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in Rural Bangladesh

Author(s): Md. Rabiul Haque, Nick Parr and Salut Muhidin

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Climate-Related Displacement and Antenatal Care Service Utilization in Rural Bangladesh

CONTEXT: Extreme weather events cause large-scale population displacement in Bangladesh. It is important to know how household displacement due to such events might affect women's antenatal care (ANC) service utilization.

METHODS: In 2017, a cross-sectional household survey was conducted in 25 rural villages in either displacement prone or non-displacement prone areas of Bangladesh. Data were collected from 611 respondents (a woman or her husband) who reported having had a live birth in the past three years; of those, 289 had experienced household displacement due to an extreme weather event. Logistic regression analyses were conducted to examine the relationship between experience of household displacement and women's ANC service utilization during their last pregnancy resulting in a live birth.

RESULTS: Eighty-three percent of women had received at least one ANC visit during their last pregnancy resulting in a live birth; of those, 31% received at least four visits with a trained provider. Women from households that had been displaced three or more times were less likely than those from nondisplaced households to have received an ANC visit and at least four visits with a trained provider (odds ratios, 0.3 and 0.4, respectively). Receiving at least four visits with a trained provider was also associated with having previous children (0.3–0.4), age at pregnancy (2.5–3.9), husband's occupation (2.2 for "other") and joint parental decision-making about ANC visits (1.8).

CONCLUSIONS: Strengthening family planning services and extending eligibility for Bangladesh's Maternity Allowance benefits in the areas prone to floods and riverbank erosion are recommended to improve ANC service utilization.

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By Md. Rabiul Haque, Nick Parr and Salut Muhidin

Md. Rabiul Haque is professor, Department of Population Sciences, University of Dhaka, Bangladesh. Nick Parr is professor, and Salut Muhidin is senior lecturer—both in the Department of Management, Macquarie Business School, Macquarie University, North Ryde, Australia.

In recent decades, Bangladesh has made considerable progress in maternal health outcomes. The maternal mortality ratio declined from 576 per 10,000 live births in 1990 to 176 in 2015.¹ Public health measures introduced to improve maternal health in Bangladesh include the national family planning program, distribution of vitamin A and the Maternity Allowance program.^{*2,3} However, substantial disparity in utilization of maternal health services—and in the quality of such services—by socioeconomic status remains a major concern.^{4–7}

The utilization of antenatal care (ANC) services by pregnant women in Bangladesh remains unsatisfactory.⁷ Use of ANC services provided by trained providers† is associated with better pregnancy and neonatal outcomes.⁸ Although most ANC services are provided by medically trained providers, not all are.^{9,10} Between 2004 and 2014, the proportion of women who had an ANC visit with any type of provider increased from 58% to 78%, and the proportion

who had at least one ANC visit with a medically trained provider increased from 51% to 64%.¹¹

In Bangladesh, ANC and other maternal and child health-related services are mostly delivered by doctors, nurses, paramedics and trained field workers at government facilities, private institutions and nongovernmental organization (NGO) outlets. Although ANC services at public facilities are free of cost, the most common source of ANC is private clinics and hospitals (52%), followed by public facilities (36%), NGO outlets (11%) and at home from other types of providers (16%).⁹ Most district- and subdistrict-level public health facilities and most private health facilities offer comprehensive ANC provision by trained providers, while trained nonmedical staff provide basic ANC services at union- and community-level facilities. ANC services are also offered by untrained providers, such as drug sellers, traditional healers and birth attendants.

The World Health Organization (WHO) recommended in the 1990s that pregnant women receive four or more ANC visits with trained providers. In 2014, the proportion of women in Bangladesh who received this minimum was still 19 percentage points below the national target of 50% by 2021.¹¹ Moreover, Bangladesh would have to increase its coverage of at least four ANC visits by six percentage points per year to achieve the Sustainable Development

*The Maternity Allowance program provides 500 taka (approximately US\$6) per month to poor rural women during pregnancy and for up to one year afterward to improve their food security and health care.

†In this article, consistent with the official definition for Bangladesh, the term "trained providers" refers to those with medical training (e.g., doctors and nurses) and nonmedical staff with training in provision of routine antenatal care (source: reference 11).

Goal (SDG) Target 3 of 98% by 2030. In 2014, only 6% of women had received the 2016 WHO supplementary recommendation of eight or more ANC visits.¹²

Utilization of ANC services from a medically trained provider has been linked in Bangladesh to a range of factors, including women's education and employment status, husband's occupation, household's access to mass media and urban residence.^{4,7,11–13} Women from richer families are significantly more likely than women from poor families to receive at least four ANC visits from trained providers.^{7,11} The probability of receiving at least four visits decreases as the number of previous children increases, and as age at birth increases, particularly above age 35.^{11,12} The most commonly cited reasons for not obtaining any ANC visits are monetary constraints, lack of local health facilities, long distance travel to reach health facilities, knowledge gaps about the benefits of ANC visits, restrictions on women's movement, family traditions and religious beliefs.^{13–15}

In addition, studies conducted in Bangladesh—as well as in India and Nepal—have found a negative association between past internal migration and ANC service utilization, particularly among those who migrated recently and those who live in slum areas.^{16–20} Moreover, rural–rural migrant women in Nepal have been found to be less likely than rural–urban and urban–urban migrant women to receive at least four ANC visits.²¹ Inadequate use of ANC services by migrant women is related to their perception of a lack of need for care, lower sociocultural status, lack of family and social networks, and lack of knowledge about health care availability in their new location.^{17,22} Among rural–urban migrant women, lower utilization of ANC services has been found to be associated with shorter duration of residence in the current location, illiteracy, higher parity and husband's unskilled occupation.^{20,23} However, no previous research has focused on internal migrants who moved for climate-related changes or events.

Climate-Related Displacement and ANC Utilization

Bangladesh has a long history of being a flood-prone country, especially during the monsoon season, during which about 80% of annual precipitation in the basins of its major rivers occurs.² The volume of runoff water generated from precipitation and melting snow from upstream countries (e.g., China and India), combined with Bangladesh's own monsoon rain, often exceeds the carrying capacity of its river channels and increases its susceptibility to catastrophic floods. Regular floods inundate 21% of Bangladesh's land surface, on average, but after extreme floods, that proportion can be as high as 80%.²⁴ The combined effects of deforestation, land erosion and melting glaciers in the upstream countries, heavy precipitation in the major river basins and a human-induced lowering of river gradients have contributed to abnormally high water flows of devastating force in Bangladesh's major rivers. These, in turn, have caused unpredictable changes to water channels, flooding and permanent riverbank erosion, resulting in a massive loss of habitable land.^{19,25}

Floods and riverbank erosion trigger migration in Bangladesh.^{26–29} In 2017, for example, four large floods inundated 24 districts in the north and northeast of the country, causing large-scale damage to agricultural production, communication and basic-service infrastructure, and homestead land and housing, which restricted access to safe drinking water, adequate sanitation and food security for millions of people.²⁶ Extensive riverbank erosion during and after floods has prompted the displacement of large numbers of Bangladeshis.³⁰ The number of individuals displaced because of natural disasters in Bangladesh—estimated to be 6.4 million between 2009 and 2017—is among the highest in the world.³¹ The displacements are mostly due to floods, riverbank erosion, cyclones and sea level rise.^{31,32} Exposure to floods and riverbank erosion alone is estimated to cause the displacement of 100,000–500,000 people annually in the low-lying displacement-prone mainland regions of Bangladesh.^{19,32,33}

Extreme weather and weather-related events may adversely affect the health of those who have experienced displacement by contributing to reductions in income, ownership of agricultural and homestead land, food security and access to clean water, and adequate sanitation.^{22,28,29,34,35} Management of illness and health-related complications is difficult during and after such events, because of reduced accessibility to health centers and availability of trained health care providers.^{17,22,36–39} A 2019 focus-group study found a perception among those living in the flood-prone riverine areas of Bangladesh that floods and flood-related damage contribute to maternal deaths, as pregnant women suffer from complications, lack of antenatal check-ups, a shortage of doctors and trained birth attendants during and after disasters, and difficulty traveling to hospitals and other health facilities—as time-consuming and infrequent boat travel sometimes becoming the only available transportation.³⁶ In light of these increased risks, it is vital that pregnant women who have experienced displacement by extreme weather events receive ANC services from trained providers.

There are various possible pathways through which natural disasters such as floods and riverbank erosion can affect outcomes that, in turn, can result in declines in ANC utilization (see Appendix Figure 1).³² These types of disasters can cause displacement either directly, due to danger, or indirectly by affecting socioeconomic well-being (assets and income) and infrastructure (roads, health, education). Relocation and the loss of transportation and health service infrastructure could affect access to health services. The socioeconomic disadvantage from being displaced and having longer travel distances, as well as the loss of social networks (including familiarity with providers), may reduce the affordability of services.

To our knowledge, no study has considered the relationship between displacement resulting from extreme weather events and ANC service utilization as measured using large-sample survey data. This study aims to examine this relationship and provide evidence that can inform strategies for

improving ANC service utilization in rural mainland areas of Bangladesh prone to flooding and riverbank erosion.

METHODS

Sample Selection and Data Collection

Of the 24 districts of Bangladesh classified by the Bangladesh Ministry of Disaster Management and Relief as susceptible to displacement—that is, areas in which displacement of households due to flooding and riverbank erosion is prevalent—12 are located in the mainland riverine regions.³² Fieldwork for this study was conducted in 25 villages located in the north-western mainland region: 13 from two displacement-prone districts and 12 from two districts without a history of displacement. The sample was drawn to include an adequate number of displaced and nondisplaced households to provide statistically robust conclusions in a time- and cost-effective manner. The displacement-prone villages—six from Kazipur in Sirajganj district and seven from Goalnando in Rajbari district—are on landmasses in the basins of the Padma and Jamuna rivers. The selected villages are highly vulnerable to massive loss of land and to displacement due to sudden and forceful flooding and riverbank erosion. The non-displacement-prone villages—six each from Mohonpur in Rajshahi district and from Manda in Nagaon district—are located in the same region of Bangladesh.

The four districts studied were selected randomly from a list of displacement-prone districts and a list of the remaining districts in the mainland riverine regions. Purposive sampling was used to identify subdistricts and unions of the classified displacement-prone districts in which there had been large-scale displacement resulting from riverbank erosion.³² The villages from each union were then selected randomly from the list of villages from the Bangladesh census. Area-level sampling was used because of a lack of available individual-level records about displacement history. For each area, the sample was distributed proportionately between the villages based on the total eligible households in each village. For each village, households were selected for interview using systematic random sampling based on computer-generated starting points and then adding the sampling fraction to subsequent numbers.

Although all four districts have experienced seasonal flooding, only the former two have been classified as displacement-prone.⁶ Because they are located in the same region, the populations of all four districts are broadly similar in terms of demographic (sex ratio and household size) and sociocultural (religion, language, literacy rate, food practices and sources of water and energy) characteristics.⁴⁰ Approximately 4.3 million people live in the two displacement-prone districts studied, and roughly 5.4 million live in the two non-displacement-prone districts.⁴¹

We conducted a cross-sectional survey between January and May 2017 of 1,200 randomly selected households: 600 from the displacement-prone districts and 600 from the districts without a history of displacement. On the basis of the random sampling technique, a sample size of 587 for each group was estimated to be sufficient for the purposes

of statistical analysis.¹¹ This was rounded to 600 for convenience and to facilitate equal distribution between the four districts. In the displacement-prone areas, households that through a screening question were identified as including children younger than 15 years of age and as having experienced displacement at least once in the 10 years prior to the survey date were considered eligible for the sample. In the areas not prone to displacement, all households with children younger than age 15 were considered eligible for inclusion. From each household one woman or her husband was interviewed.

From the 1,200 households surveyed, data for 611 women who had a live birth in the three years preceding the survey were identified for inclusion in the analysis. Data for births more than three years ago were not considered because of the greater potential for recall error. All 289 of the women from the displacement prone districts had been displaced at least once, whereas none of the 322 women in the areas not prone to displacement had been displaced. Since “displaced” and “district type” are indistinguishable in our data, controlling for both was not possible.

Face-to-face interviews were conducted using a structured survey questionnaire. Information concerning demographic and socioeconomic characteristics, displacement status, ANC visits by women, sources of ANC visits, and the local availability and accessibility of health care services were collected from either an eligible woman or, if a woman was unavailable or unwilling to respond directly, from her husband. When the husband was the respondent (in approximately 50% of cases), responses relating to ANC visits were typically based on consultation with his wife. If a household contained more than one eligible case, a parent of the youngest child was interviewed.

After obtaining written consent from the respondent, trained university-graduate interviewers conducted the interviews, which typically lasted 45–60 minutes. To minimize recall bias, the enumerators were trained to cross-check by probing the respondents to provide the year of displacement, origin and destination, and to confirm this information with an elder member of the household. The survey questionnaire was translated into the local language, Bengali. Ethics approval was obtained from the Macquarie University Human Research Ethics Committee and the National Research Ethics Committee of Bangladesh.

Measures

• *Outcome variables.* Our first outcome was a binary measure that classified women by whether they had received at least one ANC visit from any provider during their last pregnancy resulting in a live birth in the three years preceding the survey. For our second outcome variable, we classified women who had received at least one ANC visit into two groups on the basis of the number of ANC visits received from trained providers (i.e., doctors, nurses, or trained nonmedical staff): those who received at least four ANC visits and those who received fewer.

TABLE 1. Percentage distribution of rural women who had had a live birth in the past three years, by selected characteristics, according to extreme weather-related household displacement experience, Bangladesh, 2017

Characteristic	All (N=611)	No. of times displaced			
		None (n=322)	1-2 (n=119)	≥3 (n=170)	Any (n=289)
Age at last pregnancy		***			
<19	21.6	23.9	24.4	15.3	19.0
19-23	34.0	38.5	32.8	26.5	29.1
24-28	30.0	25.8	31.1	37.1	34.6
≥29	14.4	11.8	11.8	21.2	17.3
No. of previous children†		***			
0	41.6	49.1	37.0	30.6	33.2
1	36.7	40.4	35.3	30.6	32.5
≥2	21.8	10.6	27.7	38.8	34.3
Woman's education		***			
None	18.3	7.5	32.8	28.8	30.4
≤junior school level (≤8 years)	60.2	59.9	58.0	62.4	60.6
>junior school level (>8 years)	21.4	32.6	9.2	8.8	9.0
Husband's education		***			
None	26.5	16.8	38.7	36.5	37.4
≤junior school level (≤8 years)	52.2	53.1	54.6	48.8	51.2
>junior school level (>8 years)	21.3	30.1	6.7	14.7	11.4
Husband's occupation		***			
Agriculture on own land	30.1	42.9	8.4	21.2	15.9
Labor	35.0	23.0	54.6	44.1	48.4
Small business	18.5	18.3	19.3	18.2	18.7*
Other	16.4	15.8	17.6	16.5	17.0
Monthly household income (in taka‡)		***			
≤8,000	45.5	46.0	46.2	44.1	45.0
8,001-10,000	29.1	23.9	36.1	34.1	34.9
>10,000	25.4	30.1	17.6	21.8	20.1
ANC decision maker		***			
Husband/wife alone	19.0	24.5	9.2	15.3	12.8
Both jointly	63.0	59.6	61.3	70.6	66.8
Other family members	18.0	15.8	29.4	14.1	20.4
Medical doctor within 5km		***			
No	44.8	13.7	84.9	75.9	79.6
Yes	55.2	86.3	15.1	24.1	20.4
Total	100.0	100.0	100.0	100.0	100.0

***p<.001. †Number of living children at the estimated start of the index pregnancy. ‡US\$1=83.82 taka. Notes: Respondents include women themselves or their husband answering on their behalf. p values refer to the probability from chi-square tests that the distribution of the variable differs significantly by number of times displaced when categorized into "None," "1-2" and "≥3." Column percentages may not add to 100.0 because of rounding. ANC=antenatal care.

• *Independent variables.* The eligible households were classified into two broad categories based on the displacement-related responses: the "displaced" (those who had changed their place of usual residence permanently due to floods, changing river channels or riverbank erosion before the start of the pregnancy and within the 10 years prior to the interview) and the "nondisplaced" (those who had not experienced displacement due to such events during the time period). The specific question used to establish displacement status ("Have you ever experienced displacement from your usual residence due to any kind of extreme weather event or natural disaster?") indicates the move was made with permanent intent and excludes temporary returns home following the event. (Returns would be unusual because the original home and land are often completely submerged by the relocated river channel.⁴²) The survey collected data on the household's history of displacement during the 10 years prior to the interview. Our measure of displacement status was based on the number of household displacements at the

estimated beginning of the index pregnancy. We grouped responses into three categories—none, 1-2 and three or more—after initial results showed no difference between having experienced one or two displacements.

In addition, we included various sociodemographic and economic variables found in previous research to be associated with ANC service utilization. Woman's age was coded into four categories: younger than 19, 19-23, 24-28 and 29 or older. Woman's education and husband's education were each classified as none, junior-school level (eight or fewer years), and higher than junior-school level (more than eight years). Other variables included number of living children at the estimated start of the index pregnancy (zero, one and two or more), husband's usual occupation (agricultural work on own land, labor work, small business and other), household's average monthly income (in taka) during the previous three months (no more than 8,000, 8,001-10,000 and more than 10,000) and availability of a medical doctor within a five-kilometer radius (yes or no). Finally, we included a measure of who in the household makes the decision to obtain an ANC visit (husband or wife alone, both jointly and other family members); respondents reporting "other family members" were asked to specify the type of family member; the most common answers were father-in-law and mother-in-law.

Statistical Analysis

We examined the variation in women's ANC visits during their last pregnancy and in the various predictor variables by displacement experience using chi-square tests of association. We then used multiple logistic regression to examine associations between variables and the two ANC utilization measures (any and four or more with a trained provider). Statistical significance is presented using p values for model chi-squares and odds ratios with 95% confidence intervals for multiple logistic regressions. The values of variance inflation factor (VIF) and tolerance statistics indicated no unacceptable collinearity for the models. Data analysis was performed using SPSS 23.

RESULTS

Descriptive Findings

Women tended to be young when they experienced the index pregnancy, with 56% having been younger than age 24 (Table 1); 42% had no previous children. Only about one-fifth of women and their husbands had higher than a junior-school education (21% each). The most common occupations among husbands were laborer (35%; mostly in the agricultural sector) and farming their own land (30%). Household incomes were mostly low, with 46% earning less than 8,000 taka (US\$96) per month. Sixty-three percent of respondents reported that decisions about ANC visits were made jointly by the couple; 83% of women had received at least one ANC visit from any provider during her most recent pregnancy.

The proportion of women aged 24 or older at last pregnancy increased as the number of household

displacements experienced increased (from 38% among those who had experienced zero displacements to 58% among those who had experienced three or more); similarly, the proportion of women with two or more children increased with increased displacement experience (from 11% of those with zero displacements to 39% of those with three or more). Only 9% of displaced women had an education above junior-school level, compared with 33% of the nondisplaced women; displaced women's husbands also had lower educational attainment than those of the nondisplaced. Whereas the proportions of women in the lowest household income category were similar among the displaced and the nondisplaced (44–46%), the proportion in the highest income category was lower among those displaced than among the nondisplaced (18–22% vs. 30%). The proportion of women who made decisions about ANC service utilization jointly with their husband was higher among those who had been displaced three or more times than among the nondisplaced (71% vs. 60%); the proportion who lived within five kilometers of a doctor was substantially lower among the displaced than among the nondisplaced (15–24% vs. 86%).

Any ANC Visits

In bivariate analysis, a greater proportion of women who had not been displaced than of those who had been 1–2 or at least three times had received an ANC visit during their last pregnancy (91% vs. 82% and 67%, respectively; Table 2). Compared with women younger than 19 at last pregnancy, a greater proportion of those aged 19–23 had received a visit (90% vs. 88%), whereas a lower proportion of those aged 24–28 and 29 or older had received one (75% and 71%). The proportion who received an ANC visit decreased with increased number of previous children, from 92% among women with none to 65% among those with at least two. In contrast, the proportion who received a visit increased with increased education among women and their husbands. Any ANC service utilization was lowest among women whose husband worked as a laborer (75%) and highest among women from households earning at least 10,000 taka (88%). A greater proportion of women who lived within five kilometers of a medical doctor than of those who did not had received a visit (88% vs. 75%).

In the multivariate analysis controlling for other variables, a woman's odds of having received at least one ANC visit during her last pregnancy were negatively associated with her household experience of displacement: Compared with women whose household had not been displaced, those who had been displaced three or more times had 68% lower odds of receiving an ANC visit (odds ratio, 0.3). The only other variables associated with any ANC service utilization were number of previous children and age. In comparison with women who had no previous children, those who had one or more child were less likely to have had an ANC visit (0.3–0.4); women aged 19–23 were more likely than those younger than 19 to have received a visit (2.3), although the finding was only marginally significant.

TABLE 2. Percentage of women who received at least one antenatal care visit during their last pregnancy, and odds ratios (and 95% confidence intervals) from multivariate analyses examining the likelihood of the outcome—both by selected characteristics

Characteristic	% received ≥1 ANC visit (n=611)	Odds ratios
No. of household displacements		
None (ref)	82.4	1.00
1–2	82.4	0.56 (0.36–1.75)
≥3	66.5	0.32 (0.17–0.64)***
Age at last pregnancy		
<19 (ref)	87.9	1.00
19–23	90.4	2.34 (0.97–5.65)†
24–28	75.4	1.55 (0.58–4.16)
≥29	70.5	1.46 (0.47–4.55)
No. of previous children‡		
0 (ref)	92.1	1.00
1	81.7	0.35 (0.15–0.80)**
≥2	65.4	0.25 (0.09–0.68)**
Woman's education		
None (ref)	70.5	1.00
≤junior school level (≤8 years)	81.5	0.84 (0.45–1.57)
>junior school level (>8 years)	95.4	1.73 (0.57–5.27)
Husband's education		
None (ref)	72.8	1.00
≤junior school level (≤8 years)	83.7	1.27 (0.74–2.19)
>junior school level (>8 years)	91.5	1.33 (0.56–3.17)
Husband's occupation		
Agriculture on own land (ref)	86.4	1.00
Labor	75.2	0.66 (0.36–1.21)
Small business	82.3	0.71 (0.34–1.48)
Other	91.0	1.38 (0.56–3.39)
Monthly household income (in taka)§		
≤8,000 (ref)	80.6	1.00
8,001–10,000	80.3	1.21 (0.70–2.06)
>10,000	88.4	1.44 (0.74–2.80)
ANC decision maker		
Husband/wife alone (ref)	81.0	1.00
Both jointly	82.1	1.34 (0.73–2.45)
Other family members	85.5	1.03 (0.45–2.35)
Medical doctor within 5km		
No (ref)	75.2	1.00
Yes	88.4	1.22 (0.66–2.26)

Model χ^2 (df) with significance level: 87.86(19), $p < 0.001$

Overall predicted percentage: 83.5

–2Log likelihood (Nagelkerke score): 479.04(0.222)

** $p < 0.01$. *** $p < 0.001$. † $p < 0.10$. ‡Number of living children at the estimated start of the index pregnancy. §US\$1=83.82 taka. Notes: p values in the “% received ≥1 ANC visit” column represent the probability that the difference between variable categories is the result of chance. ANC=antenatal care. ref=reference group.

Four or More ANC Visits

Among the 504 women who received any ANC visit, 31% received the WHO-recommended four or more ANC visits from a trained provider during their last pregnancy. A greater proportion of nondisplaced women than of women who had been displaced 1–2 times or three or more times had received at least four ANC visits (40% vs. 20% and 16%, respectively; Table 3). Receiving at least four visits was more common among those who had no previous children than among those with previous children (37% vs. 15–31%), whereas the outcome was less common among women with no education than among those who had some education (15% vs. 30–42%). Recommended ANC service utilization was lowest among women with an uneducated husband and those whose husband worked as a laborer (23% and 20%, respectively). A greater proportion of women who lived within five kilometers of a medical doctor than of those who did not had received at least four ANC visits (38% vs. 21%).

TABLE 3. Percentage of women who received four or more antenatal care visits from a trained provider during their last pregnancy, and odds ratios (and 95% confidence intervals) from multivariate analyses examining the likelihood of the outcome—both by selected characteristics

Characteristic	% received ≥ 4 ANC visits (n=504)	Odds ratios
No. of household displacements	***	
None (ref)	39.9	1.00
1–2	20.4	0.67 (0.31–1.41)
≥ 3	15.9	0.38 (0.18–0.78)**
Age at last pregnancy	†	
<19 (ref)	24.1	1.00
19–23	36.7	2.53 (1.38–4.63)***
24–28	31.9	3.85 (1.72–8.61)***
≥ 29	22.6	2.76 (1.00–7.61)*
No. of previous children‡	***	
0 (ref)	36.8	1.00
1	30.6	0.44 (0.24–0.80)**
≥ 2	14.9	0.25 (0.10–0.61)***
Woman's education	***	
None (ref)	15.2	1.00
\leq junior school level (≤ 8 years)	30.3	1.43 (0.67–3.10)
> junior school level (>8 years)	41.6	1.10 (0.44–2.71)
Husband's education	***	
None (ref)	22.9	1.00
\leq junior school level (≤ 8 years)	28.1	1.02 (0.57–1.83)
> junior school level (>8 years)	44.5	1.43 (0.70–2.91)
Husband's occupation	***	
Agriculture on own land (ref)	34.6	1.00
Labor	19.9	0.68 (0.38–1.22)
Small business	28.0	0.95 (0.52–1.76)
Other	46.2	2.18 (1.17–4.05)*
Monthly household income (in taka)§		
$\leq 8,000$ (ref)	31.7	1.00
8,001–10,000	24.5	0.70 (0.42–1.17)
>10,000	35.8	0.78 (0.48–1.46)
ANC decision maker		
Husband/wife alone (ref)	25.5	1.00
Both jointly	33.9	1.80 (1.02–3.16)*
Other family members	25.5	1.07 (0.51–2.21)
Medical doctor within 5km	***	
No (ref)	20.9	1.00
Yes	37.6	1.28 (0.51–2.21)

Model χ^2 (df) with significance level: 77.08(19), $p < 0.001$

Overall predicted percentage: 70.2

–2Log likelihood (Nagelkerke score): 544.97(0.200)

* $p < .05$. ** $p < .01$. *** $p < .001$. † $p < .10$. ‡Number of living children at the estimated start of the index pregnancy. §US\$1=83.82 taka. Notes: p values in the “% received ≥ 4 ANC visits” column represent the probability that the difference between variable categories is the result of chance. ANC=antenatal care. ref=reference group.

In our multivariate model, women from households displaced three or more times had lower odds than those who had not been displaced of receiving at least four ANC visits from a trained provider (odds ratio, 0.4). In addition, several other independent variables were found to be associated with the outcome. In comparison with women who became pregnant before age 19, older women were more likely to have received the recommended number of ANC visits from a trained provider (2.5–3.9). The odds of receiving at least four visits were 56% lower among women with one previous child and 75% lower among women with two or more previous children than among those without children (0.4 and 0.3, respectively). Although education (of the woman or her husband) was not significant in the model, having a husband whose occupation was classified as “other” was positively associated with receiving at least four ANC visits from a trained provider (2.2). Finally, the odds

of receiving at least four visits was 80% higher among women who make decisions regarding ANC visits jointly with their husband than among those who make such decisions themselves or whose husband decides (1.8).

DISCUSSION

This study provides evidence that women from households in rural Bangladesh that have been displaced multiple times due to weather-related events utilize antenatal services less than those that have not been displaced. This disparity between the displaced and nondisplaced exists despite the two groups living in the same region of the same country, and sharing social and cultural similarities. Moreover, striking differences persist even after controlling for a range of socioeconomic and demographic characteristics. This finding is a major concern because of the large and growing number of climate-induced displaced people in Bangladesh, among whom multiple displacements are common.^{33,42}

The lower utilization of ANC services among displaced women may be linked to cumulative displacement-related disadvantages. Each extreme weather event damages—and often destroys completely—families’ home, land and possessions; disrupts their livelihood and social networks; results in relocation and resettlement costs; and damages or destroys local health facilities, which in turn can decrease the availability and accessibility of care.^{19,43,44} In addition, some fee-free public health facilities in or near displacement-prone areas do not provide comprehensive, WHO-standard quality antenatal care.^{36,40,45,46} Moreover, private-sector ANC service providers are less prevalent in displacement-prone areas, likely at least partly because of the inherent risks of riverbank erosion and flood, as well as the poverty of the local population.^{46,47} The low utilization of ANC services from trained providers among women from households that have been displaced multiple times should be of major concern because of the importance of ANC in reducing complications and deaths during pregnancy and delivery, and in increasing the likelihood that women give birth in a hospital and utilize postnatal care services.^{48,49}

In rural Bangladesh, early marriage and childbearing is common, especially among the poor.¹¹ Those who marry at a young age are more likely to lack knowledge of reproductive health and family planning, live in remote areas where access to health facilities and family planning services is limited, and experience unintended pregnancy and unmet need for family planning.¹¹ This study demonstrates that, after controlling for other variables, women younger than 19 are significantly less likely to use any ANC service and to receive at least four ANC visits by a trained provider than are older women. Our results also show that the odds of utilizing any ANC service, as well the recommended four or more visits by a trained provider, are reduced among women with previous children. Previous research in Bangladesh and other developing countries has found a similar pattern,^{7,9–12,50} but no previous study has demonstrated such associations among the substantial subpopulation of women in

areas prone to flooding and river erosion who experience climate-induced displacement.

The lack of association between women's education and ANC service utilization is consistent with the results of another study conducted in rural Bangladesh.⁵¹ In the present study, it may be attributable to our having controlled for displacement status, previous number of children, age at pregnancy, husband's occupation and decision making regarding ANC visits—all of which correlate with women's level of education. Another possible reason is the small proportion of women in the sample educated beyond the junior-school level.

The positive association between husband's occupation and his wife's receipt of at least four ANC visits with a trained provider may reflect that working in some of the "other" occupations (e.g., NGO-sector, and such government jobs as teachers and health workers) may positively influence their perceptions of the importance of receiving frequent high-quality antenatal care services. However, consistent with a study conducted in the remote wetland areas in Bangladesh,⁵² our study did not find a significant association between ANC visits and either husbands' level of education or household income.

The present study did find women to have greater odds of ANC service utilization—and particularly, receiving the recommended number of visits with a trained provider—when couples jointly make decisions regarding ANC, rather than when such decisions are made by either the husband or wife alone. In rural areas of many developing countries, including Bangladesh, decision making—especially in matters with financial consequences—tends to be male dominated.⁵³ Joint decision making about pregnancy-related care may be linked with greater spousal concern about maternal and child health. It may also heighten the husband's perception and understanding of potential pregnancy-related complications, and hence, the odds of seeking multiple ANC visits with a trained provider during pregnancy.

Our finding that a large proportion of displaced women—far more than their nondisplaced counterparts—do not live within five kilometers of a medical doctor is alarming. This variable's lack of significance in our multivariate analysis likely reflects its high correlation with a household's displacement status. Data from the 2014 Bangladesh Demographic and Health Survey make clear that medical doctors are the preferred source of ANC service provision in Bangladesh.¹¹ The almost complete absence of such providers in the displacement-prone areas we surveyed should therefore be a significant concern.

According to climate change projections, the frequency and intensity of floods will likely increase in the coming years around the world, including in Bangladesh.^{54,55} This study highlights that such changes, in combination with projected population growth, may result in increases in the number of displaced pregnant women, in challenges to the provision and utilization of ANC services, and in health risks to pregnant women and their families living in the mainland riverine regions of Bangladesh.^{19,32,42}

Limitations

Some potential limitations of the data and the interpretation of the results should be noted. First, despite a range of precautionary measures taken to enhance and validate data quality and reliability, misclassification of some responses may have occurred if any respondents reported socially desirable responses, such as overstating the use of trained providers. That half of the survey respondents were husbands answering questions related to their wife's antenatal care may also have reduced the reliability of the data, even though many consulted their wife before answering. Second, although the study's findings should be generalizable to other riverine areas of northwestern Bangladesh prone to floods and riverbank erosion, generalization to other regions of Bangladesh—particularly the coastal regions, in which returns to the predisaster village location and attendance at previous health facilities is less likely to be rendered impossible by permanent legacies of floods and riverbank erosion, such as changes to river channels—should be treated cautiously.

CONCLUSIONS

This study reveals that utilization of ANC services in rural Bangladesh—specifically, obtaining the WHO-recommended four or more visits with a trained provider—is reduced among women of households that have experienced multiple climate-related displacements. In light of this finding, policy makers and health care providers should prioritize expanding the provision of ANC delivered through local health centers to increase outreach to mothers in areas prone to flooding and riverbank erosion.

In light of our findings that ANC service utilization was negatively associated with young age and greater number of children at the time of pregnancy, strengthening the national family planning program in the areas prone to flooding and riverbank erosion—particularly through reintroduction of home delivery of family planning services[‡]—is recommended to increase utilization of ANC services. Given high rates of adolescent pregnancy and mobile phone ownership in the flood-prone areas, as well as limited access to electronic media (especially television),⁵⁶ mobile phone text messaging could be an important medium for promoting awareness of the negative consequences of early pregnancy and the value of pregnancy care.^{11,48} Extending eligibility for the Maternity Allowance benefit to cover all pregnant women in the regions prone to floods and riverbank erosion is also recommended as a measure to increase ANC service utilization in these areas, in light of the socioeconomic disadvantage of displaced individuals. Finally, there is a clear need to increase the number of doctors—especially female doctors—and nurses with specialized training in maternal and child health in health facilities located in flood-prone areas of rural Bangladesh.¹¹

‡The delivery of these services to the home was discontinued. Currently, a visit to a community clinic or other health facility is required to obtain family planning services.

§In the context of majority-Muslim Bangladesh, receipt of ANC services from male doctors is widely seen as violating religious and cultural beliefs.

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RESUMEN

Contexto: Los eventos climáticos extremos causan desplazamientos de población a gran escala en Bangladesh. Es importante conocer cómo el desplazamiento de hogares debido a tales eventos podría afectar la utilización que las mujeres hacen de los servicios de atención prenatal (APN).

Métodos: En 2017, se condujo una encuesta transversal de hogares en 25 pueblos rurales de Bangladesh tanto en áreas propensas al desplazamiento como en áreas no propensas al mismo. Se recolectaron datos de 611 personas entrevistadas (mujeres o sus cónyuges) que reportaron haber tenido un nacido vivo en los tres años previos; de ellas, 289 habían experimentado desplazamiento del hogar debido a un evento climático extremo. Se llevaron a cabo análisis de regresión logística para examinar la relación entre la experiencia del desplazamiento del hogar y la utilización de servicios de APN por las mujeres durante su último embarazo que resultó en un nacido vivo.

Resultados: Ochenta y tres por ciento de las mujeres habían tenido al menos una visita de APN durante su último embarazo que resultó en un nacido vivo; de ellas, 31% tuvo al menos cuatro visitas con un proveedor de servicios capacitado. Las mujeres de hogares que habían sido desplazados tres o más veces tuvieron menos probabilidad que las mujeres de hogares no desplazados de haber tenido una visita de APN y al menos cuatro visitas con un proveedor de servicios capacitado (razón de probabilidades, 0.3 y 0.4, respectivamente). Tener hijos previamente (0.3–0.4), edad al embarazo (2.5–3.9), ocupación del cónyuge (2.2 para “otro”) y toma de decisiones parentales conjunta sobre visitas de APN (1.8) también estuvieron asociados con el hecho de tener al menos cuatro visitas con un proveedor de servicios capacitado.

Conclusiones: Se recomienda fortalecer los servicios de planificación familiar y extender la elegibilidad para los beneficios de la Prestación por Maternidad del Gobierno de Bangladesh en las áreas propensas a inundaciones y erosión de las riberas de los ríos para mejorar la utilización de servicios de APN.

RÉSUMÉ

Contexte: Les phénomènes météorologiques extrêmes sont la cause de déplacements de population à grande échelle au Bangladesh. Il importe de documenter l'effet éventuel de ce déplacement des ménages sur le recours des femmes aux prestations de soins prénatals (SPN).

Méthodes: En 2017, une enquête transversale auprès des ménages a été menée dans 25 villages bangladais situés dans des zones sujettes ou non au déplacement. Les données ont été collectées auprès de 611 répondants (les femmes ou leur mari) ayant déclaré avoir eu une naissance vivante au cours des trois dernières années. Parmi ces répondants, 289 avaient connu un déplacement du ménage dû à un phénomène météorologique extrême. La relation entre le vécu de ce déplacement et le recours des femmes aux prestations SPN durant leur dernière grossesse ayant abouti sur une naissance vivante a été examinée par analyses de régression logistique.

Résultats: Quatre-vingt-trois pour cent des femmes avaient obtenu au moins une consultation SPN durant leur dernière grossesse ayant abouti sur une naissance vivante; parmi elles, 31% en avaient obtenu au moins quatre avec un prestataire qualifié. Les femmes des ménages déplacés trois fois ou davantage étaient moins susceptibles que celles des ménages non déplacés d'avoir obtenu une consultation

SPN et au moins quatre consultations avec un prestataire qualifié (RC, 0,3 et 0,4, respectivement). L'expérience antérieure de la maternité (0,3–0,4), l'âge au moment de la grossesse (2,5–3,9), l'activité professionnelle du mari (2,2 pour « autre ») et la prise de décision parentale conjointe concernant les consultations SPN (1,8) se sont aussi avérés associés à l'obtention d'au moins quatre consultations avec un prestataire qualifié.

Conclusions: Le renforcement des services de planification familiale et l'admissibilité accrue aux prestations de maternité du gouvernement bangladais dans les zones vulnérables aux inondations et à l'érosion des rives sont recommandés pour améliorer le recours aux prestations SPN.

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Author contact: Nick.Parr@mq.edu.au

APPENDIX FIGURE 1. Theoretical links between extreme weather events, displacement and utilization of antenatal care services in mainland Bangladesh

