THE INCIDENCE AND FACTORS ASSOCIATED WITH ACUTE RESPIRATORY INFECTION AMONG CHILDREN UNDER 5 YEARS OLD IN THE RURAL VU BAN DISTRICT, NAM DINH PROVINCE, VIETNAM

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Abstract

Objectives: This study aimed at determining the incidence of acute respiratory infection (ARI) and the associated risk factors in children under 5 years old in the rural Vu Ban district, Nam Dinh Province, Vietnam.

Methods: A cross-sectional analytic study was conducted on 389 children under five years old from September 2020 to September 2021 in the rural Vu Ban district, Nam Dinh province, Vietnam. Participants were enrolled by a simple random sampling method. A structured questionnaire was used to collect clinical, socio-demographic and maternal data. Diagnosis of ARI was based on the revised WHO guidelines and the Integrated Management of Childhood Illnesses (IMCI) classification for children with cough or difficulty breathing. The data was analysed using the statistical software SPSS 25.0.

Results: The proportion of ARI in children under 5 years old was 47% (183/389), while lower respiration tract infection was 11.8% (46/389). Risk factors associated with ARI were: history of ARI with an adjusted relative risk ratio of 0.2 (95% CI: 0.1-0.3); p< 0.001; age group with an adjusted relative risk ratio of 0.5 (95%CI: 0.3-0.8); p = 0.003, educational level of mothers with an adjusted relative risk ratio of 0.55 (95% CI: 0.36-0.86); p= 0.008, receiving counselling information of mothers with OR= 3.0; 95%CI= 1.9-4.7; p< 0.001. Gender, immunization status, breastfeeding, weaning time, birth weight, classification of BMI, mothers' age, mothers' occupation, having the first children were not significantly associated with ARI.

Conclusion: The proportion of ARI was high and associated with medical history, age group of children, educational level, receiving counselling information of mothers.

Keywords: Acute Respiratory infection, the incidence, risk factors, children under 5 years

Introduction

Acute respiratory infection (ARI) are a leading cause of morbidity and mortality in under-five children worldwide [1], [2]. The study of Ghimire P and et al in 2022 indicated the rate of ARI was 60.8% (174/286 under five children), nearly 12.16% children with pneumonia/ serious disease [3]. The research of Tazinya Alexis and et al illustrated some risk factors associated with ARI were: HIV infection, poor maternal education, exposure to wood smoke, passive smoking and contact with someone who has cough [4]. The behavior of family members impact both on the risk and prevention of ARI. Some of the identified problems capable of affecting children's health include inability to control the children, unstable income and the stressed condition of most mothers [5]. The study of Rahaman and et al in 2021 about etiology of Severe ARI in Bangladesh indicated male sex (odds ratio [OR] 2.4, 95% CI: 1.0−5.4), pre-existing conditions (OR 2.7, 95% CI: 1.5−4.8), asthma (OR 4.2, 95% CI 2.1−8.4), and history of allergies (OR 3.1, 95% CI: 1.5−6.6) were more common among severe ARI case-patients than controls [6]. There is a significant association between ARI and low socioeconomic status, overcrowding, low birth weight, delay in the initiation of breast feeding, lack of exclusive breast feeding, timely given complementary feeding and immunization status [7]. However, the incidence of ARI and specific correlates in rural population remain largely unexplored. Therefore, there is a need for research to determine the incidence and factors related to ARI in children to have effective intervention solutions that contribute to reduce the incidence of ARI and improve the health in under-five children.

Materials and methods

Aim, design, and setting

A cross sectional analytic study was conducted to assess the incidence of ARI and to identify the factors associated with ARI in rural Vu Ban district, Nam Dinh province, Vietnam.
The inclusion criteria: All children under 5 years who are living at communes in Vu Ban district, Nam Dinh province in Vietnam
The exclusion criteria were: Temporary residents, refuse to participate in the study Sampling technique and sample size
A simple random sampling technique was adopted for this study. Use Excel software to randomly select research subjects, ensuring that the minimum sample size according to the calculated formula and ensuring the selection criteria.
The sample size was calculated using the below formula.

$$n = Z^2_{(1-\alpha/2)}\frac{p(1-p)}{d^2}$$

The study of Tazinya Alexis and et al, reported the overall prevalence of ARI was 54.7% [4]. Thus, using this prevalence with an allowable error of 5% at a confidence level of 95%, the sample size was estimated to be 381 participants. In fact, the researcher collected in 3 months was 389 under-five children

Instruments
The structured questionnaire was based on the revised WHO guidelines [8], [9]. Case definition for ARI was based on the Integrated Management of Childhood Illnesses (IMCI) classification for children with cough or difficulty breathing [10]. Data was collected about socio-demographic, clinical characteristics of children and some general characteristics of their mothers. The research instrument consists of the following parts:
Part 1: Socio-demographic characteristics of under-five children include: age, gender, medical history, immunization status, breastfeeding, weaning time, birth weight, classification of BMI. Some general characteristics of mothers include: mothers' age, occupation, having the first children, receiving information about ARI, educational level
Part 2: The clinical characteristics of children to determine the incidence of ARI in under-five children. The data was collected according to: examine clinical by paediatric doctors/ nurses, interview mothers directly and indirectly on mobile phone, follow up 2 weeks/time during the period of research time, medical records at medical stations, Vu Ban Medical center, Nam Dinh Children's hospital and some private clinics at communes in Vu Ban district.
Research ethics: This study was approved by the Ethical Review Committee of Nam Dinh University of Nursing (no.2359/GCN-HĐĐĐ), and permission for data collection from the authorities of the community. Participants were informed verbally and in writing about the study's aim and their role. All participants reviewed and signed the study informed consent form as their agreement to participate. Research respondents participated voluntarily and were free to withdraw from the study without consequence.
Statistical analysis: All variables entered into the regression models were coded or transformed into categorical measurements. Collected data were coded and tabulated using a personal computer. Using an SPSS 25.0 program for Windows. The data was analysed based on objectives and hypotheses using descriptive statistics. Statistical analysis was performed using the corresponding statistical tests to determine the relationship between variable values. Odds ratio OR, Chi-square, and Fisher exact test (when the value is less than 5) were used. Significance was set at $p < 0.05$ to determine the significant independent risk factor of ARI

Results:
Table 1 describes the general characteristics of research subject. The age group from over 12 months to under 5 years old was 66.3%. Children are the first child (28.8%), children are exclusively breastfed for the first 6 months (71.2%). The weaning time from 12 months and over was a high rate of 81.6%. Most children are fully vaccinated and on schedule (80.2%). However, the proportion of children with a history of ARI was remain high (73.8%). Children with birth weight less than 2500g use a low rate (3.9%). Most of children with BMI classification was normal (68.9%).

Table 1. General characteristics of research subject (N = 389).

Variables	N	%
The age		
Under 2 months	22	5.7
From 2 - <12 months	109	28.0
From 12 months – <5 years	258	66.3
Gender		
Male	211	54.2
Female	178	45.8
The first child		
Yes	112	28.8
No	277	71.2
Breastfeed exclusively for the first 6 months		
Yes	277	71.2
No	112	28.8
Breastfeeding state		
Weaned	223	57.3
Not yet weaned	160	41.1
No breastfeeding	6	1.6
Weaning time		
< 12 months	41	18.4
≥ 12 months	182	81.6
Vaccination		
Complete and on schedule	312	80.2
Enough, not on schedule	71	18.3
Not enough	6	1.5
History of ARI		
Yes	287	73.8
No	102	26.2
Birth weight		
< 2500g	15	3.9
≥ 2500g	374	96.1
BMI classification		
Malnutrition	38	9.8
Normal	268	68.9
Overweight/ obesity	83	21.3

*Abbreviation: BMI, body mass index
*Abbreviation: ARI, acute respiratory infection
Table 2 describes the study investigated from the period from October to December 2020 to assess the incidence of ARI at the rural areas was 47% (183/389 children). The rate of upper

respiratory tract infection was 42.7% (166/389 children). The rate of lower acute respiratory tract infection was 11.8% (46/389 children).

Table 2. The incidence of acute respiratory infection in under five children (N = 389)

Variables		N	%
Children with ARI	Yes	183	47.0
	No	206	53.0
Respiratory Tract Infection	Upper	166	42.7
	Lower	46	11.8

*Abbreviation: ARI, acute respiratory infection

Table 3 describes the incidence of ARI in male children (56.8%) was higher than in female children (43.2%). The age group from 12 months to 5 years old has the highest percentage of ARI children (73.8%). The age group under 2 months has the lowest percentage of ARI children (3.2%).

Table 3. The incidence of acute respiratory infection according to the age and sex of children

Content		Children with ARI: Yes N	Yes %	No N	No %
Gender	Male	104	56.8	107	51.9
	Female	79	43.2	99	48.1
Age group	< 2 months	6	3.2	16	7.8
	2 -<12 months	42	23.0	67	32.5
	12 months – < 5 years	135	73.8	123	59.7

*Abbreviation: ARI, acute respiratory infection

Table 4 describes there was an association between the history of ARI and the incidence of ARI in under five children. This difference was statistically significant with OR = 0.2; 95%CI = 0.1-0.3; p< 0.001. Children with a history of ARI have a higher proportion of ARI at the time of evaluation than children without a history of ARI. There was an association between the age group of children and the incidence of ARI with OR = 0.5; 95%CI = 0.3-0.8; p = 0.003.

Table 4. Potential risk factors of children associated with acute respiratory infection

Factors of children		Children with ARI: Yes N	Yes %	No N	No %	OR (95% CI)	P-value (χ2 – test)
History of ARI	No	20	19.6	82	80.4	0.2 (0.1-0.3)	**0.000**
	Yes	163	56.8	124	43.2		
Age group	< 12 months	48	36.6	83	63.4	0.5 (0.3-0.8)	**0.003**
	12 months – under 5 years	135	52.3	123	47.7		
Gender	Male	104	49.1	108	50.9	1.2 (0.8-1.78)	0.38
	Female	79	44.6	98	55.4		
Breastfeed exclusively for the first 6 months	No	59	52.7	53	47.3	1.4 (0.9-2.1)	0.16
	Yes	124	44.8	153	55.2		
Weaning time	< 12 months	23	56.1	18	43.9	0.67 (0.35-1.3)	0.2
	≥ 12 months	160	46.0	188	54.0		
Breastfeeding state	Weaned	114	51.1	109	48.9	0.68 (0.45-1.0)	0.06
	Others	69	41.6	97	58.4		
Complete vaccination and on the schedule	No	36	46.8	41	53.2	1.0 (0.6-1.6)	0.96
	Yes	147	47.1	165	52.9		
Birth weight	< 2500g	9	60.0	6	40.0	1.72 (0.6-4.9)	0.31
	≥ 2500g	174	46.5	200	53.5		
BMI classification	Normal	134	50.0	134	50.0	0.68 (0.4-1.05)	0.08
	Others	49	40.5	72	59.5		

*Abbreviation: ARI, acute respiratory infection
*Abbreviation: BMI, body mass index
*Abbreviation: OR, odds ratio
*Abbreviation: CI, confidence interval

Table 5 describes the results showed that there was an association between the mother's education level and the incidence of ARI with OR = 0.55; 95%CI= 0.36-0.86; p= 0.008. There was a significant association between receiving counselling information of mothers and the incidence of ARI in their children. This difference was statistically significant with OR = 3.0; 95%CI = 1.9-4.7 and p< 0.001. The study determined that there was no association between the mothers' age group, occupation and mothers have the first child with the incidence of ARI in children, with p> 0.05.

Table 5. Potential risk factors of mothers associated with acute respiratory infection in under-five children

Factors of mothers		Children with ARI				OR (95% CI)	P-value (χ2 – test)
		Yes		No			
		N	%	N	%		
Age group	≤ 25 years	40	44.0	51	56.0	0.85 (0.5-1.4)	0.5
	≥ 26 years	143	48.0	155	52.0		
Educational level	≤ High school	117	42.7	157	57.3	0.55 (0.36-0.86)	**0.008**
	> High school	66	57.4	49	42.6		
Occupation	Civil servants	25	55.6	20	44.4	0.68 (0.4-1.3)	0.2
	Others	158	45.9	186	54.1		
Mothers have the first child	Yes	33	44.0	42	56.0	0.86 (0.52-1.4)	0.56
	No	150	47.8	164	52.2		
Receiving information about ARI	No	85	64.9	46	35.1	3.0 (1.9-4.7)	**0.000**
	Yes	98	38.0	160	62.0		

*Abbreviation: ARI, acute respiratory infection
*Abbreviation: BMI, body mass index
*Abbreviation: OR, odds ratio
*Abbreviation: CI, confidence interval

Discussion

Our research group interviewed mothers having under-five children, examined and followed up children, and then made statistics at commune health stations, private clinics, Vu Ban District Health Center, and Nam Dinh Children's Hospital from October to December 2020. This observation indicated the incidence of ARI at the rural area was high at 47.0% (183/389 children under 5 years old). The result was similar to the study of Tazinya Alexis and et al in 2018 showed that the prevalence of ARI in under-five children was remain high at 54.7% (280/512 children). In which, the rate of pneumonia was 22.3% (112/512) [4]. According to the study of Ghimire P and et al in 2022, the rate of ARI in under-five children was 60.8% (174/286 children under 5 years old), nearly 12.16% children were severe [3]. Research results showed that the majority of children with ARI at the rural area were classified as Upper Respiratory Tract Infection (URTI) at 42.9% (167/389 children). The study of Shivaprakash N.C and et al, Upper Respiratory Tract Infection (URTI) was 30.3% [7]. Other researches also had the proportion of URTI was higher than LRTI in under-five children [3], [4]. Pneumonia is a leading cause of death in children [2]. In our study, the rate of LRTI at the rural area was 11.8%. The rate of ARI in male children (56.8%) was higher than that in female children (43.2%). This can be explained that male children are hyperactive and have more exposure to the outside environment, which is a higher risk factor for ARI disease than female children. This result was consistent with the study of Shivaprakash N.C and et al, about magnitude of ARI in a rural hospital on 145 children with ARI surveyed: 63.4% male children and 36.6% female children had ARI; male: female ratio being 1.7:1 [7]. Our research result illustrated that the age group from 12 months to 5 years old has the highest percentage of ARI children (73.8%). The age group under 2 months has the lowest percentage of ARI children (3.2%). This can be explained that children from 12 months to under 5 years old are often exposed to external environmental factors, which are higher risk factors for ARI disease than others. While, the age group under 12 months, especially the group of children under 6 months, the mother takes maternity leave to focus on taking care of their children and the mother's immunity has not decreased. An associated between ARI children and their age group with an adjusted relative risk ratio of 0.5 (95%CI: 0.3-0.8); p = 0.003. The proportion of children from 12 months to under five years old (52.3%) had ARI higher than that under 12 months (36.6%). The research of Vinod K. Ramani and et al, children with ARI were 37.84% of 2-3-year-old children [11]. Early diagnosis and treatment attributable to control mortality of ARI in children. While high index of suspicion is required among health care workers, knowledge regarding danger signs of ARI in general public, especially among mothers is of paramount importance. This is the basis for seeking early health care intervention by the mothers. The social determinants for increase in prevalence of ARI need to be explored and addressed. The need of strengthening immunization against Measles, Influenza, Pertussis, H. influenza, Pneumococcus and Chickenpox apart from control of indoor air pollution can contribute to lowering mortality related to ARI [12]. Moreover, our research showed that risk factors associated with ARI were the history of ARI

with an adjusted relative risk ratio of 0.2 (95% CI:0.1-0.3); p< 0.001. This result was similar to the research of Shivaprakash N.C and et al, children had previous episodes of ARI were 31.7% compared to children had positive family history of ARI were 11.0% [7]. The study of Wognin A. S and et al in 2023 revealed that a history of coughing was the main factor associated with the occurrence of respiratory diseases. Multivariate analysis showed that respondents with a history of coughing were 3.2 times more likely to develop respiratory disease with OR: 3.2 (95% CI: 1.37 - 7.54) and p< 0.05 [13]. This illustrated the intervention programs in control ARI in children need focus on children with ARI history. The study determined an association between receiving information about ARI of mothers and the incidence of ARI in their children with OR= 3.0; 95%CI= 1.9-4.7 and p< 0.001. Mothers who received information about the disease, caring and prevention of ARI have a 3.0 times lower risk of ARI than children of mothers who did not receive this information. Therefore, it is necessary to have more extensive health information and education programs for mothers having under-five children. According to research results, there was an association between the mother's education level and the rate of ARI in children with OR= 0.55; 95%CI= 0.36-0.86; p= 0.008. Mothers with a higher level of education have a lower risk of ARI in their children. This result was consistent with the study of Tazinya Alexis and et al, low educational level of mother is a risk factor related to ARI in children [6]. Our research results showed that there was no association between characteristics such as age, gender of the children, exclusive breastfeeding for the first 6 months, weaning time, and vaccination for children with the incidence of ARI. This result was similar to the study of Tazinya Alexis, factors such as vaccination status, gender, nutritional status, and breastfeeding were not significantly related to ARI in children. Therefore, the disease control programs should focus on diagnosis, treatment and prevention of ARI in children [4]. Our research determined there was no association between the incidence of ARI and children's BMI classification. The research results of Wognin A. S and et al in 2023 had a similar reflection [13]. However, according to the study of Lamberti and et al, breastfeeding contributed reduce the risk of ARI and death from pneumonia in children under 24 months [14]. Exclusive breastfeeding during early infancy significantly reduces the rate of hospitalization due to pneumonia. Public health programs aimed at reducing the burden of disease in rural areas need to address barriers in exclusive breastfeeding [15].

Conclusion:

ARI incidence and the associated risk factors is essential. The incidence of ARI among children under 5 years old at the rural areas was remain high at 47% (183/389 children). The rate of upper RTI and lower RTI were 42.7% (166/389 children) and 11.8% (46/389 children), respectively. There was an association between receiving counseling information of mothers and ARI incidence in their children with OR= 3.0; 95%CI= 1.9-4.7; p< 0.001. There was an association between the history of ARI and ARI incidence in children. The difference was statistically significant with OR= 0.2; 95%CI= 0.1-0.3; p< 0.001. There was an association between the age group of children and ARI incidence, with OR= 0.5; 95%CI= 0.3-0.8; p= 0.003. The study indicated an importance of basic health promotion measures such as health education for mothers having under-five children about ARI disease

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