

## An Analysis of Factors for Acute Respiratory Infections (ARI) in Children under Five of Age in Bangladesh: A Study on DHS, 2014

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### ABSTRACT

Acute respiratory infection (ARI) in under-five children in developing countries is a major cause of child mortality. Acute Respiratory Infection (ARI) is associated with various risk factors and identifying these associated risk factors for ARI may, therefore, be helpful in reducing the disease burden. In Bangladesh, this study aimed to identify risk factors associated with ARI in children under the age of 5. The current study gathered ARI data from the Bangladesh Demographic Health Survey 2014. Bivariate and multivariate analysis was done in this study. Additionally, binary logistic regression is evaluated to resolve the relative risk of ARI below the age of 5 years. The findings of this study clearly revealed various risk factors associated with ARI. Age and sex of the children, wealth index, socio-economic status, the education of the mother and maternal age considered as an important risk factor. The major adverse effect of low maternal age on severe ARI risk in childhood underlines the need to raise marriage and childbearing age through both media awareness campaigns and legal avenues. Women's higher education would, directly and indirectly, reduce the likelihood of severe ARI by rising marriage age of women and women's childbearing age.

**Keywords--** Acute respiratory infection (ARI), Under-five of age, Children, binary logistic regression, Bangladesh

### BACKGROUND

Children are the population's biggest and most vulnerable group. Healthy children are growing into healthy adults who are strong in body and mind. Respiratory tract infections may be the most common human disease especially for children. Acute Respiratory Infections (ARI) are spread throughout the world, although they have different impacts between developing and developed nations. According to the WHO (2006),

many children under the age of 5 undergo between 4 and 6 episodes of ARI annually in both developing and developed countries, while in industrialized countries 1% to 3% of deaths in children under the age of 5 are due to pneumonia, pneumonia in developing countries accounts for 10% to 25% of deaths in children under the age of 5 [1]. An estimated 3.9 million deaths worldwide are caused by ARI in young children each year. It is assessed that Bangladesh, India, Indonesia and Nepal together account for 40% of the global ARI mortality. While the incidence of pneumonia may be as low as 3-4 percent in developed countries, its prevalence in developing countries varies from 20 to 30 percent. The disparity is due to the high incidence of malnutrition in developing countries, low birth weight, and indoor air pollution. In Bangladesh, according to Kabir et al. (2016) ARIs responsible for about 39% of total pediatric hospital admissions and, 40 - 60% of total pediatric outpatient department visits [2]. Different studies have shown that approximately one-fifth of the total under-five deaths in developing countries are directly attributed to ARI [3, 4]. According to Hadi (2003), half of the ARI deaths in under-five children could be reduced through early detection and appropriate treatment [5]. Williams et al. [4] found that ARIs are one of the leading causes of childhood mortality, causing approximately 1.6 – 2.2 million deaths worldwide in children under the age of 5 each year. There are various factors that are actually cause children under 5, ARIs such as age (Seidu et al. 2019) [6], socio-economic status (Adesanya & Chiao, 2017) [7], family size (Nasanen, Gilmore et al. 2015) [8], place of residence, maternal education, birth order (Hashi et al. 2016) [9], age of mother (Bbaale,2011) [10], breastfeeding practices (Amugsi, 2015) [11] etc. Children in their first three months of life have the highest risk of pneumonia. Nearly 70-75% of all child deaths are caused by pneumonia. Cigarette smokers and smokers' children are more vulnerable to pneumonia in both developing and developed countries than those not exposed to cigarette smoke. There is also a strong suspicion that indoor air pollution leads significantly to ARI child death (World Bank, 1993) [12].

This study tried to assess the factors for ARI in children through demographic, cultural and geographical variables using BDHS 2014 data.

## METHODOLOGY

### Data source

This is a secondary analytical study based on, a set of data under the BDHS (Bangladesh Demographic and Health Survey), 2014 to study the factors affecting to Acute Respiratory Infections (ARI) for under-5 Year Children. Bangladesh Demographic and Health Survey (BDHS) 2014 is the seventh national-level demographic and health survey carried out in Bangladesh which is undertaken to provide information on basic national indicators of social progress including fertility, childhood mortality, fertility preferences and fertility regulation, maternal and child health, nutritional status of mothers and children, and awareness and attitude towards HIV/AIDS. To obtain these information, a nationally representative sample of 17,863 ever-married women aged 15-49 were interviewed.

The DHS household survey is able to answer many relevant questions on access, utilization and quality of health services. The nationally representative DHS sample included all children under 5 years of age. Sample selection is multi-stage, with census enumeration areas selected in the first stage with probability proportional to size.

## Variable Selection

For this study, Total number of children have faced Acute respiratory infection of women in Bangladesh is used as the dependent Variable and predictor variables have been included for this analysis which are Division, Age 5-years group, Type of place of residence, respondent's educational qualification, Religion, Wealth index. For the suitability of this study some variables are recorded and at the same time new variables created by combining information of some variables instead of the variables with their original codes.

## RESULTS AND DISCUSSIONS

Statistical analysis is embryo of any thesis, dissertation or project. In this work, bivariate and multivariate analysis is carried out. For bivariate hypothesis-based Chi-square test is employed. Also, binary logistic regression is examined to discuss about the relative risk of chance ARI under 5 years age group.

### Bivariate analysis

In this segment, our dependent variable is prevalence of Acute Respiratory Infection (ARI) and explanatory variables are demographic and some household variables. From the result of bivariate analysis it can be seen that Acute respiratory syndrome (ARI) is severe in children but not differ in sex. In this study, the prevalence of ARI for male is more (56.90%) than female (43.10%).

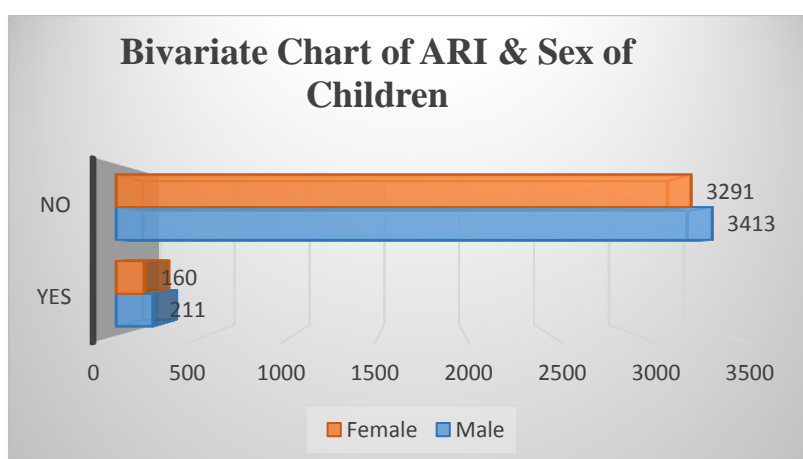


Figure 1: Bivariate chart of ARI & Sex of children

The prevalence of ARI infection decreases, as ages increases. Before one year, skin, backbone and hairs are so soft and moisture. But in this study, chance of ARI infected is much

(39.90%) for 37-59 months than others. Acute respiratory infection (ARI) of children under five age group is much vulnerable for pastoral areas for third world countries. Still it considers as a burden

of disease for Sub-Saharan nations. Out of 7075 married woman owing alive children, 31.40% are from town sides whereas 68.60% are from rural areas. In rural areas, there is 73.90% have responded to having ARI symptoms of last two weeks.

In this paper two hilly tracts –Chittagong (19.10%) and Sylhet (17.50%) have comparatively

more occurrences of ARI than other division.

Economic condition of a family is crucial for a child because it coincides his/her health, physical condition, mental growth & embellishment, food habit and time schedule in proper management. In our study, as the economic situation or wealth index increases, the possibility of being ARI decreases.

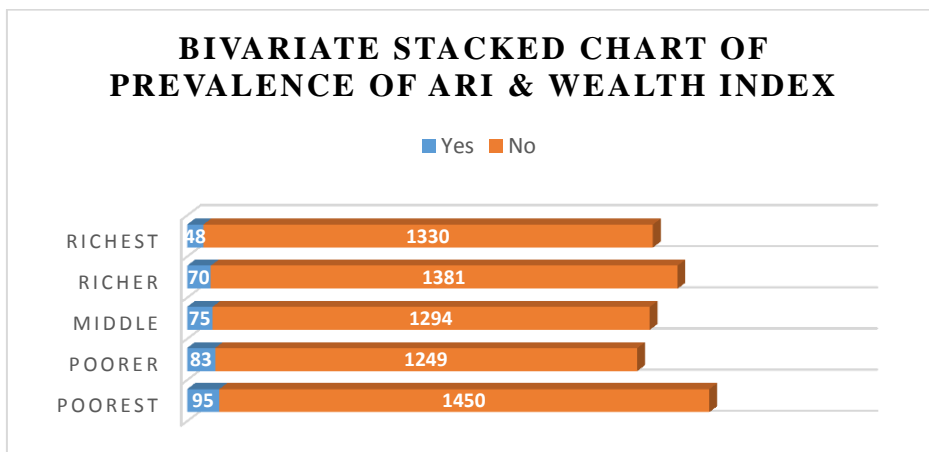


Figure 2: Bivariate Stacked Chart of Prevalence Of ARI & Wealth Index

Consciousness of mother is a safeguard for her beloved children. In this study, 46.10 percent have accomplished secondary stage of our national education layer. For ARI bearing

children, primary level accomplished mother's children (36.10% Yes, 27.50% no) are experienced more than secondary level (42.90% yes, 46.30% no).

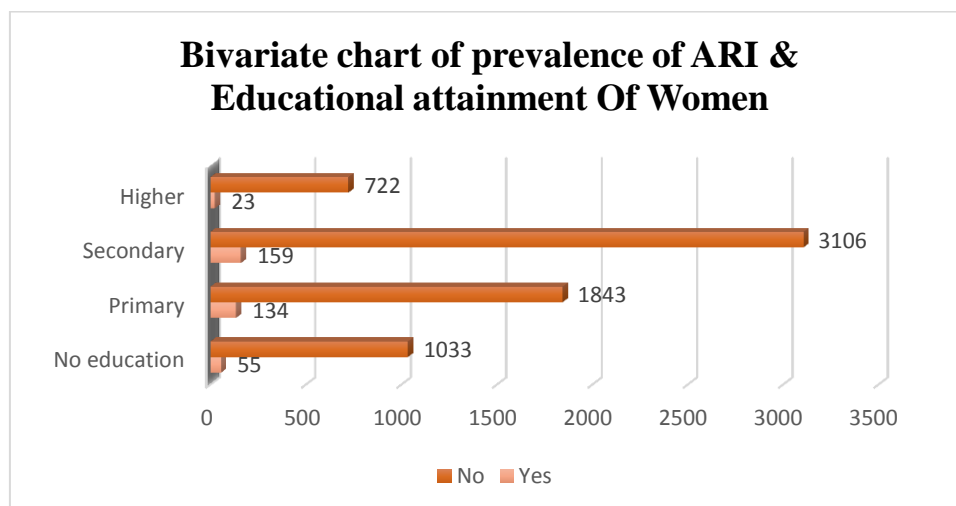


Figure 3: Bivariate Chart Of prevalence of ARI & Educational attainment Of Women

Husband's educational level also reflect his level of awareness or darkness. Husband who completed primary level or incomplete in primary have much chance of facing with ARI disease than accomplished secondary level or forth. Chance of having ARI increases for not working-group woman. The possibility of a mother having ARI infected child is 24.60% whereas for not engaging in occupation is 23.70%. The chance of being infected in ARI is increased for lack of improved

drinking water source. In our study, the chance of being ARI is more having unimproved toilet facilities (43.10% for ARI, 37.70% for non-ARI) compared with improved toilet facilities (56.90% for ARI but 62.30% for non-ARI). In our study, the possibility of having ARI for solid fuel user is 80.10% whereas for clean fuel user is 8.40%.

Body of a children is much sensitive under 5 year. In this stage, the structure of his living room plays vital role for spreading germs and infections.

In case of floor material, surface of house made of earth or sand having much possibility for children in acute respiratory infection (66.30%) than cement based floor (21.60%). Also, in wall material, the chance of infected acute respiratory children increases of Tin (40.70%) surrounded house than cement (15.90%). It's also greater possibility for tin-shade house (79%) of having ARI than cement (5.1%) or others (15.90%).

Overcrowding retards health and psychosocial development of children. The prevalence of ARI is highest (56.30%) for moderately household members (4-6 persons). Also, for overcrowded people its 31.50%.

### Logistic Regression

To exhibit the prevalence of ARI under 5 year's children, we decode dependent variable 1 if ARI present and 0 if not. We also run two logistic regression, one for demographic variables (part 1) and other household variables (part 2). In demographic analysis, our concern is to exhibit prevalence of ARI with sex of child, age-group of child, age-group of mother and also some geographic or socio-economic variables like as types of residence, division, wealth index, occupation or educational qualification of mother and father etc.

**Table 1: Binary logistic regression with odds ratio of prevalence of ARI (part 1)**

Variable	Coefficient	S.E.	Wald statistic	df	p-value	Relative risk
<b>Sex of child</b>						
Male	0.248	0.108	5.23	1	<b>0.022</b>	1.281
Female						
<b>Age group of child</b>			1.569	2	0.456	
0-24 months	-0.146	0.121	1.46	1	0.227	0.864
25-36 months	-0.029	0.144	0.04	1	0.841	0.971
37-59 months						
<b>Types of residence</b>						
Urban	-0.153	0.128	1.438	1	0.23	0.858
Rural						
<b>Division</b>			6.811	6	0.339	
Barishal	-0.372	0.222	2.798	1	0.094	0.689
Chittagong	-0.004	0.181	0	1	0.984	0.996
Dhaka	-0.023	0.187	0.016	1	0.9	0.977
Khulna	0.141	0.205	0.474	1	0.491	1.151
Rajshahi	0.127	0.197	0.413	1	0.52	1.135
Rangpur	-0.163	0.21	0.601	1	0.438	0.85
Sylhet						
<b>Age group of mother</b>			22.081	6	0.001	
15-19 years	0.398	0.748	0.284	1	0.594	1.489
20-24 years	-0.026	0.743	0.001	1	0.972	0.974
25-29 years	-0.186	0.745	0.062	1	0.803	0.83
30-34 years	-0.362	0.752	0.232	1	0.63	0.696
35-39 years	0.288	0.758	0.145	1	0.704	1.334
40-45 years	-0.424	0.894	0.225	1	0.635	0.654
45-49 years						
<b>Educational qualification of mother</b>			5.91	3	0.116	
No education	0.232	0.305	0.578	1	0.447	1.261
Primary	0.452	0.276	2.695	1	0.101	1.572
Secondary	0.165	0.256	0.416	1	0.519	1.18
Higher						
<b>Educational qualification of father</b>			10.29	3	0.016	
No education	0.2	0.256	0.612	1	0.434	1.221
Primary	0.518	0.236	4.801	1	0.028	1.678
Secondary	0.161	0.23	0.492	1	0.483	1.175
Higher						
<b>Employment status of mother</b>						
Currently working	0.054	0.13	0.172	1	0.679	1.055
Not working						
<b>Occupation of father</b>			1.617	3	0.656	
Do not work	-18.191	6743.85	0	1	0.998	0
Agriculture	0.16	0.145	1.216	1	0.27	1.173
Skilled manual	-0.002	0.131	0	1	0.988	0.998
Others						
<b>Constant</b>	-3.478	0.798	18.983	1	<b>0</b>	0.031

Source: Estimated

**Interpretation**

The risk of having ARI for male is 1.281 times significantly more than female child under 5 years age group. Hence, it indicates male children has relatively more risk of falling Ari than female. Though beta coefficient is not significant, but odds ratio reveals risk higher as age of children is larger. The risk of falling ARI symptoms for 0-24 months is 0.864 times more than of 37-59 months child. The risk of having ARI for urban is 0.851 times more than rural areas children. So, its crystal view that the risk of having ARI is greater in pastoral sides than in town life. On reference to Sylhet division, the risk of facing ARI for children is larger for Rajshahi and Khulna children. The risk of ARI o under 5 years child for Khulna is 1.151 times more and 1.135 times more for Rajshahi than Sylhet dwelling children. Similarly, other division dwellers are facing less risk. Except category, age group of mother reveals significant for the prevalence of ARI. Less than 25 years (RR=.974), more implicitly, 20 years (RR=1.489) the risk of facing ARI is severe than others. But mothers ageing from 35-39 years (RR=1.334) bearing children have also notable risk of ARI disease. Mother having primary or no education faces more problem for ARI symptoms than surpassed secondary stage education. But mother who have just primary level qualification (RR=1.572) has much risk of facing ARI of children than others (for no education, RR=1.261; for secondary, RR=

1.18) as a reference of higher education. Also, relative risk decreases, as education level increases. So, for better health treatment or primary step for caring or nurturing child, education of am other is necessary. Like as mother, father owing primary or no education faces more problem for ARI symptoms than surpassed secondary stage education. Father having just primary level qualification (RR=1.678) has much risk of facing ARI of children than others (for no education, RR=1.225; for secondary, RR= 1.175) as a reference of higher education. It's a silver line that relative risk decreases, as education level increases. So, to ensure better treatment or increasing immunization, education of a father is also crucial. It's natural that working class woman can't take care properly than non-working mother. This study also emphasis on that the risk of struggling with ARI symptoms is more (RR=1.055) for working class woman than non-working. The children of working-class father face ARI symptoms more than unemployed. Also, agricultural side faces most risk in favor of Ari (RR=1.173) than others. Another binary logistic regression is carried out for household related issues (part 2). A lot of caveats gone for attributing a major reason for ARI due to poor household structure, lack of consciousness and lack of proper facilities in sanitation and water sources. So, on the basis of this consideration, this work interpreted another regression with significant odds ratio (relative risk) values

**Table 2: Binary logistic regression with odds ratio of prevalence of ARI (part 1)**

Variable	Coefficient	S.E.	Wald	d.f.	p-value	Relative risk
<b>Drinking source of water</b>						
Improved	-0.565	0.264	4.579	1	<b>0.032</b>	0.568
Unimproved						
<b>Toilet facility</b>						
Improved	-0.013	0.125	0.011	1	0.917	0.987
Unimproved						
<b>Cooking fuel</b>			0.452	2	0.798	
Clean	0.157	0.611	0.066	1	0.797	1.17
Solid	0.28	0.6	0.217	1	0.641	1.323
Others						
<b>Floor material</b>			2.448	2	0.294	
Earth & sand	0.318	0.552	0.332	1	0.564	1.374
Cement	0.568	0.544	1.09	1	0.296	1.765
Others						
<b>Wall material</b>			6.664	2	<b>0.036</b>	
Tin	-0.063	0.131	0.23	1	0.631	0.939
Cement	-0.58	0.228	6.435	1	0.011	0.56
Others						
<b>Roof material</b>			3.95	2	0.139	
Tin	-0.246	0.265	0.858	1	0.354	0.782
Cement	-0.725	0.377	3.699	1	0.054	0.484
Others						
<b>Overcrowding</b>			0.627	2	0.731	
Not crowded	0.146	0.186	0.614	1	0.433	1.157
Moderately crowded	0.055	0.122	0.204	1	0.651	1.057
Overcrowded						
<b>Constant</b>	-2.633	0.165	255.874	1	<b>0</b>	0.072

Source: Estimated

### Interpretation

The chance of risk having ARI for using improved drinking source is significantly 0.432 times less than unimproved. Also, coefficient reveals negative relation with ARI. Hence, improved drinking facility has less risk than unimproved drinking source of water facility. Like as drinking facility, improved toilet facility household has less risk to be infected with ARI than improved toilet facility. As reference to other sources of cooking fuel, the risk of clean cooking fuel (RR=1.17) is comparatively less risk than solid user (RR=1.323). It's a matter of concern that fuel emits harmful gases from solid cooking fuel user needs to be stopped for better health of child and caring more on respiration. As child life is time for to and fro attitude, running hither and thither, so floor material in cement (RR=1.765) has larger risk for ARI symptom than earth and sand (RR=1.374) due to lack of cleanliness and consciousness of parents about breeding of germs. In winter or spring, autumn or summer, air direction in house is vulnerable for some wall and roof structure. Using tin in house wall, has more significant risk (RR=0.93) for looking out symptoms of ARI than cement user house (RR=0.59). Similarly, having tin roof material, has more significant risk (RR=0.782) for looking out symptoms of ARI than cement-based roof house (RR=0.484). This study doesn't reveal significant effect for ARI symptoms due to overcrowding houses.

### CONCLUSION

The findings of this study clearly revealed that under five children born to lower educated mothers are at a significantly higher risk of severe ARI than children born to educated mothers in Bangladesh. The second important risk factor is the mother's lower age that is also related to lower educational level of mothers. Household lower socio-economic status is an important risk factor of childhood ARI in developing countries like Bangladesh. As noted above increasing educational participation of girls in secondary schools in Bangladesh should have a positive effect on better awareness of the need for appropriate medical intervention in ARI. In addition to broad based interventions to increase maternal education, efforts to provide targeted health care information about ARI to mothers' need be strengthened. The significant adverse effect of low maternal age on childhood severe ARI risk underscores the need for increasing age at marriage and childbearing through both media awareness campaigns and legal avenues. Bangladesh has the lowest median age at marriage (15 years) and childbearing in the region although the legal framework is in place (age at

marriage legally=18 years). In recent years the government is providing free education and also incentives among females to increase female literacy in Bangladesh. Due to this policy female enrolment in secondary schools has dramatically increased (now one of the highest in South Asia) and this should start to have a positive impact on increasing age at marriage and consequently childbearing (Rahman O, 2004). So, women's higher education will reduce the chance of severe ARI directly and indirectly through increasing age at marriage and age at childbearing. Therefore, to increase age at marriage and childbearing, improvements in child health (both for severe ARI and malnutrition) are important to improve women educational levels.

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