HOUSEHOLD ENVIRONMENTAL FACTORS AND CHILDHOOD ACUTE RESPIRATORY INFECTION IN BANGLADESH: FINDINGS FROM NATIONAL

Shakina Sultana

College of Public Health Sciences, Chulalongkorn University, Bangkok, 10330, Thailand

ABSTRACT:

Background: Unsustainable household environmental factors influences the risk of under 5 morbidities. The prevalence of childhood acute respiratory infection (ARI) considerably high in Bangladesh. The objective of this study was to find out the associations of household environmental factors and ARI among child under 5 years in Bangladesh.

Methods: The data were obtained from a Multiple Indicator Cluster Survey (MICS) at national level among children under 5 years in Bangladesh conducted by the UNICEF in 2012-2013. Women aged between 15 and 49 years living in selected households provided information on 20903 of their children under the age of 5 years. Primary outcome measure the morbidity status of children was recorded with respect to episodes of ARI in the 2 weeks preceding data collection. Data was analyzed by using SPSS and binary logistic regression was used as statistical test.

Results: The factors were positively associated with ARI: children aged 6-11months (OR= 1.86; 95% CI= 1.596-2.180; p<0.001). Children who were from Chittagong Divisions were more affected than Sylhet Division (OR=2.090; 95% CI=1.760-2.483; p<0.001) poor household (OR=1.5; 95%CI=1.273-1.807; p<0.001), one child in household (OR=1.2; 95%CI= 1.099-1.322; p<0.001).

Conclusion: Results from this research underline the importance and improvement of household environment regarding childhood morbidity in Bangladesh. Preventive measurements acquire more to lower the risk of ARI in very early age group of children. However, these strategies need to be integrated with health education in primary level raise the likelihood that reduced risks are acute respiratory infections.

Keywords: Household environment; Acute respiratory infection; Multiple Indicator Cluster Survey; Bangladesh

DOI: *Received: June 2017; Accepted: July 2017*

INTRODUCTION

Worldwide, acute respiratory tract infections (ARTI) are responsible for almost 30 % of deaths among children under 5 years of age [1]. In low-income countries, the annual incidence remains high with an estimated 151 million episodes of ARTIs, making this the second cause of disability-adjusted life-years (DALYs) in children [2]. Environmental conditions are affiliated to these 60% of acute respiratory infections [3].

* *Correspondence to: Shakina Sultana*
E-mail: sultanashakina3@gmail.com

In under 5 deaths, over 50% from acute lower respiratory infections (ALRI) are related to particulate matter inhaled from indoor air pollution from household solid fuels [4].

In Bangladesh of one-fifth of all deaths of under-five children respectively pneumonia, acute respiratory infections (ARIs) which are related with household environment [5]. Currently very few studies on household environmental risk factors of ARI in Bangladeshi children at the national level. From this point, we aim to find out the association between household environmental factors with ARI among children under 5 years in Bangladesh.

Cite this article as: Sultana S. Household environmental factors and childhood acute respiratory infection in Bangladesh: findings from national. J Health Res. 2017; 31(Suppl.2): S189-94. DOI:

In this study further analysis of the MICS data were done with the aim of exploring the household environmental risk factors associated with under 5 leading morbidity. The understanding the effect of the household's environmental conditions on ARI will helps improve policy formulation and interventions related specifically to housing and environmental conditions in Bangladesh.

MATERIALS AND METHODS

This study used secondary data from the Bangladesh Multiple Indicator Cluster Survey among children under 5 years old. This cross-sectional survey was conducted in 2012-2013 by the Bangladesh Bureau of Statistics [6], Statistics and Informatics Division, Ministry of Planning, Bangladesh in collaboration with the Ministry of Health as part of the global MICS program which is technically and financially supported by UNICEF. Data regarding under 5 children, socio-demographic and socio-economic condition, household demographic and household environmental conditions were collected.

The survey employed a two-stage stratified sample of households. In primary sampling, in seven divisions, the districts were identified as the main sampling strata. Within each stratum, a specified number of census enumeration areas (cluster) were selected systematically with probability proportional to size, in urban areas and in rural areas and complete household listing operation was carried out.

In second stage, a random systematic sample of 20 households was drawn in each sample enumeration area. Among 51,895 households, data were completed for 20,903 of these children. A structured interview was conducted to select respondents at the household level. This study focused in children under 5 years old. Ethical approval was taken for the secondary analysis from the Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group, Chulalongkorn University, Bangkok, Thailand (COA No. 124/2017).

Dependent variables

Researcher studied child morbidity, acute respiratory infection among under 5 years in Bangladesh. For logistic regression two categories were used: had ARI or no ARI (Acute respiratory tract infection was those who had an illness characterized by a cough, accompanied by rapid or difficult breathing in the past two weeks preceding the survey as reported by the caretaker/mother).

Independent variables

Independent variables were selected based on review of the literature, and consulted with experts. We choose 16 independent variables. Six variables were related to household environmental factors. Rest of them were child demographic, household demographic & socio economic variables were used as control variables [2, 7-9].

Statistical analysis

Multivariate analysis was computed using binary logistic regression since outcomes are dichotomous to find the adjusted odds ratio. In bivariate analysis each independent variables were analyzed individually with the both dependent variables separately.

ARI was investigated using logistic regression models. Groups of variable in different categories (child's factors / household factors) were used in two model analysis such as; Model 1: multivariate analysis of child demographic factors and household environmental factors associated with ARI in children aged under 5 years in Bangladesh. Model 2: multivariate analysis of all independent variables associated with ARI in children aged under 5 years in Bangladesh.

The Statistical Package for Social Sciences (SPSS) software program, Version 16 were used for final analysis.

RESULTS

Male children (51.3%) were slightly more than female children49.7%. Children aged less than 23 months were 37.9% and 62.1 % children were aged between 24-59 months. About 15.6 % children under 5 years had acute respiratory infection (ARI) 2 weeks before the survey.

Majority of children (95.3%) belonged to household that consume drinking water from safety sources. Almost 95.1% treat water to make it safe for drinking. The water source distribution of these household are 65.3 % are inside yard and 32.2% are outside yard. Most children (92.7%) belonged to household that use pollute fuels for cooking.

Both models showed, children, aged 6-12 months were 1.8 times more likely to develop ARI than those aged 48-59 months and children aged 0-5 months and 12-23 months aged were 1.6 times more likely to develop ARI than children aged 48-59 months. In model 1, main source of drinking water had a positive significant effects on ARI (p=0.008). Children belonged to household used unsafe water source as drinking water were 1.3 times

Table 1 MODEL 1: Multivariate analysis of child demographic factors and household environmental factors associated with ARI in children aged under 5 years in Bangladesh. MODEL 2: Multivariate analysis of all independent variables associated with ARI in children aged under 5 years in Bangladesh

Variables	Model 1				Model 2			
	B	OR	95% CI	P	B	OR	95%CI	P
Child age (months)								
0-5	0.487	1.627	1.387-1.909	<0.001	0.523	1.687	1.435-1.986	<0.001
6-11	0.613	1.846	1.583-2.153	<0.001	0.623	1.865	1.596-2.180	<0.001
12-23	0.519	1.681	1.476-1.914	<0.001	0.514	1.672	1.466-1.907	<0.001
24-35	0.429	1.536	1.346-1.752	<0.001	0.421	1.523	1.333-1.740	<0.001
36-47	0.182	1.199	1.048-1.373	0.008	0.162	1.176	1.026-1.347	0.02
48-59		1				1		
Child gender	-0.045	0.956	0.882-1.035	0.267	0.043	0.958	.883-1.038	0.296
Breastfeeding status	0.301	1.351	.956-1.909	0.088	0.261	1.298	.915-1.840	0.143
Nutritional status								
Height for age	0.015	1.016	.944-1.092	0.678	0.023	1.023	.950-1.102	0.55
Weight for age	-0.076	0.927	.844-1.018	0.111	-0.081	0.922	.839-1.013	0.091
Weight for height	0.023	1.023	.910-1.150	0.705	0.041	1.042	.926-1.173	0.496
Main source of drinking water	0.252	1.287	1.069-1.549	0.008	0.07	1.072	.883-1.307	0.481
Treat drinking water	0.123	1.131	.923-1.387	0.235	0.169	1.184	.959-1.462	0.116
Location of water source	0.163	1.177	1.079-1.284	<.001	0.024	1.024	.925-1.133	0.646
Type of cooking fuel	-,135	0.873	.697-1.095	0.241	0.087	1.091	.849-1.402	0.469
Area					0.023	1.023	0.907-1.155	0.707
Division								
Barisal					0.338	1.402	1.143-1.719	<0.001
Chittagong					0.737	2.090	1.760-2.483	<0.001
Dhaka					-0.188	0.829	0.690-.995	0.044
Khulna					0.696	2.006	1.667-2.413	<.001
Rajshahi					0.113	1.12	0.908-1.382	0.29
Rangpur					0.413	1.511	1.247-1.831	<0.001
Sylhet						1		
Wealth index								
Poor					0.417	1.517	1.273-1.807	<0.001
Middle class					0.154	1.166	1.005-1.353	0.043
Rich						1		
Household head educational level								
None					-.011	0.989	.882-1.109	0.848
Primary completed					.117	1.124	1.004-1.258	0.042
Secondary /higher						1		
Maternal education level					-0.006	0.994	.935-1.056	0.842
Total number of under 5 children in household								
1 child					0.185	1.205	1.099-1.322	<0.001
>1 child						1		
Constant	-2.268	0.104		0.00	3.008	0.049		0.00

more likely to develop ARI than household used safe water source as a source of drinking water. In model 2, when main source of water adjusted with all predictors variables, it had no significant effect on ARI. Same as location of the water source location had highly significant association with ARI (p=<0.001) in model 1. Children belonged to household used water source outside yard were 1.2 times more likely to develop ARI than household used water source inside own yard as a source of drinking water. In model 2, when location of source water adjusted with all predictors variables, it had no significant effect on ARI.

In model 1, division had a highly significant association with ARI (p<0.001). Children lived in Chittagong Division and Khulna Division were 2 times more likely to develop ARI than children lived in Sylhet Division. In model 2, wealth index had a positive significant association with ARI (p=<0.001). Children from poor household were 1.5 times more likely to develop ARI than rich household.

Total number of children in one household had a positive significant association with ARI (p=<0.001). Household had only one child were 1.2 times more likely to develop ARI than household with more than one child.

Household head's education level had a positive significant association with ARI (p=<0.001). Children belonged to household where head had primary education were 1.1 times more likely to develop ARI than household where the head had secondary or higher education. In contrast, household head with no schooling had no statistical association with ARI development in child under 5 years.

DISCUSSION

Researcher studied the household environmental factors in Bangladesh that could cause ARI among child under 5 years. The highest risk of ARI was found in this study in children aged 0-23 months in multivariate analysis. Studies in Ghana, with children between the ages of 24 and 59 months having the lowest risk of cough and at 12–23 months were pick periods [10].

This condition may be due to loss of innate immunity and/or exposure to different types of infections from eating contaminated food prepared with unclean water and in unhealthy environment as reported in other studies [11]. On the other hand, low risk of morbidity among older children could be due to the immunity the children build over time, which enables their bodies to fight off infectious agents from the environment. A possible explanation for this is that children aged less than six months have less contact with the environment and are taken care of cautiously. They also benefit from the protective effect of breast milk (if breastfeeding). From 6 months, children are introduced to a variety of foods besides becoming increasingly mobile thereby increasing their chances of contamination and infection, bearing in mind that their immune system is still under developed.

Breast feeding status were not significant in case of ARI in multivariate analysis .The protective effect of breastfeeding on child morbidity has been widely documented in both high-income [12, 13] lower middle-income countries [13].

Division showed highly significant association with ARI in multivariate analysis. Chittagong and Khulna divisions are more likely develop ARI when adjusted with all predictors (Model 2). Similar findings have been found for Chittagong division in previous study in Bangladesh [9]. Since Khulna is the largest and Chittagong is the second largest port city and industrial area of Bangladesh which may lead to increase risks of exposure of outdoor air pollution to the children specially in dry season [14]. This in turn may be expected to put children in this region at an elevated risk of respiratory infection.

In this study, children from poor households were more likely to have ARI compared to higher income households. This finding is consistent with several studies which have found similar findings in India, Uganda [15, 16] and in low income and lower middle income countries. Children had more ARI where household head who had primary education were more none or higher education in multivariate analysis. Similar finding has been reported in Uganda [16]. This result is counter-intuitive and hence surprising. It might be the case that primary education is too low to yield favorable health outcomes. These findings contradict the results of a study conducted in Turkey where father's education was revealed as particularly important [17].

Maternal education level showed no significant association with both ARI either of the analysis. This was also reported by studies in Eritrea , Egypt and Ethiopia [18]. This findings were contradict with the results of several studies found in lower income countries and lower middle income countries [7].

This study found significant association between number of children under 5 years in the household and ARI, where risk of ARI raise with the only one child in household. This finding contradict with another study done in Eritrea [19]. The possible explanation of this outcome is, household with one child were more affected than more than one child during this periodic episode of ARI.

Main source of drinking water was associated with ARI in children in bivariate analysis. Children living those household use unsafe source for drinking water had risk to develop ARI. ARI showed association when analyzed with child demographic factors as control but it lost association when analysis with all of the predictors (Model 2). A similar scenario was observed in Uganda [16].

Type of cooking fuel was not associated with ARI by multivariate analysis; with clean fuels being linked to less ARI in children under 5 years. We expected it to have a strong effect on ARI, but the reverse became true. Similar findings had been reported by a study in Uganda [16]. This finding contradicts with a case control study conducted in

Nepal which found an association between ARI and solid fuel use among children aged 2-35 months [20] meta-analysis including Africa China, Latin America [21], and study in Mexico [22]. According to MICS survey 92.7% household were using pollute cooking fuel, so further investigation is needed to execute the finding.

CONCLUSION AND RECOMMENDATIONS

It is able to conclude that this MICS survey that children age is risk factor for acute respiratory infection (0-35 months). Household environmental factors showed no risk in case of childhood ARI, only household demographic & socio–economic factors were more risk in developing ARI of under 5 children in Bangladesh.

A major strength of this study provides a picture of factors associated with ARI at national level and can therefore be useful for policy making at these level interventions related specifically to housing and environmental conditions in Bangladesh. The major weakness of the study that, study done using data collected through a cross sectional study design, only associations can be made without inferring causality and there is potential for recall bias on ARI variables. The disease episodes are determined on the basis of self-reporting of mothers and not followed by any clinical examination.

Interventions which are known to prevent ARI in children should be emphasized more in Barisal, Chittagong, Khulna and Rangpur division and the poor households of Bangladesh. Children aged 0-53 months have higher risk of getting ARI, they should receive special attention in preventive efforts. Policy makers should take initiative to make safe and sustainable household environment. All the house members should be educated the about the cleanliness of household environment and hygiene. Further research, in the form of longitudinal studies, is needed to understand the complete dynamics of childhood ARI morbidity and associated factors.

ACKNOWLEDGEMENTS

I would like to express my heart-felt gratitude to my thesis advisor for his unfailing guidance and invaluable support during the entire course of my study**.** I would like to express my gratefulness to UNICEF Bangladesh for allowing me to use their MICS data for my thesis.

REFERENCES

1. Liu L, Johnson HL, Cousens S, Perin J, Scott S, Lawn JE, et al. Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. Lancet. 2012 Jun; 379(9832): 2151-61. doi: 10.1016/s0140-6736(12)60560-1
2. Agustina R, Shankar AV, Ayuningtyas A, Achadi EL, Shankar AH. Maternal agency influences the prevalence of diarrhea and acute respiratory tract infections among young Indonesian children. Matern Child Health J. 2015 May; 19(5): 1033-46. doi: 10.1007/s10995-014-1603-z
3. World Health Organization [WHO]. Global health observatory (GHO) data: under-five mortality. Available from: http://www.who.int/gho/child_health/mortality/mortality_under_five_text/en
4. Smith KR, Samet JM, Romieu I, Bruce N. Indoor air pollution in developing countries and acute lower respiratory infections in children. Thorax. 2000 Jun; 55(6): 518-32.
5. Demographic, Bangladesh. Health survey BDHS. Preliminary report. Addis Ababa: Federal Ministry of Health; 2011.
6. Bangladesh Bureau of Statistics. Bangladesh population and housing census 2011. Dhaka: Ministry of Planning; 2012.
7. Sonego M, Pellegrin MC, Becker G, Lazzerini M. Risk factors for mortality from acute lower respiratory infections (ALRI) in children under five years of age in low and middle-income countries: a systematic review and meta-analysis of observational studies. PLoS One. 2015; 10(1): e0116380. doi: 10.1371/journal.pone.0116380
8. Kinyoki DK, Manda SO, Moloney GM, Odundo EO, Berkley JA, Noor AM, et al. Modelling the Ecological Comorbidity of Acute Respiratory Infection, Diarrhoea and Stunting among Children Under the Age of 5 Years in Somalia. Int Stat Rev. 2017 Apr; 85(1): 164-76. doi: 10.1111/insr.12206
9. Kamal MM, Hasan MM, Davey R. Determinants of childhood morbidity in Bangladesh: evidence from the Demographic and Health Survey 2011. BMJ Open. 2015 Oct; 5(10): e007538. doi: 10.1136/bmjopen-2014-007538
10. Amugsi DA, Aborigo RA, Oduro AR, Asoala V, Awine T, Amenga-Etego L. Socio-demographic and environmental determinants of infectious disease morbidity in children under 5 years in Ghana. Glob Health Action. 2015; 8: 29349. doi: 10.3402/gha.v8.29349
11. Elizabeth AM, Raj S. Impact of bio-social factors on morbidity among under-five children in odisha. Health Popul Perspect Issues. 2012; 35(4): 176-92.
12. Duijts L, Jaddoe VW, Hofman A, Moll HA. Prolonged and exclusive breastfeeding reduces the risk of infectious diseases in infancy. Pediatrics. 2010 Jul; 126(1): e18-25. doi: 10.1542/peds.2008-3256
13. Arifeen S, Black RE, Antelman G, Baqui A, Caulfield L, Becker S. Exclusive breastfeeding reduces acute respiratory infection and diarrhea deaths among infants in Dhaka slums. Pediatrics. 2001 Oct; 108(4): E67. doi: 10.1542/peds.108.4.e67
14. Golam S. Sattar N, Uddin. Air pollution in Chittagong City, Bangladesh. In: 9th International Conference on Environmental Science and Technology (CEST2005), Rhodes, Greece; 2005.
15. Avachat SS, Phalke VD, Phalke DB, Aarif SM, Kalakoti P. A cross-sectional study of socio-demographic determinants of recurrent diarrhoea among children under five of rural area of Western Maharashtra, India. Australas Med J. 2011; 4(2): 72-5. doi: 10.4066/amj.2011.524
16. Bbaale E. Determinants of diarrhoea and acute respiratory infection among under-fives in Uganda. Australas Med J. 2011; 4(7): 400-9. doi: 10.4066/amj.2011.723

17. Etiler N, Velipasaoglu S, Aktekin M. Incidence of acute respiratory infections and the relationship with some factors in infancy in Antalya, Turkey. Pediatr Int. 2002 Feb; 44(1): 64-9.
18. Tarekegn M, Enquselassie F. A case control study on determinants of diarrheal morbidity among under-five children in Wolaita Soddo Town, Southern Ethiopia. Ethiop J Health Dev. 2012; 26(2): 78-85.
19. Woldemicael G. Diarrhoeal morbidity among young children in Eritrea: environmental and socioeconomic determinants. J Health Popul Nutr. 2001 Jun; 19(2): 83-90.
20. Bates MN, Chandyo RK, Valentiner-Branth P, Pokhrel AK, Mathisen M, Basnet S, et al. Acute lower respiratory infection in childhood and household fuel use in Bhaktapur, Nepal. Environ Health Perspect. 2013 May; 121(5): 637-42. doi: 10.1289/ehp.1205491
21. Dherani M, Pope D, Mascarenhas M, Smith KR, Weber M, Bruce N. Indoor air pollution from unprocessed solid fuel use and pneumonia risk in children aged under five years: a systematic review and meta-analysis. Bull World Health Organ. 2008 May; 86(5): 390-8c.
22. Schilmann A, Riojas-Rodriguez H, Ramirez-Sedeno K, Berrueta VM, Perez-Padilla R, Romieu I. Children's Respiratory Health After an Efficient Biomass Stove (Patsari) Intervention. Ecohealth. 2015 Mar; 12(1): 68-76. doi: 10.1007/s10393-014-0965-4.