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Prevalence and risk factors of acute respiratory infection among under fives in rural communities of Ekiti State, Nigeria

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ABSTRACT

Background

Acute respiratory tract infections (ARI) constitute a major cause of morbidity and mortality among under-five children in the developing world. It constitutes one-third of the deaths in under-five in developing countries. The objectives of this study were to determine the prevalence of ARI and risk factors for ARI among under-fives children in rural communities of Ekiti State.

Study design

The study was cross sectional descriptive/analytical in nature. A semi-structured, pretested and interviewer administered questionnaire was used to obtain information from 436 care givers who were selected using multistage sampling technique. Data was analyzed using SPSS version 20. Descriptive and inferential statistics were generated and level of significance was $p < 0.05$.

Results

Among the under-fives 237 (54.4%) were males while 199 (45.6%) were females with mean age of 28.4 ± 15.2 months. Numbers of under-fives with ARI were 283 (64.9%). The commonest symptoms of ARI were cough 161 (36.9%), fever 176 (40.4%) and running nose 157 (36.0%). The major risk factors for ARI were second hand smoking (90.9%), cooking with charcoal (79.4%), overcrowding (70.6%) and sleeping on earthen floor (90.8%) The odds of ARI among under-five sleeping with two adults in a room was lower compared to under five sleeping with more than two adults (AOR 1.739, CI 1.123 – 2.694, $p<0.05$).

Conclusion

The prevalence and level at which the under-five children were exposed to ARI risk factors in this study were high. Care givers in the rural communities will benefit from public awareness campaign on risk factors for ARI and this will go a long way in reducing mortality and morbidity due to ARI among under-five children.

Keywords: Acute Respiratory Infection (ARI), Risk Factors, Prevalence, Under Fives, Nigeria

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INTRODUCTION

Children's world revolves round their homes, schools and their local community. These places are supposed to create a healthy and protective environment for them but most often than all this is not what obtained. This is because some of the causes of diseases and death in children are linked to their environment.[1] Children have been at the center of global efforts towards improving their health

conditions, especially in developing countries. Notable strides have been made towards reducing child morbidity and mortality globally. For example, over the last 20 years, mortality rates among children worldwide have fallen considerably, from 87 in year 1980 to 51 deaths per 1000 live births in year 2012.[2, 3] In absolute terms, this represents a reduction from 12 million to 6.9 million children dying every year.[2, 3] Despite this progress, child mortality rates in developing countries though falling is still eight times as high as those observed in developed countries. Many still die from preventable diseases like acute respiratory diseases, diarrhoea, malaria, measles and malnutrition.[3,4]

Acute respiratory infection (ARI) is considered as one of the major public health problems and constitute a major cause of morbidity and mortality among under-five children in the developing world.[6] In developing countries like Nigeria, Kenya, Philippines, Thailand, Colombia and Uruguay, prevalence was reported to the range between 21.7 and 40%,[7-9] with the percentage of deaths due to all causes of ARI being between 2 times and 6 times higher in less developed countries than in developed countries. ARI constitute one-third of the deaths in under-five in developing countries.[4]

An infection of any part of respiratory tract or its related structures including para nasal sinuses, middle ear and pleural cavity is referred to as ARI.[6] According to World Health Organization working group on case management of ARIs, Acute respiratory infections are defined as any infection of upper or lower respiratory system. Acute Lower Respiratory Infection (ALRI) affects the airways below the epiglottis and includes severe infections such as pneumonia. Pneumonia is identified by clinical symptoms such as cough, fast or difficulty in breathing, inability to feed, raised respiratory rate, lower chest in drawing, fever and tachycardia.[6]

Several risk factors have been associated with acute respiratory infection among under-five children; these risk factors include: age, sex, socio-economic status, overcrowding, indoor air pollution, passive smoking, absence of ventilation, defects in immune system, lack of basic health services, lack of awareness and overuse and misuse of antibiotics.[7, 8] Some of these factors predisposing to ARIs are more prevalent in the rural communities with limited access to health care for their children and more exposure to indoor air pollution. In the rural communities, the women use fire wood and kerosene stove for cooking mostly.[9,10] Identifying these risk factors may help in introducing interventions that are targeted toward reducing the burden of ARI. There is paucity of community based study on ARI in rural communities of Ekiti State, most studies focused on the hospitals in the urban cities. This study, a community based observed the role some of these factors play on the prevalence of ARI in the rural communities of Ekiti State. This will help in speeding up the achievement of sustainable development goal 3 thereby preventing death among our under-five children in Nigeria.

METHODS AND MATERIALS

Study Area and Population

It was a cross sectional study design; multistage sampling technique was used in selecting two rural local government areas by simple random sampling out of the four predominantly rural local governments. Ekiti State is one of the six states in South-west Nigeria. It has 16 Local Government Areas (LGAs), comprising of four urban LGAs, four rural LGAs and eight semi urban LGAs. Four hundred and thirty-six caregiver/child pairs were selected through multistage sampling technique. Three communities were selected from each of the two local governments through simple random sample. Since a community (settlement) was taking as a cluster, using cluster sampling method all houses where there were eligible under-five children were selected. Household's selection was from one household to the other i.e. from one door to the next. Caregiver/child pair was selected from each household. Where there was more than one care-giver/child pair, one of them was selected by balloting. Where there was more than one child, one was selected by balloting. Where there is no care giver/child pair the next household was automatically selected.

The study population were caregiver and child pair. A caregiver is anyone who is18 years old or above and

has been with the child since birth or for the past 12 months and has been involved in taking care of the child. Caregivers with under-five children suffering from chronic respiratory diseases or severely ill children requiring hospital admission was excluded from the study.

Data Collection

An interviewer administered semi structured pre tested questionnaire was used. The questionnaire was translated to Yoruba language with back translation by language expert at Ekiti State University. Research assistants were trained to collect data and their proficiency was verified through role play.

Definition of Terms/ Outcome Measures

Acute Respiratory Infection

Any under-five with at least two of these signs (cough, fever, running or blocked nose, difficulty in breathing and chest in drawing) in the past 2 weeks.

Measure of Exposure to Risk Factors

The risk factors the under five was exposed to were classified as mild, moderate and high risk. Those exposed to one or two risk factors was classified as mild risk, those exposed to three or four risk factors was classified as moderate risk and those having five or more risk was classified as high risk.

Statistical Analysis

Analysis was done using Statistical Package for Social Sciences (SPSS) version 20.

Descriptive Statistics

Categorical variables were expressed as frequencies and percentages to get the general description of the study respondents and their parents, socio-demographic characteristics, risk factors and prevalence of ARI.

Inferential Statistics

Chi square test statistics was used to determine the association between categorical variables like socio-economic status of the mother and prevalence of ARI, while multiple logistic regression was used to determine independent predictors of ARI. Level of significance was put at p value < 0.05.

Ethical Approval

Research approval was obtained from the Ethics and Research Review Committee of the Ekiti State University Teaching Hospital Ado Ekiti. Permission was obtained from the community heads and written inform consent from the care givers of the study respondents after giving adequate information on the study objectives including the risks and benefits.

RESULTS

Total of 436 were selected for the study from age 6 months to 5 years with mean age of 28.76 ± 14.64. Table 1 revealed that highest percentage (28.2%) was from 12 – 23 months, followed by 23.8% from 24 – 35 months. Out of the under-five children, 54.4% were males while 45.6% were females, M: F ratio of 1.19:1 (Table 1). The most common symptoms were cough (36.9%), fever (40.4%) and running nose (36%). Difficulty in breathing and chest in drawing were fewer 11.5% and 3.9%.

Table 1 Socio-Demographic Characteristics of Respondents

Variables	Frequency (N=436)	(%)
Age in Months		
6-11	55	12.6
12-23	123	28.2
24-35	104	23.8
36-47	90	20.6
48-59	64	14.8
Gender		
Male	237	54.4

Female	199	45.6
Ethnicity		
Yoruba	325	74.5
Igbo	36	8.3
Hausa	10	2.3
Others	65	14.9
Religion		
Christianity	346	79.4
Islam	90	20.6
Caregiver's Marital Status		
Single	9	2.1
Married	406	93.1
Cohabiting	12	2.8
Divorced	4	0.9
Widowed	5	1.1
Father's Educational Level		
Tertiary	80	18.3
Secondary	242	55.5
Primary	88	20.2
None	26	6
Mother's Educational Level		
Tertiary	49	11.2
Secondary	207	47.5
Primary	142	32.6
None	38	8.7
Socio Economic Status		
Upper Class	12	2.7
Middle Class	196	45.0
Lower Class	228	52.3

Prevalence of ARI

Prevalence of ARI in the rural communities of Ekiti State was 64.9% among under-five children (Fig 1). Table 2 revealed that the highest prevalence was among the infants 6 -11 months (76.4%) and least among ages 48 -59 months, though this difference was not statistically significant (p>0.05). Prevalence of ARI among the female was higher (68.8%) compare to the male (61.6%). The difference in prevalence between the sex is not statistically significant (p>0.05). So also, the prevalence of ARI was higher (71.1%) among under-five from lower socioeconomic class compare to upper socioeconomic class (41.7%) and this difference is statistically significant (p = 0.009). Prevalence of ARI among children whose mothers were not educated was the highest 84.2% compared with those with tertiary education 63.3% and this difference was statistically significant (p = 0.001) (Table 2).

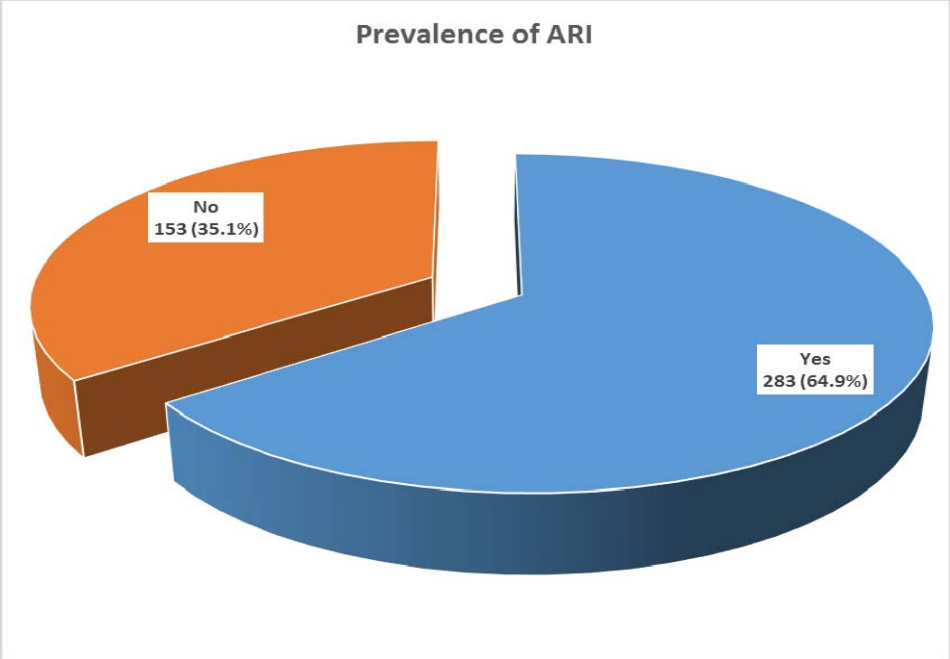

Fig 1 Prevalence of ARI rural communities of Ekiti State

Table 2 Association Between Prevalence of ARI among Under Five and Socio-Demographic Factors

Variables	ARI		Total N=436	Statistical Indices
	Yes (%) N=283	N (%) N=153		
Age in Months				
6-11	42 (76.4)	13 (23.6)	55	$\chi2 = 8.986$ P = 0.061
12-23	83 (67.5)	40 (32.5)	123	
24-35	71 (67.3)	33 (32.7)	104	
36-47	52 (57.8)	38 (42.2)	90	
48-59	35 (54.7)	29 (45.3)	64	
Gender				
Male	146 (61.6)	91 (38.4)	237	$\chi2 = 2.490$ P = 0.115
Female	137 (68.8)	62 (31.2)	199	
Ethnicity				
Yoruba	201 (61.8)	124 (38.2)	325	$\chi2 = 6.510$ P = 0.089
Igbo	26 (72.2)	10 (27.8)	36	
Hausa	9 (90.0)	1 (10.0)	10	
Others	47 (72.3)	18 (27.7)	65	
Religion				
Christianity	222 (64.2)	124 (35.8)	346	$\chi2 = 0.410$ P = 0.522
Islam	61 (67.8)	29 (32.2)	90	
Caregiver's Marital Status				
Single	7 (77.8)	2 (22.2)	9	$\chi2 = 5.335$ P = 0.255***
Married	263 (64.8)	143 (35.2)	406	
Cohabiting	6 (50.0)	6 (50.0)	12	
Divorced	4 (100.0)	0 (0.0)	4	
Widowed	3 (60.0)	2 (40.0)	5	

Father's Educational Level				
Tertiary	54 (67.5)	26 (32.5)	80	$\chi^2 = 13.293$ P = 0.004
Secondary	172 (71.1)	70 (28.9)	242	
Primary	66 (75.0)	22 (25.0)	88	
None	22 (84.6)	4 (15.4)	26	
Mother's Educational Level				
Tertiary	31 (63.3)	18 (36.7)	49	$\chi^2 = 16.292$ P = 0.001
Secondary	144 (69.5)	63 (30.5)	207	
Primary	103 (72.5)	39 (27.5)	142	
None	32 (84.2)	6 (15.8)	38	
Socio Economic Status				
Upper Class	5 (41.7)	7 (58.3)	12	$\chi^2 = 9.445$ P = 0.009
Middle Class	116 (59.2)	80 (40.8)	196	
Lower Class	162 (71.1)	153 (28.9)	228	

Level of significance < 0.05, *** Likelihood ratio

Risk Factors

Majority of the under-five were exposed to three or more risk factors. Out of them 47% were severely exposed to risk factors, 45% were moderately exposed while only 8% were mildly exposed to the risk factors under studied (Fig 2). The under-five children from homes where they cook with fire wood were 68.3%, 49.1% of them sleep in rooms where 3 or more adults were sleeping. Five percent of them were exposed to second hand smoking and 20% were sleeping in rooms with bare floor is just earth. This is shown in Table 3.

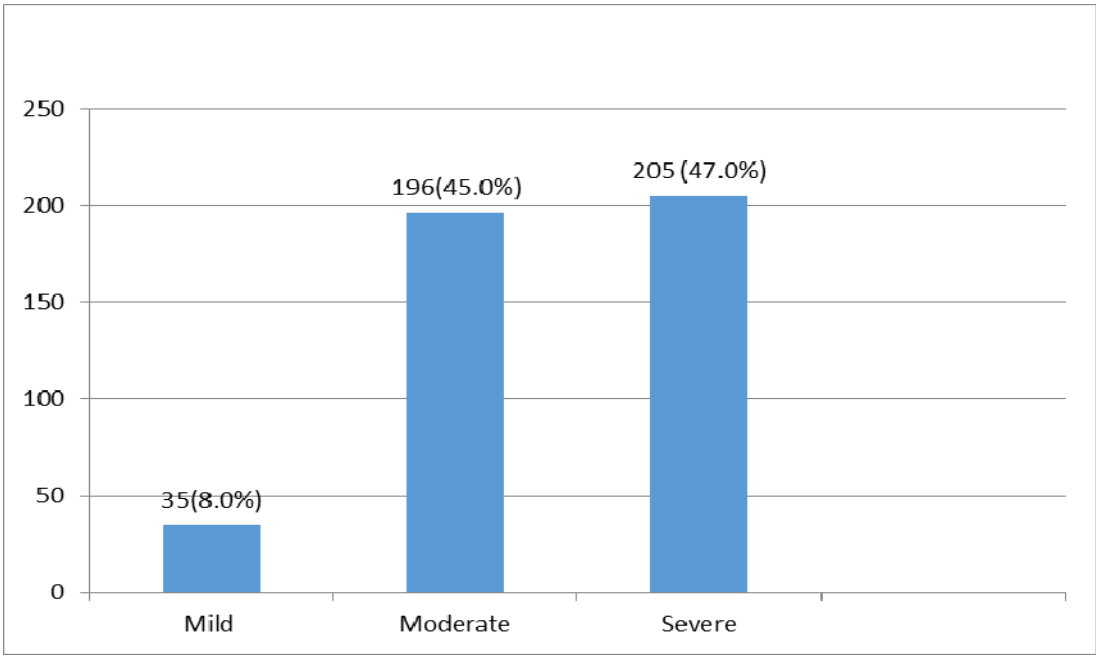

Fig 2 Level of Exposure to ARI Risk Factors Among the Under Five

Table 3 Distribution of ARI Risk Factors among Study Population

Variable	Total (N = 436)	Frequency (%)
Day Care Attendance		
Yes	220	50.5%
No	216	49.5%
Smoking Exposure		
Yes	22	5.0%
No	414	95.0%
Cooking Methods		
Gas	7	1.6%
Electric Stove	4	0.9%
Kerosene Stove	94	21.6%
Charcoal	33	7.6%
Fire Wood	298	68.3%
Room Occupancy		
≤ 3 people	222	50.9%
>3 people	214	49.1%
Lantern Use in the house		
Yes	96	22.0%
No	340	78.0%
Candle use in the house		
Yes	29	6.7%
No	407	93.3%
Mosquito Coil use in the house		
Yes	139	31.9%
No	297	68.1%
Generator use in the house		
Yes	189	43.3%
No	247	56.7%
Room Floor type		
Earth	87	20.0%
Cement	338	77-5%
Tile	5	1.1%
Terrazzo	6	1.4%
Untarred Road		
Yes	295	67.7%
No	141	32.3%

Room occupancy >3 people determines overcrowding

From this study, factors like second hand smoking, smoke from the cooking fuel, overcrowding and the type of floor in the room were significant factors. Percentage of the second hand smokers with ARI was 90.9% with p value of 0.012. Looking at the cooking fuel, 78.8% of children from home where charcoal is their major cooking fuel had ARI and 64.8% of the children where fire wood was there major source of fuel had ARI (p = 0.022). 70.6% of children sleeping in an overcrowded room had ARI with p value of 0.015, Table 4. The odds of ARI among under-five sleeping with two adults in a room was lower compared to under-five sleeping with more than two adults (AOR 1.739, CI 1.123 – 2.694, p<0.05). Prevalence of ARI among children sleeping in rooms with bare floor was 90.8% (p<0.001) as shown on Table 5.

Table 4 Association between Prevalence of ARI among Under-five and Socio Demographic Factors

Variable	ARI			Chi square	p - value
	Yes (%) n = 283	No (%) n = 153	Total N = 436		
Day Care Attendance					
Yes	147 (66.8)	73 (33.2)	220	0.711	0.399
No	136 (63.0)	80 (37.0)	216		
Smoking Exposure					
Yes	20 (90.9)	2 (9.1)	22	5.727	0.017*
No	263 (63.5)	151 (36.5)	414		
Caregivers' Cooking Methods					
Gas	1 (14.3)	6 (85.7)	7	11.415	0.022**
Electric Stove	2 (50.0)	2 (50.0)	4		
Kerosene Stove	61 (64.6)	33 (35.4)	94		
Charcoal	26 (78.8)	7 (21.2)	33		
Fire Wood	193 (64.8)	63 (35.2)	298		
Room Occupancy					
≤ 3 people	132 (59.5)	90 (40.5)	222	5.896	0.015
>3 people	151 (70.6)	63 (29.4)	214		
Lantern Use in the house					
Yes	55 (57.3)	41 (42.7)	96	3.135	0.077
No	228 (67.1)	112 (32.9)	340		
Candle Use in the house					
Yes	20 (69.0)	9 (31.0)	29	0.225	0.636
No	263 (64.6)	144 (35.4)	407		
Mosquito Coil Use in the house					
Yes	93 (66.9)	46 (33.1)	139	0.358	0.550
No	190 (64.0)	107 (36.0)	297		
Generator use in the house					
Yes	124 (65.6)	65 (34.4)	189	0.072	0.789
No	159 (64.4)	88 (35.6)	0.868		
Room Floor type					
Earth	79 (90.8)	8 (9.2)	87	32.928	<0.001
Cement	198 (58.6)	140 (41.4)	338		
Tile	2 (40.0)	3 (60.0)	5		
Terrazzo	4 (66.7)	2 (33.3)	6		
Untarred Road Exposure					
Yes	194 (65.8)	101 (34.2)	295	0.292	0.589
No	89 (63.1)	52 (36.9)	141		

**Yate's Continuity correction, ** Likelihood Ratio, Level of significant was set at p < 0.*

Table 5 Multiple Regression for Identifying Risk Factors of Under Five ARI

Variable		AOR	95% C.I. for AOR		p – value
			Lower	Upper	
Father's education	Literate**	1.000	0.616	11.400	0.190

Mother's education	Non Literate	2.651			
	Literate**	1.000	0.435	3.528	0.689
Socio – economic Status	Non Literate	1.238			
	Upper class**	1.000	0.489	6.385	0.385
Smoking Exposure	Others	1.768			
	Yes**	1.000	0.063	1.334	0.112
Caregivers' Cooking method	No	0.291			
	Fire wood**	1.000	0.475	1.202	0.231
Room Occupancy	Others	0.755			
	≤3 people**	1.000	1.123	2.694	0.013
Floor type	>3 people	1.739			
	Earth**	1.000	0.114	0.462	0.001
	Others	0.230			

***** Reference category, AOR – Adjusted Odd Ratio, Room occupancy > 3 people is determined to be overcrowding***

DISCUSSION

Acute respiratory tract infection (ARI) is considered as one of the major public health problems and constitutes a major cause of morbidity and mortality among under-five children in the developing world.[5] The prevalence of acute respiratory infection in this study was 64.9%. This finding is similar to the one reported by Sikolia et al in Kenya where the prevalence was reported at 69.7%.[13] In a community based study conducted by Goel et al in India the prevalence of ARI was found to be 52%,[14] this is lower compared to the outcome of this study. The prevalence of ARI was high in these studies most likely because all these studies are conducted in rural communities where the care givers had poor knowledge of ARI, were of low socioeconomic status and had higher level of exposure to risk factors. The result of this study is in contrast to the prevalence of 26% reported by Mekuriaw Alemayehu in Ethiopia.[15]

The finding from the study revealed that the highest prevalence was among those below 3 years (6 -11 months 76.4%. 24 – 35 months 68.3%). Above 3 years, the prevalence decreases in similarity to Oguonu's report in Enugu South East Nigeria.[16] This is similar to a community based study in India that reported highest prevalence between 1 to 4 years. A similar result was also reported in a community based study in Australia. Findings from this study showed that there was inverse relationship between the age and prevalence of acute respiratory infection. This inverse relationship between age and predisposition to ARI in this study continued even after adjusting for other potential confounders for ARI. The high prevalence found in the U5 can be explained by the behaviour of young children, they lack awareness of hand hygiene and other hygiene measure increasing their risk of being exposed to pathogens via person to person contact. It has been shown that children can shed respiratory viruses, for longer periods than adults, thus increasing the exposure to pathogens for other children.[31, 32]

Prevalence of acute respiratory infection in this study among U5 male is slightly lower 61.6%, compared to female U5 at 68.8%. The finding in Naseer's work in Pakistan found the prevalence of ARI among the female under-five also higher 63.9% compared to 36.1% among the male though the difference here is significant.[33] Other studies also reported higher prevalence among female compared to males which are also in support of the outcome in this study.[14, 20, 21] However, Goel reported higher prevalence among the male respondents contrary to the result in this study.[26] Although the reason for this was not properly understood.[10]

It was observed that the prevalence of acute respiratory infection reduces with increase in educational status of parents. In this study, the prevalence of ARI among respondents whose

mothers had tertiary education was 63.3% while those with no education had prevalence of 84.2%. This finding is consistent with the outcome of other studies.[22,23] Father's educational level was also inversely proportional to prevalence of ARI in this study as also found in other studies. However, a community based study in India found that there was no association between parents' educational level and ARI.[14] This may be explained by the fact that educated parents are more knowledgeable on how to prevent and likely to recognise signs of infection earlier and utilise the health service more.

Studies have shown that prevalence of ARI is usually highest among persons with low socio economic status, followed by the middle class and only few of those in the upper socio economic class contact ARI.[24, 25] The reason for this may not be far-fetched since the awareness, knowledge and compliance with health related issues is better among the upper socio economic class compared to the lower socio economic class. Moreover those in the upper socio economic class can afford to spend more to take care of health related challenges. The findings of this study supports the fact that prevalence increases as socio economic class declines as ARI prevalence was lower among the upper socio economic class compared with lower socio economic class. This was in comparison with what was reported by Johnson in South West Nigeria[26] and Oguonu in South East Nigeria[16] - though these are hospital based studies. In a community based study from India similar observations were made, where those with higher prevalence of ARI belonged to the lower socioeconomic class.[7, 27] This is not surprising in this study because most of the parents had secondary and primary education and they are majorly farmers, skilled artisans and traders. Educational level and the type of occupation determine the social status and by inference ability to recognise early signs of ARI, take appropriate preventive measure and early presentation at the health facility.

A lot of risk factors have been associated with acute respiratory infections in under-five children. Some of these factors were: overcrowding, air pollution, day care attendance etc. In this study the probability of developing ARI was higher with the under five sleeping with three or more adults in a room. This was statistically significant even after bivariate and multivariate testing. Ahmed result in the Northern Nigeria reported similar findings though the study was hospital based.[28] Similar result was reported by Sikolia in a study of rural community in Kenya.[13] Goel also reported higher prevalence of ARI among under five in houses where there was overcrowding.[14]

This study also observed an association between under-five ARI prevalence and parental smoking (second hand smoker or passive smoker). The prevalence of ARI in the U5 second hand smokers was 90.0% compared to 63.5% in U5 non smokers. Johnson also reported that smoking is associated with development of ARI from Ibadan South West Nigeria.[26] Similar result was observed by Goel in India[14] and Yeasir Azad in Bangladesh.[29] The result of a systematic review and meta-analysis by Laura L Jones was also in support of this fact.[30]

Indoor pollution has adverse effects on respiratory morbidity and mortality.[31] Biomass is mostly used in the rural communities usually referred to as the main source of domestic energy for the poor and it's a major source of indoor air pollution. In the present study of ARI prevalence (78.8%) was higher among the respondents from the household where their major cooking fuel source was charcoal followed by fire wood (64.8%). This is because cooking with charcoal is usually within the house while cooking with fire wood is outside. For this reason charcoal will cause indoor air pollution more and therefore the high prevalence of ARI among under-five children from the household where charcoal is the major source of cooking fuel. Series of other studies within Nigeria (hospital based)[26, 28] and elsewhere also support this observation.[15, 29, 34]

In this study, 90.8% of the U5s living in houses with earth or mud floor had ARI. This is in keeping with a study by Sikolia in Kenya where 70.0% of those living in mud floor house had ARI.[13] This shows that there is an association between mud or earth floor and acute respiratory infections. Indoor pollution with dust will be more in house with mud/earth floor compared to a cemented floor.

CONCLUSION

The conclusion from this study is that there was high prevalence of ARI 64.9% among under -fives children in the rural communities of Ekiti State. Some of the risk factors the under-five children were exposed to were: overcrowding, smoking in the household, cooking with charcoal and household where the floor is earth. To reduce the prevalent of ARI among the under-five children, public awareness campaign using all available means against these modifiable risk factors by the government, non-governmental organisation, and religious organisations to reduce the prevalence of ARI among our under-five children.

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