Internal migration and utilization of maternal and child health services: trends in Bangladesh[*]

Yoonjoung Choi and Courtland Robinson

Department of International Health

Johns Hopkins Bloomberg School of Public Health

[*] Draft prepared for the presentation at the 2009 PAA Annual Meeting. Not for citation.

INTRODUCTION

Across the developing world, especially in the latter half of the 20th century, a strong urban advantage in health care and health status has been well documented. Two important factors negatively associated with health outcomes among urban populations, however, are poverty and rural-urban migration.[1] On the other hand, rural-urban migrants have demonstrated better care-seeking and child survival after migration, compared to rural residents, explained partially by better access to health care in urban areas as well as positive selection factors for migration.[2] Certain personal and household characteristics established in rural areas of origin may determine both migration decision-making and care-seeking behaviors.[2] Data from the late 1970s and 1980s, for example, suggested that, among women in rural areas, unmarried, single, more educated, and younger women were more likely to move to urban areas than their counterparts who remained in rural areas.[3,4]

In less developed countries, the percent of population in urban areas increased from 27.0% to 43.8% during the last three decades; by 2050 about 67% of the population in less developed countries is projected to live in urban areas.[5] The public health implications of increasing urbanization are critical, if public health interventions—including preventative health care services—in urban areas have to address needs of the newer rural-urban migrants who potentially are less likely to utilize essential health care services than urban residents or previous migrants. Thus, it is important to understand changes in characteristics of rural-urban migrants in the context of more rapid urbanization in order to fully assess differential health care utilization and health outcomes by residential area and migration status over time.

The primary goal of the study is to assess differential utilization of health care services by migration status in a rapidly urbanizing, less developed country, using an example from

Bangladesh. Specific aims included: (1) to assess trends of internal migration patterns, (2) to investigate factors associated with rural-urban migration, and (3) to investigate associations between rural-urban migration and utilization of selected preventive maternal and child health care services.

METHODS

Study Country

Bangladesh, with a population of about 149 million, has experienced relatively high rates of population growth over the past few decades as mortality rates have fallen faster than fertility rates. Overall maternal and child health in Bangladesh has improved substantially.[6,7] Under-five mortality rates decreased by a third over the last decade,[8] although reducing neonatal mortality remains challenging.[7,9,10]

Bangladesh also has experienced rapid urbanization, largely driven by economic and social forces. Urban population has grown at a rate of 6% per year during the last three decades,[11,12] compared to the rate of 2.2% in national population.[12] About a quarter of the total population lived in urban areas in 2006, compared to 8% in 1971 – at the time of independence – and 20% in 1990.[5,12] It is projected that 80 million will reside in urban areas by 2030.[12] Female migration is largely restricted to internal movements, while international labor migration has increased among males.

Data

Data for the study came from four Bangladesh Demographic and Health Surveys (BDHS) conducted in 1993/94, 1996/97, 1999/2000, 2004. BDHS is a nationally representative cross-

sectional household survey which interviews all ever-married women between 10 to 49 years of age living in sampled households. The survey provides information on recent residential changes based on four simple questions: (1) the type of current residence area (urban or rural), (2) years lived in current residence, (3) whether she had ever moved to current residence, and (4) among women who moved to current residence, type of previous residence area (large city, small city, town, or rural area). In addition, the latest two BDHS collected information on childhood origin (i.e., type of primary residential area, as either rural or urban, during the first 12 years of life). Classification of the residence area is based on a definition of the master sample, created and maintained by the Bangladesh Bureau of Statistics.

BDHS also includes individual demographic information, including a birth history and a marital history, and household characteristics for all sampled women. In addition, among women who had at least one live birth during the 5-year period before the survey, information on prenatal and delivery care is collected. For all children alive who are 5 years of age or younger, the survey collects information on preventive and curative child health care utilization. A total of 40,751 women were interviewed in the four BDHS. Among those, 18,744 women had at least one live birth during 5 years before the interview and provided maternal and child health care information (Table 1).

Analysis

Trends of rural-urban migration

Migration status was examined using both continuous and categorical variables. We first measured a proportion of women who ever moved to their current residence. Among women who moved to current residence, an average of continuous years and an average proportion of

life lived in the current residence were calculated. Preliminary descriptive analyses suggested median length of stay for those moved was about 10 years. Considering the objectives of current study – examination of associations between migration and utilization of maternal and child health services, we focused on relatively recent migration and defined migrants as women who moved during the last 10 years before the survey. Based on binary migration status within the last 10 years and type of current and previous residence, there were six possible categories: (1) urban residents, (2) urban-urban migrants, (3) rural-urban migrants, (4) rural residents, (5) urban-rural migrants, and (6) rural-rural migrants (Figure 1). Information was available only regarding the latest move to current residence; we assumed that there was no reverse-migration once women crossed residential boundaries.

Since the main interest of the study involved migration between rural and urban areas, not migration within urban or rural area, we combined urban residents and urban-urban migrants into urban residents (green cells in Figure 1); and rural residents and rural-rural migrants into rural residents (yellow cells in Figure 1). The resulting four categories of migration status include: (1) urban residents, (2) rural-urban migrants, (3) rural residents, and (4) urban-rural migrants. Distributions of the 4 categories were assessed by each of the four BDHS. Hereafter in this paper, "migration status" refers to this 4-category classification.

The analysis of trends in rural-urban migration over time, we should note, is hindered in BDHS by a change made in the definition of residential areas in the master sample in preparation for the 2001 census; both the 1999/2000 and 2004 surveys used the revised urban/rural categorizations in the master sample.[13] For purposes of this paper, therefore, direct comparisons regarding migration status and residential area were restricted to comparisons between the first two surveys (1993/1994 and 1996/1997) and the latter two surveys (1999/2000 and 2004).

Factors associated with rural-urban migration

Descriptive analyses were conducted to assess differential background characteristics by migration status and survey. We examined ***current*** characteristics by migration status across 4 surveys. They are: age (in years), current marital status (married *vs.* not-married), parity, education (< *vs.* ≥ primary school completion), and household wealth quintiles, defined by BDHS for each survey, based on household wealth score which was constructed using principal component analysis of household assets and housing condition.[14] We also compared age at first marriage (in years) by migration status and survey.

In addition, among rural-urban migrants, we further assessed characteristics ***at the estimated time of migration***[†] across surveys, including age (in years), parity, and marital status (ever married *vs.* never married)[‡]. In addition, primary education of 5 years is usually completed by 11 years of age in Bangladesh, and we assumed primary education attainment status would remain constant once women reach 11 years. Therefore, among rural-urban migrants ≥ 11 years of age at move, we examined primary education attainment status (< *vs.* ≥ primary school completion).

Associations between rural-urban migration and health care utilization

Among women who gave at least one live birth in the last 5 years before the survey, utilization of three selected preventive maternal and child health services was examined. We focused on

[†] Year and month of migration was estimated based on date of interview (reported in year and month) and years lived in current residence (reported in full years). We assumed women who reported X full years moved 'X * 12 + 6 months' before the survey.

[‡] Only two types of marital information is available in BDHS which interviewed ever-married women: current marital status and first age at marriage. Therefore it is not possible to examine marital status at the estimated time of migration.

preventive services, since utilization of those services is a widely used indicator of population health. Further, utilization of curative services may be associated with health status before migration, likely causing an endogenous relationship between migration and utilization. Binary outcome variables include: (1) receipt of antenatal care from a qualified provider (i.e., a doctor, a nurse/midwife, or a Family Welfare Visitor[§]), (2) delivery attended by a skilled birth attendant (i.e., delivery at a health facility or delivery at home assisted by a doctor, a nurse, or a midwife), and, (3) among children older than 4-59 months of age, receipt of three complete doses of DPT vaccinations, which are typically provided at 6, 10, and 14 weeks after birth under the national Expanded Program on Immunization (EPI).[15]

The main research question is whether or not ***rural-urban migration within the last 10 years*** is associated with health care utilization (preliminary analyses suggested that the number of urban-rural migrants was too small to generate meaningful results, and urban-rural migrants was excluded from current analyses). Based on the 4-category migration status (Figure 1), rural residents were considered a reference group, and 2 dummy variables were constructed to represent rural-urban migrants and urban residents. Additional covariates included: (1) maternal age at birth (<20, 20-29, or ≥ 30 years), (2) women's parity at birth (primiparae vs. multiparae), (3) women's educational attainment (< *vs.* ≥ primary school completion), and (4) household wealth status. In addition, to control for any secular trend in programmatic effort at the national-level, we included a continuous variable of birth year. For the child care outcome, sex of the child was further included.

Migration is a selective process and we recognize there may be endogeneity between migration and health care utilization. As one approach to address this issue, we generated a

[§] Health personnel at a Family Welfare Centre, a public primary health facility serving approximately 20,000 population in Bangladesh.

dummy variable indicating whether an index birth occurred before or after migration in the rural or urban area, respectively. Although we were still not able to separate the effect of migration itself on migration (independent of the characteristics of migrants), we were able to assess differential health care utilization between rural residents and rural-urban migrants prior to their move. We also included interaction terms between rural-urban migration and survey to assess whether the associations between migration and utilization varied across surveys.

Unit of analyses was a woman who had at least one live birth within the last 5 years before each survey (for the two maternal care outcomes) or a child alive between 4-59 months of age at the survey (for the immunization outcome). Multivariable logistic regression analyses were conducted for each of the three outcomes, based on associations found in bivariate analyses. Analyses were conducted separately for the first two and the latter two surveys due to changes in the rural/urban definitions.[13] The latest live birth was used as the index if there were two or more births during the 5-year period.[**] All descriptive and regression analyses were adjusted for sampling weights, and a p-value of 0.05 was considered statistically significant.

RESULTS

Trends of rural-urban migration

Migration trends among ever-married women between 15-49 years of age are summarized across the four surveys in Table 1.Overall, 80% of all women reported having ever moved to their current residence. Among those who moved, the mean years lived at the current residence was about 13 years. The proportion of those who ever moved and the mean length of time lived at the current residence did not vary by survey. The proportion of women in urban areas did increase

[**] Among 18744 women who had at least one live birth within last 5 years before each survey, 721 (3.5%) have two or more births during the 5-year period.

most substantially between 1996/1997 and 1999/2000 surveys, but we attribute this mainly to changes in urban/rural classification.[13] Nevertheless, between 1999/2000 and 2004 surveys, the proportion living in urban areas increased from 0.20 to 0.23 and the proportion of rural-urban migrants within the last 10 years increased from 0.04 to 0.06, although neither difference was statistically significant. Among women who in urban areas at time of survey, however, the proportion of rural-urban migration within the last 10 years increased from 0.22 in 1999/2000 to 0.25 in 2004 (chi-square test p-value of 0.050).

Characteristics of women by migration status

Table 3 presents current characteristics of women by migration status, across surveys. Within each survey, rural-urban migrants were younger and had lower parity, compared to both urban and rural residents. Also rural-urban migrants tend to be more educated and wealthier, compared to rural residents, while they did not differ compared to urban residents. There was no significant change in characteristics within each group of women by migration status, between 1999/2000 and 2004 surveys (Table 3). However, with marginal statistical significance, the proportion ≥ primary school completion decreased (from 0.54 [90% CI: 0.50-0.57] in 1999/2000 to 0.45 [90% CI: 0.41-0.49] in 2004) and the proportion in the lowest household wealth quintile increased (from 0.04 [90% CI: 0.031-0.057] in 1999/2000 to 0.08 [90% CI: 0.058-0.103] in 2004) among urban residents.

Among rural-urban migrants, we examined characteristics at the estimated time of move (Table 4). Most were ever-married at the estimated time of move, while about 64.0% of them were never-married at the beginning of the 10-year period (result not shown). Among those rural-urban migrants never-married at the beginning of the period, we further assessed timing of

first marriage and timing of migration. Only 7.0% of those moved to urban areas before their first marriage and 67.4% of them moved within the first 2 years of the first marriage (Figure 2), implying that the move by the female more likely was associated with a change in marital status and less likely with motives of human capital development such as education or employment. There was no significant change in characteristic at the estimated time of move across surveys (Table 4).

Rural-urban migration and health care utilization

Appendix 1 summarizes unadjusted utilization levels for selected services by survey and migration status. Overall, substantial improvement was observed in the proportion of women receiving antenatal care from a qualified provider and the proportion of children receiving three doses of DPT immunization. Differences in both antenatal and delivery care between urban and rural residents were persistent in each survey. However, there was no significant gap in the DPT immunization coverage across migration status in 1993/1994 and 2004 surveys, although the coverage varied between urban and rural residents in the two middle surveys.

Table 5 and 6 present differentials in utilization based on the multivariable logistic regression models.[††] Analyses were stratified between the first two and second two surveys due to changes in the urban/rural classification as discussed earlier. Results were comparable between two analysis samples, and only results from 1999/2000 and 2004 surveys are presented. Compared to rural residents, rural-urban migrants had higher odds of maternal service utilization during both pre- (Odds ratio (OR) 2.0 for antenatal care and OR 2.7 for delivery care) and post-migration periods (OR 2.9 for antenatal care and OR 4.2 for delivery care) (Table 5-Model 1).

[††] Bivariate analyses showed all covariates were significantly associated with each outcome, and results are not presented.

However, adjusted for background characteristics, only odds after migration (i.e., in urban areas) was significantly higher for both services (Table 5-Model 2). Urban residents had substantially higher odds of maternal service utilization both compared to rural residents (OR 2.7 for antenatal care and OR 3.0 for delivery care) (Table 5-Model 2, Figure 3) and compared to rural-urban migrants after the move (Figure 3). Interaction terms of migration status and survey were not significant, indicating differential odds by migration status did not vary between 1999/2000 and 2004 surveys.

Odds of receiving three doses of DPT immunization was higher only among children of rural-urban migrants born ***before*** the move, compared to children in rural areas, controlling for background characteristics (OR 1.97, Table 6, Model 2). There was no significant difference in odds between urban and rural children. In addition, the odds did not improve over time after adjusted for covariates.

DISCUSSION

We examined associations between relatively recent rural-urban migration and utilization of selected preventive maternal and child health services in Bangladesh. Women who delivered in urban areas after rural-urban migration were more likely to use maternal services than those who remained in rural areas but were less likely to use the services than urban residents. The gap in maternal service utilization between rural residents and urban-rural migrants *post-migration* may be attributable to better availability of and access to the services in urban areas as well as unobserved characteristics of migrants. However, odds of utilization of maternal services did not vary between rural residents and rural-urban migrants *pre-migration*, suggesting that migrants did not differ from those who remained in rural areas in terms of maternal service utilization,

while staying in rural areas. The difference between migrants and urban residents, controlling for household wealth, may reflect within-urban variation in care-seeking behaviors, possibly due to lower availability of affordable services in migrant settlement areas, higher reliance on traditional practices, and less adequate social networks among the migrants.[1]

However, odds of completing three doses of DPT immunization did not vary between children of urban and rural residents. This is possibly attributable to successful Bangladesh EPI in recent years; in 2005, 88% of all eligible children were fully immunized for 3 doses of DPT.[15] The program promoted both initial immunization and completion of the full immunization schedule by actively tracking children who were registered in the system. In fact, compared to children of rural residents, odds of completion was significantly higher among children of rural-urban migrants who were born in rural areas *pre-migration* but not among those born in urban areas *post-migration*. This implies that, in spite of migrants' characteristics being positively associated with utilization *pre-migration*, migration processes may have caused disconnection from social networks and local health systems, which is important in the context of EPI.

In addition, despite rapid growth in urban population, BDHS data suggest that characteristics of rural-urban female migrants did not change substantially and differential relative odds of utilization by migration status did not vary across surveys. It is also possible that the stable profile of migrants is due to the fact that BDHS interviewed only ever-married women, who tend to migrate with a family in traditional Bangladesh culture. Never-married migrants who might have had different background characteristics would have been excluded in the data. Marriage, however, is universal in Bangladesh; the median age at first marriage was 15 years among women between 20-49 years of age in 2007, an increase only by one year over the past

decade, and almost all women marry by age 30.[16] Thus, we believe the BDHS sample was generally representative of adult women.

Nevertheless, our study was limited in terms of assessing trends. In spite of rapid urbanization in Bangladesh, where urban population has increased by 6% per year,[11] substantially higher than those in other developing countries,[11,12] still a relatively small portion of women were recent rural-urban migrants. We expanded our definition of recent migrants to those who moved within 15 years before each survey, but results did not differ from those based on current definition. In addition, because BDHS provides little information on socioeconomic characteristics at the time of migration as well as characteristics of origin rural areas, we were not able to address selection bias of rural-urban migrants properly.

Our analysis of the Bangladesh DHS data suggest, much like has been shown by Brockerhoff (1995) and others (Stephenson et al, 2003) for child mortality,[1,17] maternal and child health service utilization among migrants "lies between that of origin and destination".[17] With continued urbanization in Bangladesh and throughout the developing world, there is a need to better understand the dynamics of internal migration and the settlement patterns and characteristics of rural-urban migrant households so that within-urban disparities can be addressed.

Reference List

(1) Brockerhoff M. Child survival in big cities: the disadvantages of migrants. *Soc Sci Med.* 1995;40:1371-1383.

(2) Brockerhoff M. The impact of rural-urban migration on child survival. *Health Transit Rev.* 1994;4:127-149.

(3) Brockerhoff M, Eu H. Demographic and socioeconomic determinants of female rural to urban migration in Sub-Saharan Africa. *Int Migr Rev.* 1993;27:557-577.

(4) Massey DS, Arango J, Hugo G, Kouaouci A, Pellegrino A, Taylor JE. Theories of International Migration: A Review and Appraisal. *Population and Development Review.* 1993;19:431-466.

(5) United Nations Population Division. An overview of urbanization, internal migration, population distribution and development in the world. UN/POP/EGM-URB/2008/01. 1-14-2008. Population Division, Department of Economic and Social Affairs, United Nations. United Nations expert group meeting on population distribution, urbanization, internal migration and development.

(6) El AS. Child health and mortality. *J Health Popul Nutr.* 2008;26:273-279.

(7) Sack DA. Achieving the millennium development goals in Bangladesh. *J Health Popul Nutr*. 2008;26:251-252.

(8) National Institute of Population Research and Training, Mitra and Associates, and ORC Marco. Bangladesh demographic and health survey 2004. 2005. Dhaka, Bangladesh and Calverton, MD, National Institute of Population Research and Training, Mitra and Associates, and ORC Macro.

(9) Baqui AH, El-Arifeen S, Darmstadt GL et al. Effect of community-based newborn-care intervention package implemented through two service-delivery strategies in Sylhet district, Bangladesh: a cluster-randomised controlled trial. *Lancet.* 2008;371:1936-1944.

(10) El AS. Child health and mortality. *J Health Popul Nutr.* 2008;26:273-279.

(11) United Nations Population Division. World Urbanization Prospects: The 2001 Revision. ESA/P/WP.173. 3-20-2002. New York, NY, United Nations.

(12) World Bank. Bangladesh: strategy for sustained growth. 18. 2007. Washington, DC, The World Bank. Bangladesh Development Series.

(13) National Institute of Population Research and Training, Mitra and Associates, and ORC Marco. Bangladesh demographic and health survey 1999/2000. 2001. Dhaka, Bangladesh and Calverton, MD, National Institute of Population Research and Training, Mitra and Associates, and ORC Macro.

(14) Filmer D, Pritchett LH. Estimating wealth effects without expenditure data--or tears: an application to educational enrollments in states of India. *Demography.* 2001;38:115-132.

(15) World Health Organization, South East-Asia Regional Office. Bangladesh EPI Fact Sheet 2005. World Health Organization . 10-23-2006. 3-27-2009.

(16) National Institute of Population Research and Training, Mitra and Associates, and Macro International. Bangladesh demographic and health survey 2007. 2009. Dhaka, Bangladesh and Calverton, MD, National Institute of Population Research and Training, Mitra and Associates, and Macro International.

(17) STEPHENSON ROB, MATTHEWS ZOE, MCDONALD JW. The impact of rural-urban migration on under-two mortality in India. *J Biosoc Sci.* 2003;35:15-31.

Table 1. Data sources and number of observations, Bangladesh Demographic and Health Surveys

Survey year	Number of women* interviewed	Number of women* interviewed for maternal and child health information
1993/1994	9,640	3,578
1996/1997	9,127	4,606
1999/2000	10,544	5,194
2004	11,440	5,366
TOTAL	**40,751**	**18,744**

* Ever-married women between 10-49 years of age

Figure 1. Classification of women by current residential area and recent history of migration

		Ever moved to current place ***within the last 10 years***		
		No	Yes	
			Previous residence	
			Urban	Rural
Current residence	Urban	Urban R	Urban-Urban M	Rural-Urban M
	Rural	Rural R	Urban-Rural M	Rural-Rural M

R: residents, M: migrants

Table 2 Migration trends among ever-married women between 15-49 years of age in Bangladesh, by survey

Survey	1993/1994	1996/1997	1999/2000	2004
N (Un-weighted)	9110	8624	9840	10600
Proportion ever moved to current residence	0.79	0.80	0.81	0.82
	(0.771-0.800)	(0.784-0.811)	(0.803-0.827)	(0.808-0.830)
Average years lived at current residence*	12.7	12.7	12.6	13.1
	(12.4-13.1)	(12.4-13.1)	(12.3-12.9)	(12.7-13.4)
Proportion of life lived at current residence*	0.39	0.39	0.38	0.39
	(0.383-0.400)	(0.380-0.398)	(0.370-0.387)	(0.377-0.396)
Proportion in urban areas	0.12	0.12	0.20	0.23
	(0.087-0.146)	(0.088-0.149)	(0.159-0.239)	(0.184-0.269)
Proportion by 10-year migration status				
Urban residents	0.09	0.09	0.16	0.17
	(0.068-0.115)	(0.070-0.120)	(0.124-0.188)	(0.139-0.203)
Rural-urban migrants	0.02	0.02	0.04	0.06
	(0.018-0.032)	(0.016-0.030)	(0.033-0.052)	(0.044-0.067)
Rural residents	0.86	0.86	0.78	0.75
	(0.828-0.886)	(0.828-0.888)	(0.738-0.817)	(0.706-0.789)
Urban-rural migrants	0.03	0.02	0.02	0.03
	(0.021-0.032)	(0.018-0.029)	(0.019-0.028)	(0.021-0.031)

Proportions are weighted for sampling weights.
* Among women who moved to current residence. 95% confidence interval in parenthesis.

Table 3 Background characteristics of ever-married women between 15-49 years of age in Bangladesh, by survey and migration status

	Survey 1993/1994		1996/1997		1999/2000		2004	
	Est.	(95% CI)	Est.	(95% CI)	Est.	(95% CI)	Est.	(95% CI)
Age at survey interview (years)								
Urban R	31.7	(31.0-32.4)	31.4	(30.6-32.1)	32.7	(32.2-33.1)	33.2	(32.6-33.7)
Rural-Urban M	24.7	(23.8-25.7)	24.6	(23.7-25.4)	24.7	(23.9-25.5)	24.8	(24.0-25.5)
Rural R	29.6	(29.3-29.8)	29.7	(29.4-29.9)	30.1	(29.8-30.3)	30.5	(30.2-30.8)
Urban-Rural M	26.0	(24.9-27.0)	26.2	(24.9-27.4)	25.7	(24.5-26.9)	26.0	(24.6-27.5)
Age at first marriage (years)								
Urban R	15.0	(14.6-15.4)	15.3	(14.9-15.8)	15.7	(15.4-16.0)	15.4	(15.1-15.6)
Rural-Urban M	15.2	(14.8-15.6)	14.8	(14.5-15.2)	15.5	(15.2-15.8)	15.2	(14.9-15.5)
Rural R	14.0	(13.9-14.1)	13.7	(13.6-13.9)	14.4	(14.3-14.6)	14.5	(14.4-14.6)
Urban-Rural M	15.1	(14.6-15.6)	15.4	(14.9-15.9)	16.0	(15.4-16.6)	15.6	(15.2-16.0)
Number of children ever born								
Urban R	3.4	(3.2-3.6)	2.8	(2.7-3.0)	2.9	(2.8-3.1)	3.0	(2.9-3.2)
Rural-Urban M	2.1	(1.8-2.3)	1.9	(1.7-2.1)	1.9	(1.8-2.1)	2.0	(1.8-2.1)
Rural R	3.6	(3.5-3.7)	3.5	(3.4-3.5)	3.3	(3.2-3.4)	3.2	(3.1-3.3)
Urban-Rural M	2.3	(2.0-2.6)	2.3	(2.0-2.6)	1.9	(1.7-2.2)	2.1	(1.8-2.3)
Proportion ≥ primary school completion								
Urban R	0.49	(0.43-0.55)	0.52	(0.47-0.58)	0.54	(0.49-0.58)	0.45	(0.41-0.50)
Rural-Urban M	0.37	(0.30-0.44)	0.43	(0.36-0.50)	0.50	(0.45-0.54)	0.52	(0.46-0.58)
Rural R	0.20	(0.18-0.21)	0.23	(0.21-0.25)	0.29	(0.27-0.31)	0.33	(0.31-0.34)
Urban-Rural M	0.50	(0.43-0.57)	0.54	(0.46-0.62)	0.59	(0.52-0.66)	0.58	(0.52-0.65)
Proportion in the lowest wealth quintile								
Urban R	0.03	(0.01-0.04)	0.01	(0.00-0.02)	0.04	(0.03-0.06)	0.08	(0.05-0.11)
Rural-Urban M	0.07	(0.04-0.11)	0.01	(0.00-0.03)	0.08	(0.05-0.10)	0.11	(0.07-0.15)
Rural R	0.25	(0.23-0.28)	0.24	(0.21-0.26)	0.25	(0.23-0.27)	0.24	(0.22-0.27)
Urban-Rural M	0.10	(0.06-0.15)	0.04	(0.01-0.07)	0.14	(0.08-0.19)	0.12	(0.07-0.17)

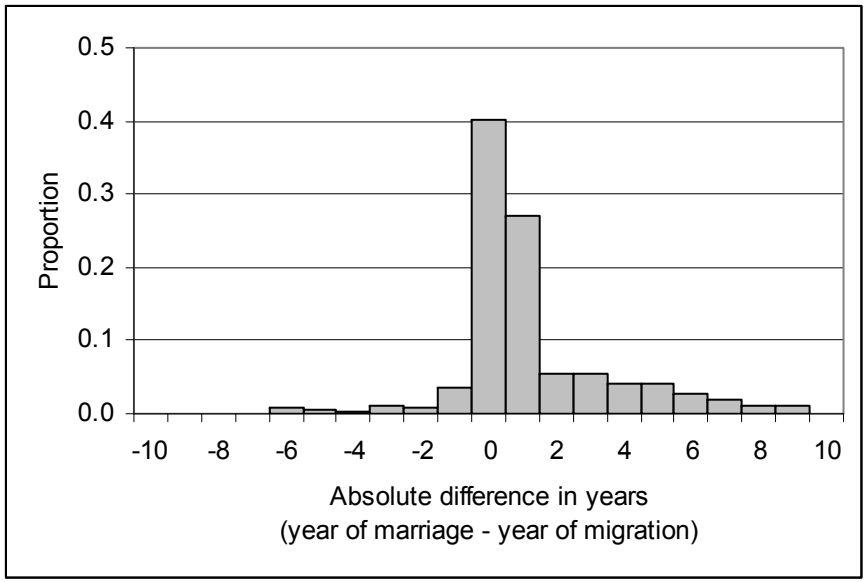
Est: Estimate, CI: Confidence Interval, R: Residents, M: Migrants
Estimates are weighted for sampling weights.

Table 4 Background characteristics at the estimated time of move, among rural-urban migrants within the last 10 years, by survey

	Survey 1993/1994		1996/1997		1999/2000		2004	
N (Un-weighted)	312		296		648		900	
	Est.	(95% CI)	Est.	(95% CI)	Est.	(95% CI)	Est.	(95% CI)
Age (years)	21.3	(20.3-22.3)	21.0	(20.1-21.8)	20.9	(20.2-21.6)	21.0	(20.1-21.8)
Proportion ever-married	0.95	(0.92-0.97)	0.96	(0.93-0.98)	0.95	(0.93-0.97)	0.97	(0.95-0.98)
Proportion by number of children ever born								
0	0.55	(0.48-0.61)	0.55	(0.49-0.61)	0.56	(0.51-0.61)	0.58	(0.52-0.65)
1-4	0.37	(0.31-0.44)	0.39	(0.33-0.45)	0.37	(0.33-0.42)	0.34	(0.29-0.40)
≥5	0.08	(0.04-0.11)	0.06	(0.03-0.09)	0.06	(0.04-0.09)	0.07	(0.05-0.09)
Proportion ≥ primary school completion*	0.37	(0.30-0.44)	0.43	(0.36-0.50)	0.50	(0.46-0.54)	0.52	(0.46-0.58)

Est: Estimate, CI: Confidence Interval,
Estimates are weighted for sampling weights.
* Among those who were 11 years or older at move (99.4% of the sample). n=311 (1993/1994), n=295 (1996/1997), n=644 (1999/2000), and n=894 (2004).

Figure 2 Distribution of absolute differences between year of first marriage and year of rural-urban migration, among rural-urban migrants within the last 10 years who were never married 10 years ago



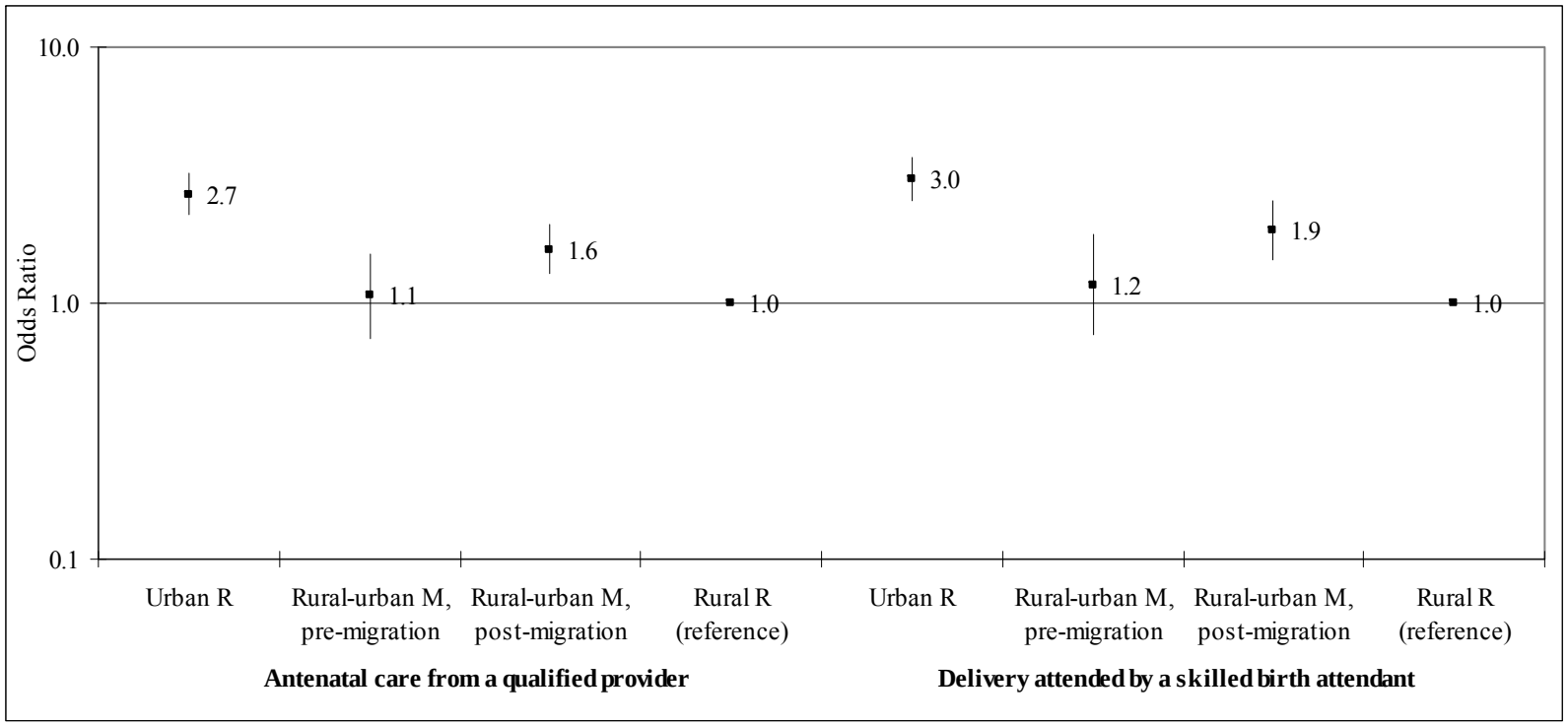
Proportions are weighted for sampling weights.
The distribution did not vary by survey, and the figure is based on data from all 4 surveys (n=1380).

Table 5 Odds ratio of utilizing 2 selected maternal health services among women who had at least one live birth during 5 years before the survey, BDHS 1999/2000 and BDHS 2004: Multivariable regression analyses

	Antenatal care from a qualified provider				Delivery attended by a skilled birth attendant			
	Model 1		Model 2		Model 1		Model 2	
N (un-weighted)	9418		9418		9428		9428	
	OR	(p-value)	OR	(p-value)	OR	(p-value)	OR	(p-value)
Year of birth (year, continuous)	1.15	(0.000)	1.16	(0.000)	1.03	(0.122)	1.03	(0.085)
Migration status								
Urban residents	4.56	(0.000)	2.66	(0.000)	6.52	(0.000)	3.04	(0.000)
Rural-urban migrants: pre-migration (rural)	2.00	(0.000)	1.06	(0.744)	2.70	(0.000)	1.18	(0.472)
Rural-urban migrants: post-migration (urban)	2.85	(0.000)	1.62	(0.000)	4.15	(0.000)	1.93	(0.000)
Rural residents	1.00		1.00		1.00		1.00	
Maternal age at birth (year)								
<20			0.80	(0.003)			0.55	(0.000)
20-29			1.00				1.00	
≥ 30			0.76	(0.000)			1.05	(0.641)
Parity								
Primiparae			1.60	(0.000)			2.66	(0.000)
Multiparae			1.00				1.00	
Maternal education								
< Primary completion			1.00				1.00	
≥ Primary completion			2.23	(0.000)			2.42	(0.000)
Household wealth								
Lowest quintile			0.59	(0.000)			0.51	(0.000)
Middle 3 quintiles			1.00				1.00	
Highest quintile			2.88	(0.000)			3.53	(0.000)

Regression analyses were weighted for sampling weights.

Figure 3 Adjusted* odds ratio of maternal health service utilization and 95% confidence interval, by migration status and actual place of birth, BDHS 1999/2000 and BDHS 2004



* Based on multivariable logistic regression analyses (Model 2, Table 5)
R: Residents, M: Migrants

Table 6 Odds ratio of receiving 3 doses of DPT immunization among children 4-59 months of age, BDHS 1999/2000 and BDHS 2004: Multivariable regression analyses

	Model 1		Model 2	
N (un-weighted)	8212		8212	
	OR	(p-value)	OR	(p-value)
Year of birth (year, continuous)	1.01	(0.530)	1.01	(0.763)
Migration status				
Urban residents	1.74	(0.000)	1.17	(0.174)
Rural-urban migrants: pre-migration (rural)	2.73	(0.001)	1.97	(0.017)
Rural-urban migrants: post-migration (urban)	1.36	(0.024)	0.92	(0.568)
Rural residents	1.00		1.00	
Child sex				
male			1.00	
female			0.80	(0.000)
Maternal age at birth (year)				
<20			0.81	(0.009)
20-29			1.00	
≥ 30			0.77	(0.000)
Parity				
Primiparae			1.16	(0.081)
Multiparae			1.00	
Maternal education				
< Primary completion			1.00	
≥ Primary completion			1.80	(0.000)
Household wealth				
Lowest quintile			0.67	(0.000)
Middle 3 quintiles			1.00	
Highest quintile			1.68	(0.000)

Regression analyses were weighted for sampling weights.

Appendix 1 Utilization levels for selected preventive health service, among women gave birth during 5 years before each survey, by survey and migration status

Survey	1993/1994		1996/1997		1999/2000		2004	
Years of births included	1990-1994		1991-1997		1994-2000		1999-2004	
	Est.	(95% CI)	Est.	(95% CI)	Est.	(95% CI)	Est.	(95% CI)
Antenatal care from qualified provider								
Number of women*	***3255***		***4198***		***4659***		***4759***	
All	**0.25**	**(0.22-0.28)**	**0.28**	**(0.25-0.31)**	**0.33**	**(0.30-0.35)**	**0.47**	**(0.44-0.51)**
Urban R	0.61	(0.54-0.68)	0.69	(0.63-0.75)	0.63	(0.57-0.69)	0.74	(0.70-0.79)
Rural-Urban M	0.46	(0.36-0.56)	0.47	(0.38-0.56)	0.49	(0.43-0.54)	0.66	(0.59-0.72)
Rural R	0.22	(0.19-0.25)	0.24	(0.22-0.27)	0.27	(0.24-0.29)	0.41	(0.37-0.44)
Urban-Rural M	0.56	(0.45-0.67)	0.55	(0.44-0.66)	0.56	(0.47-0.65)	0.68	(0.60-0.77)
Delivery attended by a skilled birth attendant								
Number of women*	***3259***		***4206***		***4667***		***4761***	
All	**0.09**	**(0.07-0.11)**	**0.09**	**(0.07-0.11)**	**0.13**	**(0.11-0.14)**	**0.13**	**(0.11-0.15)**
Urban R	0.39	(0.31-0.46)	0.44	(0.37-0.52)	0.39	(0.32-0.45)	0.33	(0.28-0.38)
Rural-Urban M	0.30	(0.21-0.40)	0.25	(0.18-0.32)	0.25	(0.19-0.31)	0.26	(0.21-0.32)
Rural R	0.06	(0.05-0.07)	0.06	(0.05-0.07)	0.07	(0.06-0.08)	0.08	(0.07-0.10)
Urban-Rural M	0.25	(0.14-0.35)	0.22	(0.13-0.32)	0.25	(0.17-0.34)	0.25	(0.17-0.33)
Received 3 doses of DPT immunization								
Number of children 4-59 months old*	***2678***		***3570***		***3995***		***4217***	
All	**0.62**	**(0.59-0.65)**	**0.69**	**(0.66-0.71)**	**0.68**	**(0.65-0.70)**	**0.79**	**(0.76-0.81)**
Urban R	0.66	(0.60-0.73)	0.79	(0.75-0.83)	0.79	(0.75-0.83)	0.83	(0.79-0.87)
Rural-Urban M	0.70	(0.61-0.79)	0.68	(0.59-0.77)	0.77	(0.71-0.83)	0.81	(0.75-0.86)
Rural R	0.61	(0.58-0.65)	0.68	(0.65-0.71)	0.65	(0.62-0.68)	0.78	(0.75-0.80)
Urban-Rural M	0.69	(0.59-0.80)	0.70	(0.60-0.80)	0.82	(0.75-0.90)	0.84	(0.77-0.91)

Est: Estimate, CI: Confidence Interval,
Estimates were weighted for sampling weights.
* Un-weighted number of observations