Prevalence and determinants of acute respiratory infections among under-five children in a tertiary care center at Pokhara, Nepal

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ABSTRACT

Introduction: Acute respiratory infection (ARI) is a major determinant of morbidity and mortality among under-five children in developing countries. Despite decreasing trends in childhood morbidity and mortality, ARI remains a significant predictor of recurrent illness and hospitalization among under-five children in Nepal. This study was conducted to assess the prevalence and determinants of ARI among under-five children at a tertiary care center at Pokhara, Nepal. **Methods:** An analytical cross-sectional study was conducted among 358 mother-child dyads who were recruited through a purposive sampling technique and data was collected through the computer-assisted personal interview (CAPI) technique. Descriptive and inferential statistics were used. The level of statistical significance was set at $p<0.05$. **Results:** The prevalence of ARI among under-five was 39.38%. The age of the child (AOR=8.37, 95% CI: 5.00–13.99), being male (AOR=3.13,95% CI: 2.00–4.86), mother's education below secondary level (AOR=2.28, 95% CI:1.39–3.73), child with no EBF (AOR=1.86, 95% CI:1.21–2.86), stunted child (AOR=2.99, 95% CI: 1.93–4.64), wasted child (AOR=2.66, 95% CI:1.71–4.12), passive smoking by child (AOR=2.43, 95% CI: 1.49–3.97), having no separate kitchen (AOR=0.18, 95% CI: 0.11–0.29) were found to be significant determinants of ARI. **Conclusions:** More than 1/3rd of the under-five children had ARI. Age and gender of the child, maternal education, breastfeeding and nutritional status of the child, passive smoking, not having a separate kitchen, and using wood as a cooling fuel were the determinants of ARI among under-five children. The occurrence can be minimized by improving households, the nutritional status of children, and by increasing awareness regarding its prevention and management.

Keywords: Acute respiratory infections, determinants, prevalence, under-five.

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INTRODUCTION

Infant and child morbidity and mortality is of great concern globally and a fundamental indicator of the health, quality of life, and socioeconomic status of a country's population.[1] Children in Low and Low middle income (LMIC) continue to have the worst rates of mortality in the world, with 74 deaths per 1000 live births—14 times greater than the risk for children in Europe and North America.[2] Problems associated with preterm birth such as birth asphyxia/ trauma, pneumonia, diarrhea, and malaria are the top causes of mortality in children under the age of five.[2] Acute Respiratory Infections (ARI) cause 15% of the global under-five deaths in children, especially in low- and middle-income countries (LMICs).[3] Under-five-year-old children in LMICs are exposed to levels of ambient air pollution that are higher than those recommended by the WHO in almost 98% of cases.[4] According to the most recent 2019 Nepal Multiple Indicator Cluster Survey (MICS),[5] 2.1% of children under the age of five had an ARI.

According to Nepal Demographic Health Survey (NDHS, 2022),[6] the prevalence of Under-five mortality (U5MR)[6] is 33/1000 live births and ARI remains a significant predictor of it. The danger of fatal diseases and severe illnesses is increased since many of these children's parents fail to seek prompt and proper care. As part of the Sustainable Development Goals (SDGs), Nepal hopes to reduce under-five mortality to (25 per 1000)[7] live births by 2030. Several risk factors such as malnutrition, low birth weight, non-exclusive breastfeeding, overcrowding at home, and the use of polluting cooking fuel are the major contributors to childhood pneumonia in low- and middle-income countries (LMICs).[8] Many young lives can be saved by having access to fundamental life-saving measures including skillful birthing, postpartum care, breastfeeding, proper nutrition, immunizations, and treatment for common childhood illnesses.[2]

Lack of access to medical treatment, low socioeconomic status, and health, environmental, and nutritional-related factors are determinants of ARI among under-five children in developing countries.[9] Low birth weight, a lack of exclusive breastfeeding, crowded living conditions, and indoor air pollution have all been linked to childhood pneumonia, according to studies from several nations.[10-16] According to research, factors that significantly increased the risk of pneumonia were socioeconomic level, mothers' education, exposure to household smoking, children of teenage mothers, inadequate vaccination, malnutrition, and location of residence.[11,14-17] Therefore, this study was conducted to assess the prevalence and determinants of ARI among under-five children at a tertiary care center in Pokhara, Nepal.

METHODS

An analytical cross-sectional study was conducted on the pediatric outpatient department (OPD) of Gandaki Medical College Teaching Hospital and Research Centre, Pokhara Nepal. The hospital is a 550-bed tertiary care teaching hospital with a 54-bed pediatric Inpatient unit with an outpatient occupancy of 15-20 under-five children per day. The hospital offers services to the people of Gandaki Province and nearby districts as a multi-specialty tertiary care center. The study population was all the mothers and under-five children dyad attending the pediatric outpatient department from March 15 to June 9, 2023. Mothers of under-five children aged 6 to 59 months, already initiated complementary feeding, and willing to participate were included in the study whereas children with clinically diagnosed bronchial asthma, requiring admission to PICU and associated co-morbidity were excluded from the study. A non-probability purposive sampling technique was adopted and the sample size was calculated at a 95% confidence level and 5% precision based on the prevalence of children with ARI being 36.67%.[18] The calculated sample size was 358. A structured interview schedule which was developed after extensive review of related literature and qualitative validation of the tool was ascertained by consulting the prepared tool with a team of experts which comprised child health nurses, pediatricians, public health personnel, and statisticians. The tool was pretested among 36 participants for validation before administration in the main study. Based on the pretesting, the practicability and usability of the instrument were amended as required. Cronbach's alpha test was computed to assess the internal consistency of the tool which was found to be 0.82.

The research instrument comprised four sections

Part I: Prevalence of ARI according to IMCI classification

Part II: Socio-demographic and economic characteristics

Part III: Child related characteristics

Part IV: Environmental characteristics

The researchers introduced themselves to the participants, explained the objectives of the study clearly, and obtained informed written consent (obtained in a consent form with an information sheet) from each participant before data collection. Data were collected during their waiting period in the OPD of Pediatrics. The structured interview schedule was programmed into a personal smartphone to facilitate computer-assisted personal interviewing (CAPI) for data collection from all the mothers. Measurement of weight was done using the same Seca medical scale with a digital display, supplied by the hospital. Length (recumbent) and height (standing) were measured with a measuring board. The anthropometric information was completed in a paper; Z scores were compared based on the WHO[19] growth standard. Nutritional status was categorized and then entered into the CAPI system. The data collection procedure took approximately 25 to 30 minutes for a participant and six to eight sessions per day were conducted conveniently. The collected data were transferred to the IBM Statistical Package on Social Sciences (SPSS) version 20.0. Descriptive statistics such as frequency, percentage, and mean score were applied to find out socio-demographic, environmental, and child-related variables. The Kolmogorov-Smirnov test of the normality of data was done before analysis. Inferential statistics such as the chi-square test and binary logistic regression were applied to find the association between the prevalence of ARI with selected variables of the dyad. A p-value of <0.05 was regarded as the appropriate level of statistical significance, and the strength of statistical association was assessed by adjusted odds ratios with 95% confidence intervals. Ethical approval to conduct the study was obtained from the Institutional Review Committee of Gandaki Medical College (Ref. No. 78/078-079) Pokhara, Nepal. Formal administrative approval to collect the data was obtained from the Medical superintendent and head of the department of the Pediatric unit. Informed written consent was obtained from each participant and assurance of confidentiality of the information collected was ensured before data collection.

RESULTS

A total of 358 respondents completed the study. More than one-third of the respondents 141(39.38%) reported having ARI, while 217(60.62%) had no ARI. Among the 141 respondents with ARI, the data further classified them based on the Integrated Management of Neonatal and Childhood Illness (IMNCI) criteria. Out of the 141 respondents with ARI, more than half 73(51.77%) have been classified as having pneumonia (Table 1).

Table 1: Prevalence of among respondents (N=358)

Variables	Frequency(n)	Percentage(%)
ARI	141	39.38
No ARI	217	60.62
ARI classification by IMNCI (n=141)		
No pneumonia	45	31.91
Pneumonia	73	51.77
Severe pneumonia	23	16.32

Among the aged 25 to 59 months, most of the respondents 188(86.66%) had no ARI. Similarly, more than two-thirds of male children 96(68.10%) had ARI. Regarding education and occupation of mothers, most of the respondents 178(82.03%) had education above secondary level, and 123(56.68%) were employed and had no ARI respectively. The majority of the respondents 102(72.35%) had monthly income of above 40,000 rupees. More than two-thirds of the respondents 149(68.70%) had no involvement in the national health insurance scheme and they had no ARI. There was statistical significance between the presence of ARI with selected variables like age (p=0.00001), sex of child (p=0.00001), and education ((p=0.0008). (Table 2)

Table 2: Association between the presence of ARI and selected variables of the respondents (N=358)

Variables	Presence of ARI		χ2	p-value
	Yes No (%)	No No (%)		
Age of Child (in months)				
6-24	80(56.73%)	29(13.34%)	70.10	0.00001*
25-59	61(43.27%)	188(86.66%)		
Sex of Child				
Male	96(68.10%)	88(40.6%)	25.93	0.00001*
Female	45(31.90%)	129(59.4%)		
Age of Mother				
21-30	97(68.08%)	113(52.07%)	9.85	0.39
31-40	44(31.92%)	104(47.93%)		
Education of Mother				
Up to secondary	47(33.33%)	39(17.97%)	11.04	0.0008*
Above secondary	94(66.67%)	178(82.03%)		
Occupation of Mother				
Employed	65(46.09%)	123(56.68%)	3.83	0.05
Unemployed	76(53.91%)	94(43.62%)		
Monthly Family Income (in rupees)				
Up to 40, 000	39(27.65%)	71(32.71%)	1.02	0.31
Above 40,000	102(72.35%)	146(67.29%)		
Involve in the National Health Insurance Program				
Yes	49(34.75%)	68(31.33%)	0.45	0.50
No	92(65.25%)	149(68.70%)		

*p<0.05 denotes statistical significance

Out of the 358 respondents, more than two third of the respondents 151(69.58%) had normal delivery and had ARI. Regarding birth weight, 121(55.77%) had above 3.6 kg and had no ARI. Most of the respondents 189(87.10%) were born at term with no presence of ARI. More than two third of the respondents 139(64.06%) had no exclusive breastfeeding and 78(55.31%) initiated complementary feeding below 6 months with the presence of ARI. Likewise, 89(63.12%) were stunted and 148(68.21%) had normal weight respectively with no presence of ARI. The majority of the respondents 198(91.24%) completed immunization for age with no ARI. There was statistical significance between the presence of ARI with children characteristics of the respondents like type of delivery (p=0.01), breast breastfeeding status (p=0.0046). height for age (p=0.0001) and weight for age (p=0.0001). (Table 3)

Table 3: Association between presence of ARI and children characteristics of the respondents (N=358)

Variables	Presence of ARI		χ2	p-value
	Yes n(%)	No n(%)		
Type of Delivery				
Normal	78(55.31%)	151(69.58%)	6.57	0.01*
Surgery	63(44.69%)	66(30.42%)		
Birth Weight				
2.5-3.5 kg	66(46.80%)	96(44.23%)	0.22	0.63
Above 3.6 kg	75(53.20%)	121(55.77%)		
Preterm	29(20.56%)	28(12.90%)	3.75	0.05
Term	112(79.44%)	189(87.10%)		
Breast Feeding Status				
Exclusive Breast Feeding (EBF)	72(51.06%)	78(35.94%)	8.02	0.0046*
No EBF	69(48.94%)	139(64.06%)		
Initiation of Complementary feeding				
Below 6 Month	78(55.31%)	118(54.37%)	0.03	0.86
After 6 Month	63(44.69%)	99(45.632%)		
Height for Age				
Stunted	89(63.12%)	79(36.40%)	25.36	0.0001*
Not Stunted	52(36.88%)	138(63.60%)		
Weight for Age				
Under Weight	78(55.31%)	69(31.79%)	19.53	0.0001*
Normal	63(44.69%)	148(68.21%)		
Immunization Status				
Complete for Age	127(90.14%)	198(91.24%)	0.14	0.85
Incomplete for Age	14(9.86%)	19(8.96%)		

*p<0.05 denotes statistical significance

Out of the 358 respondents, more than half of the respondents 113(52.07%) had pucca houses and had no ARI. Regarding cross-ventilation, 123(56.68%) had ventilation at home and with no ARI. The majority of the respondents 159(73.27%) had separate kitchen. Most of the respondents 178(82.03%) had no smoker family member and had no ARI. Similarly, the majority of the respondents 161(74.20%) had no members with ARI. There was statistical significance between the presence of ARI with environmental characteristics of the respondents like type of fuel used (p=0.00001), place of cooking (p=0.0001), and smoking by family (p=0.0005). (Table 4)

Table 4: Association between presence of ARI and environmental characteristics of the respondents (N=358)

Variables		Presence of ARI Yes n(%)	No n(%)	χ2	p-value
Type of House					
	Pucca (concrete)	69(48.93%)	113(52.07%)	0.33	0.56
	Kutcha (mud packed)	72(51.07%)	104(47.93%)		
Cross Ventilation					
	Present	76(53.90%)	123(56.68%)	0.26	0.60
	Absent	65(46.10%)	94(43.32%)		
Type of Fuel Used					
	Liquefied petroleum Gas(only)	32(22.69%)	191(88.01%)	155.26	0.00001*
	Miscellaneous		26(11.99%)		
Place of Cooking					
	Separate Kitchen	45(31.91%)	159(73.27%)	0.11	0.0001*
	Common room	96(68.09%)	58(26.73%)		
Smoking by Family					
	Present	49(34.75%)	39(17.97%)	12.97	0.0005*
	Absent	92(65.25%)	178(82.03%)		
Presence of ARI in family					
	Yes	49(34.75%)	56(25.800%)	3.29	1.06
	No	92(65.25%)	161(74.20%)		

*p<0.05 denotes statistical significance

Out of the 358 respondents, children aged 25 to 59 months were eight times less likely to have ARI compared to the reference group (children aged 6 to 24 months). Similarly, male children were three times more likely to have ARI compared to female children. Regarding education, children of mother with education above secondary level were two times more likely to have ARI compared to the reference group (mother with education up to secondary level). Children of employed mothers were 0.65 times less likely to have ARI compared to unemployed mother. Likewise, children who were delivered normal are 0.54 times less likely to have ARI compared to those born through surgery. Children with no exclusive breastfeeding are 1.86 times more likely to have ARI compared to exclusive breastfed children. Stunted children are three times more likely to have ARI than non-stunted. Similarly, underweight children are 2.66 times more likely to have ARI compared to normal-weight children. Regarding the type of fuel, children who used LPG as cooking fuel were 0.04 times less likely to have ARI compared to those who had used miscellaneous. Children having separate kitchen at home are 0.18 times less likely to have ARI compared to those with a common room as a place of cooking. In addition, children whose family members are smokers are two times more likely to have ARI compared to those who do not smoke. Thus, the presence of ARI is significantly associated with the age and sex of the child, education, type of delivery, breastfeeding status, height for age, weight for age, type of fuel used, place of cooking, and smoking by family members. (Table 5)

Table 5: Bivariate logistic regression analysis between the presence of ARI and selected variables (N=358)

Variables	Presence of ARI Yes n(%)	No n(%)	χ2	p-value	OR	95% CI Lower	Upper
Age of Child (in month)							
6-24	80(56.73%)	29(13.34%)	70.10	0.00001*	1	5.00	13.99
25-29	61(43.27%)	188(86.66%)			8.37		
Sex of Child							
Male	96(68.10%)	88(40.60%)	25.93	0.00001*	1	2.00	4.86
Female	45(31.90%)	129(59.40%)			3.13		
Education of Mother							
Upto secondary	47(33.33%)	39(17.97%)	11.04	0.0008*	1	1.39	3.73
Above secondary	94(66.67%)	178(82.03%)			2.28		
Occupation of Mother							
Employed		123(56.68%)	3.83	0.05	1	0.43	1.00
Unem-ployed	76(53.91%)	94(43.62%)			0.65		
Type of Delivery							
Normal	78(55.31%)	151(69.58%)	6.57	0.01*	1	0.35	0.84
Surgery	63(44.69%)	66(30.42%)			0.54		
Breast Feed-ing Status							
EBF	72(51.06%)	78(35.90%)	8.02	0.0046*	1	1.21	2.86
No EBF	69(48.94%)	139(64.10%)			1.86		
Height for Age							
Stunted	89(63.12%)	79(36.40%)	25.36	0.0001*	1	1.93	4.64
Not Stunted	52(36.88%)	138(63.60%)			2.99		
Weight for Age							
Under Weight	78(55.31%)	69(31.79%)	19.53	0.0001*	1	1.71	4.12
Normal	63(44.69%)	148(68.21%)			2.66		
Type of Fuel Used							
LPG (only)	32(22.69%)	191(88.01%)	155.26	0.00001*	1	0.02	0.07
Miscella-neous	109(77.31%)	26(11.99%)			0.04		
Separate Kitchen	45(31.91%)	159(73.27%)	0.11	0.0001*	1	0.11	0.29
Common room	96(68.09%)	58(26.73%)			0.18		
Smoking by Family Present	49(34.75%)	39(17.97%)	12.97	0.0005*	1	1.49	3.97
Absent	92(65.25%)	178(82.03%)			2.43		

*p<0.05 denotes statistical significance, 1-reference group, significance at 95% CI, OR-odd Ratio, CI- Confidence Interval; Note- LPG (Liquefied Petroleum Gas), EBF-(Exclusive Breast Feeding)

DISCUSSION

The present study aimed at assessing the prevalence of, and factors associated with ARI among children aged 6 to 59 months attending a tertiary care hospital at the Kaski district of western Nepal. In this study, the overall prevalence of ARI was found to be 39.4% which is greater than the national data (27%) and provincial data (17%) in the year 2021.[20] In addition, another study conducted in Bharatpur Municipality revealed a lesser prevalence (36.67%),[18] while greater prevalence (63%)[21] was observed in another study conducted in Pokhara Municipality. Both studies were conducted in municipalities within Gandaki Province. The differences in these findings can be the impact of variations in study populations, study sites, seasons, and the method used to assess the outcome.

In the present study, among the children who had symptoms of ARI, half of them (51.8%) had pneumonia, 31.9% had no pneumonia, and 16.3%) had severe or very severe pneumonia. This finding is in contrast with the findings of a similar study conducted in a teaching hospital in Kathmandu, Nepal which revealed the prevalence of (50%, 26.44%, 23.56%), no pneumonia, pneumonia, and severe pneumonia respectively.[22]

Furthermore, the bivariate analysis showed that the variables significantly associated were age and gender of the child, maternal educational status, absence of exclusive breastfeeding, stunted, wasted, passive smoking, no separate place for cooking and fuel as significant determinants of ARI. This finding is consistent with other similar studies conducted in Low-middle-income countries.[23,24] In contrast to the finding of this study, a similar study conducted in a similar setting in Nepal revealed no significant association of age, sex, nutritional status, exclusive breastfeeding, parental education, and socio-economic status of the respondents.[22] Another similar study conducted in Pokhara, Nepal revealed that malnutrition, exposure to wood smoke, and passive smoking by children as associated factors of ARI among those under five.[21]

In the present study, children whose families used wood as a means of fuel for cooking and not having a separate kitchen room were more prone to have ARI compared to those who used LPG and had a separate kitchen. This finding is supported by several studies[21,25,26] conducted at various places. Thus, the results of this study hold important implications for mothers of under-five children who are the primary care takers of their child and their role in promoting the child's health and preventing various illnesses is vital. Future research might apply to different study designs (i.e., intervention, longitudinal designs) and settings to identify the contributing factors of ARI among under-five children and future interventions might also target creating awareness regarding the determining factors and also the effectiveness of such interventions can be studied. Besides, qualitative studies can be conducted in order to gain in-depth insight regarding the care-providing behavior among the mothers and families in their family settings.

This study was conducted in a single setting therefore it could not be generalized. As it was a cross-sectional study it could not establish the causality regarding the determinants of ARI among under-five in other settings. Qualitative attributes could not be collected as a structured tool was used to obtain the data.

CONCLUSIONS

In this study, determinants for ARI among under-five children were child age and gender, maternal education, breastfeeding and nutritional status of the child, passive smoking, not having a separate kitchen, and using wood as a cooling fuel. Implementing interventions to improve household, nutritional status, and community awareness regarding the determinants of ARI can be beneficial in reducing the incidence of ARI among under-five children.

CONFLICTS OF INTEREST: None declared

SOURCE OF FUNDING: None

AUTHORS' CONTRIBUTION

PP conceptualized the entire study. PP and HS were involved in data collection, statistical analysis, and interpretation of the data. PP prepared the initial draft of the manuscript and it was revised by HS. The final version of the manuscript was prepared with the involvement of both authors.

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