and RC, Lokikere, Davangere, Karnataka.

Study period: One year - 1st Jan 2016 to 31st Dec 2016

Study population: Under five children in rural field practice area of SSIMS and RC, Lokikere, Davangere, Karnataka.

Inclusion criteria: Children under the age of five years, whose family is residing in the study area for at least past six months, and willing to participate in the study.

Exclusion criteria: Houses which were locked and not able to contact even after three consecutive visits.

Sample size: A study done by Kumar GS *et al*. [9] in rural part of India showed prevalence of acute respiratory infections to be 53.7%. Using this prevalence, sample size has been estimated to be 382 using the formula n = $\frac{Z^2 pq}{L^2}$ (382 ≈ 400).

Sampling Method: Systematic random sampling technique. Rural field practice area of SSIMS & RC consists of 12 villages with a total population of 17,495 and 19 anganwadis with 1586 under-five population. Each village has at least one anganwadi.

Step 1: Data regarding households with under five children was collected from the anganwadi registers.

Step 2: Under five children from all anganwadis were line listed with continuous numbers. Sample interval (K) was calculated.

K = Total no of under five children in rural field practice area / sample size

K = 1586/400= 3.96 ≈ 4.

Step 3: A random number was selected between 1 & 4 using lottery method and that number was the first sample included in the study which is also called as random start number. From then every 4th child was selected understudy until the desired sample size of 400 was obtained.

Step 4: House to house visit was done to collect information from participants. If the selected households were locked and not available even after 3 consecutive visits, next household with under five child was included in the study.

Collection of data

Ethical committee clearance was obtained from the institutional ethics review board (IERB) before starting the study. Written informed consent was obtained from the parents/guardians.

Tool used

A predesigned, pre-tested, semi-structured and validated questionnaire was administered by an interview method to the parent/guardian, preferably to the Mother.

Information regarding demographic details of the family, socioeconomic status, housing condition including fuel used for cooking factors indicating indoor air pollution and history of ARI in last 2 weeks was collected.

Results

Table 1: Distribution of Study population based on Age, Gender, and religion (n = 400)

Variables	Frequency (n)	Percentage (%)
Age (in years)		
<1	61	15.3
1-5	339	84.75
Gender		
Male	211	52.7
Female	189	47.3
Religion		
Hindu	345	86.2
Muslim	55	13.8

Table 2: Distribution of Study population based on Socio economic classification (n= 400)

Variables	Frequency (n)	Percentage (%)
SES		
Class I	15	3.8
Class II	29	7.2
Class III	70	17.5
Class IV	106	26.5
Class V	180	45.0
Variables	Frequency (n)	Percentage (%)

Table 3: Distribution of Study population based on factors indicating indoor air pollution (n = 400)

Separate kitchen		
No	38	9.5
Yes	362	90.5
Smoke vent		
No	246	61.5
Yes	154	38.5
Fuel Used for cooking		
Wood/Kerosene/Dung/Others	180	45.0
LPG/Electric	220	55.0
Smoking Inside the House		
Yes	60	15.0
No	340	85.0

Table 4: Distribution of Study population based on Prevalence of ARI

Variables	Frequency (n)	Percentage (%)
History of ARI		
Yes	182	45.5
No	218	54.5
Total	400	100.0

Table 5: Association of ARI with demographic variables (n = 400)

Variables		ARI		Total	x^2 Value	df	p value
		YES n (%)	NO n (%)				
Age (in years)	<1	35(57.4)	26 (42.6)	61(100.0)	4.094	1	0.043*
	1-5	147(43.4)	192(56.6)	339(100.0)			
Gender	Male	88(41.7)	123(58.3)	211(100.0)	2.592	1	0.107
	Female	94(49.7)	95(50.3)	189(100.0)			
Religion	Hindu	158(45.8)	187(54.2)	345(100.0)	0.089	1	0.765
	Muslim	24(43.6)	31(56.4)	55(100.0)			
Total		182(45.5)	218(54.5)	400(100.0)			

*Significant at 5% level of significance

Table 6: Association of ARI with Socio-economic status and poverty line (n = 400)

Variables		ARI		Total	x^2 Value	df	p value
		YES n (%)	No n (%)				
Socio Economic Status	Class I	4(26.7)	11(73.3)	15(100.0)	8.70	4	0.054
	Class II	11(37.9)	18(62.1)	29(100.0)			
	Class III	41(58.6)	29(41.4)	70(100.0)			
	Class IV	43(40.6)	63(59.4)	106(100.0)			
	Class V	83(46.1)	97(53.9)	180(100.0)			

Table 7: Association of ARI with Factors indicating Indoor air pollution

Variables		ARI		Total	x^2 Value	df	p value
		YES n(%)	NO n(%)				
Separate Kitchen	No	22(57.9)	16(42.1)	38(100.0)	2.601	1	0.107
	Yes	160(44.2)	202(58.8)	362(100.0)			
Smoke Vent	No	96(39.0)	150(61.0)	246(100.0)	10.805	1	0.001*
	Yes	86(55.8)	68(44.2)	154(100.0)			
Fuel Used For Cooking	LPG	104(47.3)	116(52.7)	220(100.0)	8.438	1	0.011*
	Wood	78(43.3)	102(56.6)	180(100.0)			
Smoking Inside The House	Yes	34(56.7)	26(43.3)	60(100.0)	7.55	1	0.040*
	No	148(43.5)	192(56.5)	340(100.0)			
Total		182(45.5)	218(54.5)	400(100.0)			

*Significant at 5% level of significance

Table 8: Association of ARI with Indoor air pollution

Variable		OR	95% CI	P value
Smoke Vent	Absent	1.424	0.781 – 2.594	0.249
	Present	1		
Fuel Used For Cooking	Wood/ Biomass	1.512	0.874 – 2.616	0.139
	LPG	1		
Smoking Inside The House	Present	1.801	0.794 – 4.081	0.159
	Absent	1		

*Significant at 5% level of significance

Results

The majority of study population were in 1 – 2 years age group (24.7%), males were more in number (52.7%) and majority belonging to Hindu religion (86.2%). (Table 1). Major group of the study population (45.0%) were belonging to Class V according to Modified BG Prasad classification (table 2). Separate kitchen facility was present in majority of households (90.5%) but no smoke vent (61.5%) and used LPG for cooking purpose (55.0%). None of the family members smoked inside the house in majority of houses (85.0%) (Table 3). In the study, history of ARI in last two weeks was present in 45.5% of the study population. (Table 4).

From the above table showing association of ARI with demographic details of a child, ARI is significantly high in infants (p value <0.05). In comparison with male children ARI was higher in female children but not statistically significant. In comparison between religions, there was more prevalence in Hindu children but not statistically significant (table 5). When compared with socio-economic class according to Modified B G Prasad classification (2016) there was no significant association of lower classes with ARI (table 6). From the above table showing association of ARI with factors indicating indoor air pollution, there was significant association of ARI with absence of smoke vent and using wood as fuel for household purpose. The association was statistically significant (p value <0.05) (table 7).

Risk of ARI was higher in children living in housing conditions with absence of smoke vent, wood used as fuel for cooking and smoking inside the house but the association was not statistically significant (table 8)

Discussion

A cross-sectional study on prevalence and risk factors of ARI was conducted among under- five children residing in 19 villages under rural field practice area of SSIMS&RC. Study was conducted during Jan to Dec 2016 with estimated sample size of 400.

The proportion of boys (52.7%) was greater than porportion of girls in the present study (47.3%), which is in line with similar studies conducted in other parts of India [11-13] In contrast to this, proportion of girls was more than boys in a study conducted by prajapati B in rural communities of Ahmedabad district [14] In our study, majority of the study population belonged to Hindu religion (86.2%) and similar observation was found in other studies [12, 15]

Factors causing indoor air pollution were among the main risk factors for ARI and it was found to be significantly associated in the present study. Similar association was found in WHO report 2008. [16] In our study Wood or biomass used as fuel had significantly increased risk to cause ARI in under-five children but when seen for strength, the association was not statistically significant. Similar results were found in others studies done on risk factors for ARI [17, 18]. Use of wood or other biomass fuels for cooking and absence of smoke vent in houses leads to indoor air pollution, and these dust or soot particles are known to cause irritation of respiratory tract of children leading to ARI.

There was increased risk of ARI in children living in houses with passive smoking (p value – 0.04) but the strength of association was not significant (CI of OR – 0.794 - 4.081). The results were comparable with other similar studies looking for association of indoor air pollution and ARI [19, 13]

In present study prevalence of acute respiratory tract infection among under-five children was 45.5%. A longitudinal study done by vinod K Ramani *et al*. in urban slums of Gulbarga showed the incidence of ARI among under five children to be 27.45%. A cross-sectional study on

prevalence and risk factors of ARI was conducted by Bhagyalakshmi *et al*. among under- five children in urban slums of Bangalore. This study results showed overall prevalence of ARI to be 10.4% [20, 21].

The study conducted among under-five children in rural areas of Kancheepuram district by Sharma D *et al*. showed the prevalence of ARI to be 45.6% among children of 1-4 years age group and overall prevalence among under-five children of both rural and urban area was 27% [22].

A community based comparative study done among under-five children in rural and urban areas of puducherry by Kumar GS *et al* showed 53.7% of prevalence of ARI among under five children living in rural areas of Puducherry [13].

A cross sectional study on prevalence of acute respiratory infections, carried out in rural areas of Meerut district by Geol k *et al*., showed that the overall prevalence of ARI in under-five children was 52% [19].

Conclusion

The prevalence of ARI among under-five children in the present study was found to be 45.5%.

The risk of ARI was significantly associated with absence of smoke vent, fuel used for cooking, smoking inside the house. The association was statistically significant (p value < 0.05).

Recommendations

To utilise subsidy facility for LPG given by government and reduce using wood or biomass as fuel. To adopt smokeless chullhas facility which reduces indoor air pollution to considerable extent. To improve the socio economic status of the people, as the majority of study population were in below poverty line and depending on agriculture for livelihood, they can adopt other small scale earnings in non-yield times of the year by utilising government funds and facilities. example: Poultry, tailoring, small shops.

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