Impact of rural-urban migration on childhood risk of Acute Respiratory Infection (ARI) among under-5 children

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ABSTRACT

Although the implications of rural-urban migration for socio-economic development are of long-standing interest to social scientists, relatively little is known about the effects of migration on the health of the most vulnerable members of migrants' families –young children under 5 years of age. This study uses a large nationally representative dataset from Bangladesh (Bangladesh Demographic and Health Survey- (BDHS) 2004) to examine whether rural-urban migrant children are more likely to suffer from Acute Respiratory Infections (ARI) than their non-migrant peers (urban non-migrants and rural non-migrants). Even after controlling for potential confounders such as poverty, use of solid fuels, maternal under-nutrition, child under-nutrition, maternal education and maternal age, rural-urban migrant children are significantly more likely to suffer from ARI than non-migrant children (OR: 1.28; 95% C.I. [1.017---1.614]). Interestingly there is no difference in childhood risk of ARI between the two non-migrant groups (rural non-migrants and urban non-migrants) once adjustments are made for household poverty and use of solid fuels. Other potential confounders relating to social networks such as access to health care, knowledge about ARI prevention may help further explain this increased risk but the absence of specific data on these factors is a barrier to forming any definitive conclusion. These results suggest we need to have better information on social networks, health care access and knowledge about prevention to better understand the risk environment of childhood ARI. Moreover couples may want to avoid migration when their children's age is less than five years as they have a high risk of suffering from ARI.

INTRODUCTION

Urbanization is defined as the process of development where rural-urban migration is responsible for urbanization (Islam and Azad, 2008; Afsar, 2000). Most of the studies define rural-urban migration as the process of development. People are migrating from rural areas to urban areas due to unequal infrastructure between rural and urban areas, searching job opportunity, pursuing education, treatment and other purpose (Afsar, 2000). A large number of studies documented that rural-urban migrants are increasing their income through job opportunity after rural-urban migration (Azad and Islam, 2007). Apart from this, rural-urban migrants have improved their life style by adopting different modern urban facilities like electricity, modern sanitation system, tap water for drinking and washing, improved housing, education etc (Azad and Islam, 2007). Although the implications of rural-urban migration for socio-economic development are of long-standing interest to social scientists, very little work has looked at the effects of migration on the health and survival of the most vulnerable members of migrants' families – infants and children.

Apart from socio-economic development, rural-urban migrants have positive and negative impacts on biological and demographical characteristics of human beings such as fertility, morbidity, mortality, immunization, malnutrition, diseases, health, demographic and genetic structure etc. (Bogin and MacVan, 1981). Health care service is of a higher standard in urban places compared to rural places. So, children born to rural-urban migrants have nearly similar immunization coverage like children born to urban native mothers that is higher than rural children. This may reduce the childhood morbidity as well as childhood mortality among migrants' children's compared to rural native children. However, impact of rural-urban migration on childhood morbidity and mortality is mixed. Using Demographic and Health Survey Data of 17 countries, Brockerhoff (1994) documented that rural to urban migrants have an improved child (children of age 12-59 months) survival status. Stephenson et al. (2002) in another study in India found that infant (children of age<12 months) and toddler (children of age 12-23 months) mortality of rural-urban migrants is similar to urban native children. Using the BDHS 2004 data, Islam and Azad (2008) found that childhood (both infant and under-5) mortality is higher among children to rural-urban migrants than non-migrant children (both urban and rural non-migrants) and even this difference is higher among the children that come from

poor migrant families. However, this may lead to the conclusion that migrant children are more vulnerable to poor health in Bangladesh.

In recent years, most of the cities in Bangladesh are experiencing rapid but unplanned urbanization (Islam and Azad, 2007; Afsar, 2000). Though the annual population growth rate is 1.5 per cent at national level, it is more than 5 per cent in most of the big cities, and it is expected that more than half of the population in Bangladesh will live in urban areas by the year 2025 (World Bank, 1999). Urban growth in Bangladesh is mainly an outcome of rural-urban migration that is estimated to contribute between three-fifths to two-thirds of urban growth (UN, 1993a: 2-16) and about three-quarters to four-fifths of the urban poor represent migrant groups in the mega city of Dhaka (Islam and Azad 2008; Centre for Urban Studies (CUS), 1990; Majumdar *et al*., 1996). In a recent urban slum study (CUS, 2006) of six divisions, it was found that roughly 35 percent of the urban population are slum dwellers whereas they live on only 4 percent of the total urban area. Although Bangladesh has the world's highest population density (at 2600 per square mile), density in the slum is roughly 531,000 people per square mile that is 200 times higher than the national density. Over 70 percent of these slum dwellers have no access to safe latrines, 42 percent houses are made brick walls with a tin roof and roughly 90 percent of slum households had a monthly income below the poverty line (of 5,000 taka per household per month) (CUS 2006).

Though rural-urban migrants improve their socio-economic status after migrating to urban areas, their living standard is always lower compared to the urban natives. It may be easy to migrate to an urban area, but it is difficult to survive in urban areas especially for the poor. Evidence demonstrates that usually poor are migrating to urban areas from rural areas and staying in slum areas (Majumdar et al., 1995). Even though they adopt urban facilities and improve their socio-economic status, most of the time they stay outside the main city as it is expensive to live closer to the main city. Apart from this, most of the time these people live in slum areas or in low quality housing areas with more crowding, lack of proper sanitation and sewerage system, and improper source of drinking water with more air, water, land, noise and other environmental pollution (CUS, 2006; Brokerhoff, 1995). These rural-urban migrants work in various informal sectors and their earning is poor also. Besides this, these people are spending most of their

income for housing and transport and for this reason they are unable to spend sufficient money for their children's nutrition and health care. As a result, these children suffer from malnutrition that leads to worse health like ARI among rural-urban migrant children.

Studies have shown that due to lower intake of adequate food, improper treatment and insufficient care giving, children from poor families grow up malnourished compared to their counterparts in richer households (Hong et al. 2006; Rice et al. 2000; Owor 2000; Pelletier D.L. 1998; Ashworth and Dowler 1991). However studies documented that wealth status of urban residents is better than rural residents and people are migrating to urban areas from rural area mainly for economic reasons (Afsar, 2000). After migration, migrants improve their wealth status that is better than rural native and slightly lower than urban native (Azad and Islam, 2007). Afsar (2000) has observed positive relationship between economic development and urbanization in Bangladesh. The study notes that rural-urban migration in Bangladesh involves people from both the low and high socio-economic strata. For the poor in rural areas, urban migration is predominantly a poverty alleviation strategy, whereas for the rich, such migration is a strategy for better education, health and economic development (Afsar, 2000).

Acute respiratory infection (ARI) is the leading cause of childhood death in developing countries (Kristensen and Olsen, 2006; Williams et al., 2002; Victora, 1999, World Bank, 1993; Denny and Loda, 1986). Each year, globally over two million children under five (roughly 20% of total under five child deaths) die from ARI, with 90% of these deaths due to pneumonia (WHO, 2006; Jennifer et al., 2005; Williams et al., 2002; Victora, 1999; World Bank, 1993). However, a previous study in Bangladesh found that rural-urban migrants have higher childhood mortality (Islam and Azad 2008). Therefore this study aims to identify whether there is any higher risk of ARI among rural-urban migrants in Bangladesh or not.

DATA AND METHODOLOGY

Study design

The data for this study comes from the Bangladesh Demographic and Health Survey 2004 (BDHS 2004) that covered a nationally representative sample of 11,440 ever-married women of age 10-49 years and their children born 0-59 months prior to the survey date. BDHS 2004 is a stratified, multistage cluster sample with 361 primary sampling units (PSUs): 122 from urban areas and 239 from rural areas. An average of 30 households was selected from each PSU. The unit of analysis is the child. In order to reduce the recall bias in the BDHS survey, information regarding Antenatal Care (ANC), Post Natal Care (PNC), immunization, diseases etc. was asked only for the children of age less than 60 months. Therefore, a file was created for the sample of children of age 0-59 months including all variables of household and mother. A list of 6,498 surviving children (weighted) was obtained from that file. Excluding missing, non-eligible (visitors in household, urban to rural migrants), non-response cases for the questions related to ARI and child nutrition (height and weight without being flagged); a final sample size of 5,286 children was obtained for this study.

VARIABLES

Dependent Variable

In this study, the dependent variable is ARI, coded as 1 if the child suffered from ARI in the two weeks prior to the survey date and 0 otherwise. A child was considered as having experienced ARI if the mother reported that the child had a cough in the last two weeks preceding the survey date along with any one of three symptoms of: (i) short, rapid breathing; (ii) difficulty in breathing; (iii) chest in drawing (NIPORT, 2005).

Independent Variables

The first complicated work in this analysis was to define migration. In addition to current place of residence (categorized as city, town, other urban, village), the survey collects basic information on childhood residence, number of years the respondents spent in the current place

of residence (coded in single years, always and visitors), and type of residence prior to the most recent migration. Using this information it is possible to identify four migration streams: those who had moved from rural to rural areas, urban to urban, rural to urban and urban to rural. In this study, a migrant is defined as a person who has changed place of residence across an administrative boundary. Visitors were excluded from the analysis. Women reported childhood residences as rural and current residence as urban, are classified as rural to urban migrant (RUM). Similarly women reported childhood residences as urban and current residence as rural, is classified as urban to rural migrant (URM). The non-migrant groups of respondents are classified as rural native (RN) and urban native (UN) based upon their reported duration at the current residence as "always". Respondents who reported current and childhood places as similar (either rural or urban) are considered as native (rural native (RN) or urban native (UN). URM were not included in the final analysis as no. of cases is relatively small and these are not important for the objectives of this study.

Other independent variables were chosen based on prior knowledge of determinants of ARI. The main interest in this study was in exploring the impact of rural-urban migration on ARI. In addition, we included other potential control and confounding variables such as household wealth index, age of child, sex of child, wasting status of child (measured by weight/height), vitamin A supplementation of child in last six months, mother's age, mother's BMI, mother's education and use of solid fuels for cooking. Most of the variables included in the study were included based on previous studies (Azad and Rahman 2007; Arifeen et al. 2001; Victors 1999; Chhabra et al. 1997).

The confounding variable in this analysis is an index of wealth status. In the absence of income or consumption data, BDHS 2004 used household assets to construct a wealth index using principal components analysis (Rutstein and Johnson, 2004, NIPORT, 2005). The wealth or household asset index was classified into five quintiles i.e. richest, richer, middle, poorer, and poorest. After exploratory analysis, it was found that the top two quintiles were no different (tested using individual t-test) from each other in terms of their risk of ARI. Similarly, no difference was found between the bottoms three quintiles in terms of ARI risk. Thus we

dichotomised the quintiles into two categories: the poor (the bottom three quintiles) with the reference category being the rich or non-poor (the top two quintiles).

Childhood malnourishment and maternal BMI were operationalized using standard anthropometrical measures of height and weight. The standard measurements were based on the U.S. National Center for Health Statistics (NCHS) standard, recommended by the World Health Organization (WHO). Standard normal (Z score) was calculated for each variable. Details can be found in NIPORT (2005). Other independent variables in this study are self-explanatory.

Analysis

Logistic regression analysis using a standard statistical package (STATA 8) was used to estimate the effect of key explanatory variables on ARI among the children after controlling for the effects of other confounding variables. Odd ratios adjusted for clustering were estimated and 95% confidence intervals (CI) for the odd ratios were calculated. Models were tested sequentially in stages to explore the mechanisms by which different migration status affects ARI.

RESULTS

Table1: Background characteristic of the respondents

Migration status	No. of children (%)	% suffered from ARI within group	Odds ratio (OR) (95% CI)		
Migration status			OR	lower	upper
Urban non-migrant†	415 (7.86)	15.2	1.00		
Rural non-migrant	4199 (79.42)	21.6	1.54	1.15	2.05
Rural-urban migrant	672 (12.72)	21.9	1.56	1.14	2.12
Total	5286 (100)	21.14			

† Reference category

Table1 shows that children of rural native and rural-urban migrants suffer more from ARI compared to children of urban native. Two weeks prevalence of ARI among the children of urban native was nearly 15% whereas this rate is nearly 22% for both rural native and rural-urban migrants and these rates are significantly higher than urban native. This may indicate that children born to rural-urban migrants have similar types of ARI prevalence like children born to rural natives.

Table2: Unadjusted odds ratio of ARI for selected variables, Bangladesh 2004

	No. of persons (n)	Among them, who suffered from ARI (%)	Unadjusted Odds ratio	95% CI lower	95% CI upper
Migration status					
Native (urban & rural)	4614	971 (21.04)	1		
Rural-urban migrant	672	147 (21.83)	1.05 ns	0.85	1.30
Children's age in month			0.98*	0.98	0.98
Sex of children					
Boy	2703	606 (22.42)	1.17*	1.01	1.35
Girl	2584	511 (19.8)	1		
Socio-economic status					
Poor	3550	830 (23.37)	1.53*	1.30	1.81
Well off	1736	288 (16.58)	1		
Types of cooking fuel					
Solid fuel	4851	1053 (21.71)	1.60*	1.15	2.24
Others	435	64 (14.75)	1		
Stunting children (ht/age)					
No	2951	585 (19.8)	1		
Yes	2335	533 (22.83)	1.20*	1.04	1.38
Wasting present in Children					
No	4568	941 (20.61)	1		
Yes	718	176 (24.53)	1.25*	1.03	1.52
Children have taken Vitamin A in last 6 months					
Yes	3842	712 (18.53)	1		
No	1444	405 (28.07)	1.72*	1.45	2.03
Mother's BMI (kg/m^2)					
<18.5	2007	469 (23.37)	1.24*	1.05	1.45
18.5+	3279	648 (19.77)	1		
Mother's age					
20+	4470	878 (19.63)	1		
<20	816	240 (29.42)	1.71*	1.40	2.08
No. of children ever born			0.99 ns	0.95	1.03
Mother's Highest educational level					
Primary or less education	3747	836 (22.32)	1.29*	1.11	1.49
Secondary+	1539	281 (18.27)	1		
# of person in HH			0.99 ns	0.96	1.01

* =Significant at ά=0.05; ns =Not significant

Table2 represents the unadjusted odds ratios for different risk factors of childhood ARI. The age of the child is an important biological risk factor for ARI where the risk of ARI substantially declines as children become older. Like other studies (Victora, 1999) boys are significantly more likely to have ARI than girls in this sample. Children born to poor families have higher odds of

suffering from ARI compare to children from well-off families. Other child characteristics that were significant risk factors for ARI were childhood under-nourishment as measured by (i) height/age, (ii) weight/height and (iii) access to Vitamin A supplementation in the last six months. Maternal factors that were important included: (i) lower age, (ii) under-nutrition and (iii) lower education. Children of young, under-nourished and less educated mothers were at much higher risk of ARI than children of older well-nourished and more educated mothers. Exposure to solid fuels for cooking also significantly increased ARI risk.

Table 3: Background characteristic of urban and rural natives and rural-urban migrants

	Native			Rural-urban migrant (RUM)	Total
	Urban	Rural	Total		
Mean age of Children's in month	30.00	29.93	29.94	29.80	29.92
% Male children	50.6	51.6	51.5	48.8	51.1
% of poor HH	25.5	75.7	71.2	39.7	67.2
% HH using solid fuel for cooking	58.9	98.7	95.1	68.8	91.8
Childhood under-nourishment					
% stunting (ht/age)	35.3	45.6	44.7	40.5	44.2
% Wasting (wt/ht)	12.1	14.1	13.9	11.6	13.6
% without Vitamin A in last 6 months	25.2	28.0	27.7	24.4	27.3
Maternal factors					
Mother's BMI<18.5	25.6	40.5	29.0	30.7	38.1
% mother's age <20	10.8	15.8	15.4	16.0	15.4
Mean # of children ever born (parity)	2.7	3.21	3.17	2.85	3.12
% Mother's primary or less education	57.8	73.8	72.4	60.5	70.9
Mean # of person in HH	6.35	6.24	6.25	6.03	6.22

Table3 shows the background characteristics of urban native (UN), rural native (RN) and rural-urban migrants (RUM). Here it is found that biological risk factors of children (sex of child and age) are similar for different migration status. However, distribution of socio-economic status like wealth status, solid fuel for cooking food is different for different migration status. Other risk factors of childhood ARI like Mother's characteristics (education and BMI) and health care utilization are differently distributed with different migration status. Thus for most of the cases it is noted that urban natives are in a better position compared to rural natives and rural-urban migrants whereas the rural-urban migrants are in a better situation than rural natives but not better than urban natives. This table reveals that for the most part, rural natives are more likely than rural-urban migrants than urban natives to have known risk factors of ARI.

Multivariate Analysis

Table4: Logistic regression models of the relative OR of ARI among children age 0-59 month

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Migration status							
Native (urban & rural)	1	1	1	1	1	1	1
Rural-urban migrant	1.05	1.22	1.30*	1.30*	1.30*	1.29*	1.28*
Children's age in month	0.98*	0.98*	0.98*	0.98*	0.98*	0.98*	0.98*
Sex of children							
Boy	1.19*	1.18*	1.18*	1.18*	1.18*	1.19*	1.19*
Girl	1	1	1	1	1	1	1
Socio-economic status							
Poor		1.61*	1.51*	1.43*	1.41*	1.32*	1.30*
Well off		1	1	1	1	1	1
Types of cooking fuel							
Solid fuel			1.43 ns	1.38 ns	1.37 ns	1.34 ns	1.35 ns
Others			1	1	1	1	1
Stunting children (ht/age)							
No				1	1	1	1
Yes				1.35*	1.34*	1.31*	1.31*
Wasting present in Children							
No				1	1	1	1
Yes				1.19 ns	1.18 ns	1.18 ns	1.18 ns
Children have taken Vitamin A in last 6 months							
Yes				1	1	1	1
No				1.34*	1.34*	1.32*	1.32*
Mother's BMI (kg/m^2)							
<18.5					1.08 ns	1.07 ns	1.07 ns
18.5+					1	1	1
Mother's age							
20+						1	1
<20						1.41*	1.42*
No. of children ever born						1.00 ns	1.01 ns
Mother's Highest educational level							
Primary or less education						1.20*	1.20*
Secondary+						1	1
# of person in HH							0.99 ns

* Significant at ά<.05, ns =Not significant at ά <.05

Model1 and Model2 demonstrate that there is no significant different of ARI prevalence among native children (both UN and RN) compared with children from RUM families after controlling for the effects of child age and sex and poverty. However in Model3, after controlling for solid fuel for cooking (as a proxy for indoor air pollution and wealth), it is found that children from RUM families suffer significantly more form ARI compare to children from native families. This result suggests that though RUM are improving their socio-economic status

through different household assets after migrating to urban areas, their children are still vulnerable to different kinds of disease like ARI. One reason may be a worse living environment that is indicated by indoor air pollution.

In Model4 and Model5, when measures of child under-nourishment as proxied by stunting, wasting and vitamin A supplementation and mother's under-nutrition are included, the odds ratio of ARI does not change. This model reveals that although stunting and vitamin A deficiency are the risk factors of ARI, child under-nutrition and mother under-nutrition are equally distributed between natives and migrants.

In Model6, after controlling for maternal characteristics (mother's body mass index (BMI), maternal age, parity and education) there is a slight decline in the OR from 1.30 to 1.29. This decline suggests that mother's lower age and education are the risk factor of ARI and a substantial part of the excess risk of ARI for migrant children is due there being a greater likelihood of lower maternal education among the RUM relative to native. This result is supported by the study of Henry et al. (2004) where they found that mother's education (not father's education) along with household assets or land ownership is the best predictor of child health.

Finally in Model7 after adjusting for the effect of crowding (proxied by number of person in the household), the OR declines from 1.29 to 1.28 but still it is significant. This Model indicates that some excess risk of ARI among the RUM children is due to household crowding though crowding is not a significant risk factor for in this study.

Discussion

This study demonstrates that migrant children suffer significantly more from ARI compared to native children. Due to infrastructure and economical differences, people are migrating to urban areas in order to improve their socio-economic status. Though they are improving their economic

status after migration, if we consider child health, their child health status is deteriorating after migration. In a recent study in Bangladesh (Islam and Azad 2008) it is found that mortality of rural-urban migrant children is higher. This study demonstrated that rural-urban children suffer significantly more from different kind of diseases (proxied by ARI) and that may be the reason of higher childhood mortality among rural-urban migrants compared to both urban and rural natives in Bangladesh. One possible explanation may be childcare. For natives (both for rural and urban), apart from parents there may be few relatives who can look after the children that leads to fewer health complications among children and such kinds of facilities are less for rural-urban migrants (Brokerhoff, 1995). Secondly, it is important to become familiar with health facilities and health provider. Networking with health service providers may be relatively stronger for natives (for both rural and urban) than for rural-urban migrants. Due to weak network with health service providers, they have less access to health services that leads to higher morbidity and mortality among rural-urban migrant children.

Most of the urban-migrants are living in slum areas where living standards are very low. Usually slums are more crowded, lack basic amenities like safe drinking water, hygienic sanitation system and have highly polluted land, water, noise and indoor air (CUS 2006, Brokerhoff, 1995). A number of studies have shown that over crowding and indoor air pollution are the important risk factors for ARI (Kristensen and Olsen, 2006; Cardso, 2004; Victora, 1999; Chhabra et al., 1997; Rahman and Rahman, 1997; Victora et al., 1994). This analysis has explored a crude proxy of this effect by examining the impact of solid fuels. If more sensitive measures of indoor air pollution are available, more of this residual excess risk of the rural-urban migrants could have been explained. Apart from this, they have to spend a large portion of their earnings for house rent and for that reason they can spend less for nutritious food and treatment. Residences of migrants may be comparatively far from their working place. For this reason, they get comparatively less time to look after their own children that may leads to lower immunity and higher diseases among rural-urban migrants' children.

A major posited risk factor for ARI is crowding as it increases transmission probabilities. A crude proxy for crowding used in many studies is the number of household members. In this study there was no increase (in fact there is a decrease although it is not significant) in ARI risk

for households having higher number of inhabitants. One way to reconcile these results is to consider the premise that increased number of household members may not correlate with increased crowding.

Availability/access and knowledge about the desirability of medical services may have a significant impact on ARI prevalence. One can posit that earlier and judicious use of medical services reduces the duration of ARI and thus the prevalence. Due to weak networks and relatives, rural-urban migrants have lower access to health care. This may be an important difference between the migrants and the natives. However no such data is available in this dataset.

Another possible explanation for higher ARI among the migrant children may be selection bias. It may be possible that due to higher childhood morbidity/mortality in rural areas, mothers are migrating to urban areas with children if they think that their children is comparatively less healthy and will get better treatment if they migrate to urban areas. However, it is not possible to test it due to lack of information.

Limitations

The most important limitation of this study is its cross sectional design that does not gives us the overall information about the scenario before and after migration. There is also the issue of mortality selection or survivorship bias. As only children who survived to the survey date are counted, it is possible that due to lower health system facilities in rural areas, mothers are migrating to urban areas with children if they think that their children are comparatively less healthy and will get better treatment if they migrate to urban areas. It was not possible to test it because of lack of relevant information due to study design. It is also hard to know if child malnourishment (proxied by weight/height) is a result of the ARI or a cause.

Categorisation of poor vs non-poor may also have resulted in misclassification with the most likely possibility of being that some of the poor (in terms of consumption capability) were labelled as rich due to non-liquid asset ownership. It may be such that though rural-urban

migrants were considered as comparatively richer than rural natives, basically still they are poor. This kind of misclassification would result in increasing the relative risk of ARI for the rural-urban migrants versus natives.

It may be such that residence and living standard of migrants are comparatively lower. A large proportion of rural-urban migrants stay in slum areas with more crowding, lack of proper water and sanitation system, more environmental and air pollution. However information related to environment, air pollution, and crowding are missing from this study. Information related to caregivers for children in the house or neighbourhood, care giving, health access and network are also not available in this study.

Conclusion

In spite of various constraints and limitations, the findings of this study clearly demonstrate that under-five children of rural-urban migrants in Bangladesh are significantly at higher risk of ARI than their non-migrant counterparts. This disadvantage is to some extent explained by the lower socio-economic status of the migrants compare to urban native, greater likelihood of the migrants having more under-nourished children (lower height/age, weight/height, lower rates of Vitamin A supplementation), more under-nourished mothers (lower maternal BMI; lower age at marriage and childbirth), mothers with less knowledge about health care and nutrition (less educated mothers) and greater exposure to indoor air pollution (use of solid fuels for cooking).

This study demonstrates the negative impact of poverty on ARI risk in children. Children to poor families suffer significantly more from ARI. However, poor families use more solid fuels for cooking. Efforts to improve ventilation either through better technology (e.g. better designed stoves) or knowledge dissemination (e.g. promotion of cooking outside cramped indoor quarters) would have an advantageous impact on ARI risk in poor children.

The significant adverse effect of low maternal age on childhood 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 female enrolment in secondary school 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).

This analysis also demonstrates the importance of maternal education (a proxy for knowledge about nutrition and health care practices) on reducing ARI risk. As noted above increasing educational participation of girls in secondary school 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 also need to be strengthened.

Finally this analysis demonstrates an alarming situation regarding rural-urban migration and slum dwellers. More than one third of the urban residents are slum duellers where these slums grow as a consequence of rural-urban migration. People who migrate to urban areas are mostly indirectly forced to consider slums as their place of residence. Such kind of behaviour is increasing the health risk of child. These results also suggest that couples may think about avoiding migration when children's age is less than five as they have high chance of suffering from ARI. Government/NGO should provide health and nutrition service among urban slum duellers especially for women and children. It is also important to ensure hygienic environment in urban slum areas.

Reference:

Afsar, R. (2000) *Rural-urban migration in Bangladesh: causes, consequences and challenges*. The University Press Limited, Dhaka.

Arifeen, S., Black, R.E., Antelman, G., Baqui, A., Caulfield, L. (2001) Exclusive breastfeeding reduces acute respiratory infection and diarrhea deaths among infants in Dhaka slums. *Pediatrics* Oct 108(4):[8]

Ashworth, A., Dowler, E., (1991) Child malnutrition, In: Disease and mortality in Sub-Saharan Africa, edited by Richard G. Feachem, Dean T. Jamison. Oxford, England, Oxford University Press:122-33.

Azad, A.K., & Islam, M.M., (2007) Rural-Urban Migration and Its Effects on Fertility in Bangladesh, *Dhaka University Journal of* Science, Vol. 55, No. 1: 47-52

Bogin B; MacVean RB, (1981): Biosocial effects of urban migration on the development of families and children in Guatemala, *American Journal of Public Health*. 1981 Dec;71(12):1373-77

Brockerhoff M (1995) Child survival in big cities: the disadvantages of migrants; *Social Science and Medicine.* 1995 May; 40(10):1371-83.

Brockerhoff M; 1994: The impact of rural-urban migration on child survival. *Health Transition Review*.

Cardoso, M. R., Cousens, S. N. et al. (2004) "Crowding: risk factor or protective factor for lower respiratory disease in young children?" *BMC Public Health* 4: 19.

Centre for Urban Studies (1990) The Urban Poor in Bangladesh, vol. 1, Comprehensive Summary Report, Dhaka: Centre for Urban Studies, Dhaka University.

Chhabra, P., Garg. S., Mittal, S.K., Chhabra, S.K. (1997) Risk factors for acute respiratory infections in underfives in a rural community, *Indian Journal of Maternal and Child Health* 8(1):13-7.

Denny, F.W., Loda, F.A. (1986) Acute respiratory infections are the leading cause of death in children in developing countries, *American Journal Of Tropical Medicine And Hygiene* Jan;35(1):1-2

Hong, R., James, E.B., Jose, A.B. (2006) Relationship between household wealth inequality and chronic childhood under-nutrition in Bangladesh, International Journal for Equity in Health, 5(1), http://www.equityhealthj.com/content/5/1/15

Jennifer, B., Cynthia, B.P., Kenji S., Black, R.E., et al., (2005) WHO estimates of the causes of death in children. *Lancet*; 365: 1147–52

Kaushik, P.V., Singh, J.V., Bhatnagar, M., Garg, S.K., Chopra. H. (1995) Nutritional correlates of acute respiratory infections, *Indian Journal Of Maternal and Child Health* 6(3):71-2.

Kristensen, I.A., Olsen, J. (2006) Determinants of acute respiratory infections in Soweto – a population-based birth cohort, *South African Medical Journal*, 96(7): 633-40

Islam M.M., Azad A.K. (2008) "Rural-Urban Migration and Child Survival in Urban Bangladesh: Are the Urban Migrants and Poor Disadvantaged?" *Journal of Biosocial Science*, Volume (40), Page 83-96.

Majumdar, P., Mahmud, S. and R.Afsar (1995), Squatters of Dhaka:Dynamism in the Life of Agargoan Squatters, University Press Limited, Dhaka.

National Institute of Population Research and Training (NIPORT), (2005) Bangladesh Demographic and Health Survey 2004. Calverton, Maryland: National Institute of Population Research and Training (NIPORT), Mitra and Associates, and ORC Macro.

Owor, M., Tumwine, J.K., Kikafunda, J.K. (2000) Socio-economic risk factors for severe protein energy malnutrition among children in Mulago Hospital, Kampala. *East African Medical Journal*. Sep;77(9):471-5.

Pelletier, D.L. (1998) Malnutrition, morbidity and child mortality in developing countries. In Too young to die: Genes or gender? United Nations. New York: Department of Economic and Social Affairs, Population Division, United Nations: 109-32.

Rahman, M.M. and Rahman, A.M. (1997) Prevalence of acute respiratory tract infection and its risk factors in under five children, Bangladesh Med Res Counc Bull. Aug; 23(2):47-50.

Rice, A.L., Sacco, L., Hyder, A., Black, R.E. (2000) Malnutrition as an underlying cause of childhood deaths associated with infectious diseases in developing countries. Bull World Health Organ, 78:1207-21.

Rob Stephenson, Zoe Matthews And J. W. Mcdonald 2003 The Impact Of Rural–Urban Migration On Under-Two Mortality In India, *J. biosoc. Sci.* 35, 15–31

Rustein, S.O. & Johnson, K. (1994) The DHS wealth index. DHS Comparative Report No. 6. Calverton, Maryland, USA: ORC Macro

United Nations (1993a). Urbanization and socio-economic development in Asia and the Pacific, Bangkok, Thailand, United Nations, Economic and Social Commission for Asia and the Pacific (ESCAP), Asian Population Studies Series No. 122

United Nations (1993b). World urbanization prospects: the 1992 revision. Estimates and projections of urban and rural populations and of urban agglomerations. Department of Economic and Social Information and Policy Analysis, United Nations, New York, Sales No. E.02.XIII.16

Victora, C.G. (1999) Risk factors for acute lower respiratory infections, In: Respiratory infections in children, [edited by] Yehuda Benguigui, Francisco J. Lopez Antunano, Gabriel Schmunis, Joao Yunes. Washington, D.C., Pan American Health Organization [PAHO], Division of Disease Prevention and Control, Communicable Diseases Program, Integrated Management of Childhood Illness, Feb.: 41-58. Series HCT/AIEPI-1.I

Williams, B.G., Gouws, E., Boschi-Pinto, C., Bryce J, Dye C., (2002) Estimates of world-wide distribution of child deaths from acute respiratory infections. *Lancet Infect Dis*; 2: 25–32.

World Bank (1999). Toward an Urban strategy for Bangladesh, Report No. 20289, Bangladesh.

World Bank (WB), (1993) Acute Respiratory Infections, Human Resources Development and Operation Policy, http://www.worldbank.org/htms/extdr/hnp/hddflash/hcnote/hrn004.html

World Health Organization (WHO) (2006) Acute respiratory infections in children Web:http//www.who.int/entity/fch/exd/ed