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Inside

Rural Bangladeshis' willingness to pay for 4% chlorhexidine to prevent neonatal cord infection

Community-based, multi-country trials have demonstrated that 4% chlorhexidine prevents neonatal cord infection. We conducted a household survey with 1,717 eligible couples in rural Bangladesh to assess their willingness to pay for three types of 4% chlorhexidine products (single-dose liquid, multi-dose liquid and gel preparation). We compared respondents' separately reported willingness to pay responses to a range of suggested market prices. The majority of respondents were unwilling to pay the asking prices, but everyone was willing to pay some amount of money. They also reported that if the price exceeded the maximum price they were willing to pay, they would cope with the deficit by borrowing money. We recommended a range of unit prices that our respondents could afford without borrowing money, which was between Taka 15-25.

Poor hygiene and lack of antisepsis at birth and in the first week of life increases the risk of umbilical cord infection (1). In rural Bangladesh

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80% of childbirths take place at home under suboptimal hygienic conditions (2). Approximately 60% of home deliveries are attended by untrained care givers, 12% by trained traditional birth attendants, and 4% by relatives, neighbours and friends (2). While the World Health Organization generally recommends keeping a newborn's umbilical cord clean and dry, it also promotes the application of topical antiseptics to the cord stump in areas with high infection risk (3). Recent trials in Bangladesh, Nepal and Pakistan have shown that 4% chlorhexidine is an effective antiseptic in preventing newborn umbilical cord infection in vulnerable conditions (1). We conducted a study to assess couples' willingness to pay for three topical antiseptic products containing 4% chlorhexidine that could prevent umbilical cord infections in newborns.

Trained field workers interviewed pregnant women and women with a first-born child aged <6 months old, as well as their husbands, living in rural sub-districts of Abhoynagar and Mirsarai during April-July 2010. Our total estimated sample size was 1700, based on the assumption that there would be a 10% difference in proportion of willingness to pay for chlorhexidine products between women and their husbands in the study sites. The required number of respondents for each category was randomly selected from participants in icddr,b's ongoing surveillance in these two areas. Wives and husbands were interviewed separately.

The interviewer first gave the respondent a clear description of three different products containing 4% chlorhexidine: single-dose liquid, multi-dose liquid and gel preparation, and explained each of the products' indications, possible side-effects, benefits and advantages over alternatives. The interviewer then asked about the respondent's interest in the product and asked them to choose which one of the three formulations of the product they would prefer. Interviewers then reminded the respondents to take into account alternative products currently available and their own limited household financial resources and explained that there was no right or wrong answer and that they could decide to reject any product at any price. Interviewers then implemented an assessment of contingent valuation to assess willingness to pay (4).

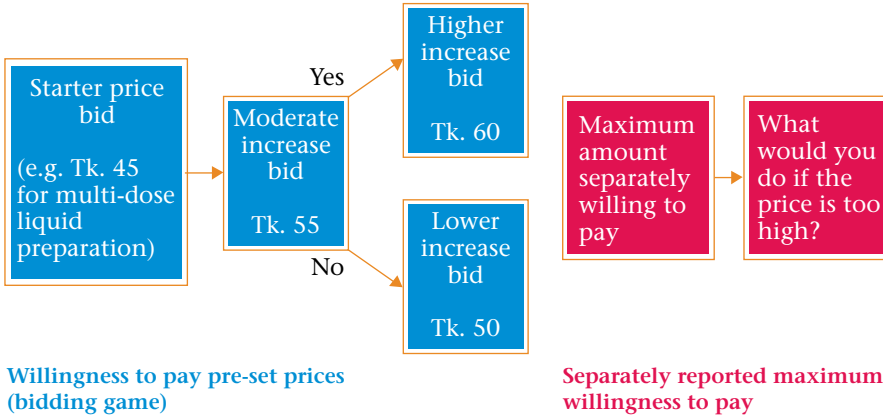
Specifically, interviewers initiated a bidding game by introducing four different price bids that were preset for the selected product. The price bids asked for single-dose chlorhexidine liquid were Taka 27, 30, 32, and 35. For multi-dose liquid and gel preparation the price bids asked were Taka 45, 50, 55 and 60. Starter price bids for the single-dose liquid (Taka 27) and for multi-dose liquid (Taka 45) were manufacturer suggested prices. The starter price of the gel (Taka 45) was chosen based on prices of alternative gel products in the marketplace. The subsequent increase in suggested price bids (moderate, higher and lower prices) was determined by considering the market price of locally available alternative allopathic products for umbilical

cord care. These included neomycin sulphate + bacitracin zinc powder and ointment, chlorhexidine gluconate 0.5% w/w in 70% isopropanol solution, povidone iodine lotion, oral amoxicillin drops, cephradine drops or erythromycin drops. We based our price bids in Taka on an average daily currency conversion rate in 2010 of USD 1 = Taka 70.00.

Interviewers started the bidding game by asking the preset prices, initially with the lowest price for the product chosen and then moved to the moderate price increase. Based on the respondents' 'yes' or 'no' response to the moderate price increase interviewers then asked respondents' willingness to pay for either preset higher or lower price increase. Finally, interviewers asked an open-ended question on what would be the maximum price he/she would be willing to pay, irrespective of preset prices assigned to each product.

Therefore, there were two different sets of willingness to pay responses for each product type: 1) responses to the preset prices and 2) a separately reported maximum price that individual respondents were willing to pay. If the pre-set price was higher than the separately reported maximum willingness to pay price, interviewers asked how the respondent would be able to afford it (Figure 1).

Figure 1: Sequence of willingness to pay questions



(Source: Willingness to pay surveys: A user's manual, The Population Council, September 2001)

We then categorized the willingness to pay responses that emerged from the separately reported maximum prices according to the preset prices proposed in the bidding game. After that we compared and cross-matched the proportion of respondents' willingness to pay between the bidding game and separately reported maximum prices to find out what proportion

of willingness to pay responses to preset prices actually matched or did not match with their separately reported maximum price(s). Thus, the proportions of respondents' willingness to pay prices were identified that were either less, equivalent or more than the preset prices we asked for. Finally, based on respondents' proposed coping mechanism to cover the deficit when paying a price higher than their separately reported maximum willingness to pay, we identified an affordable price range.

We interviewed a total of 1,717 respondents: 427 pregnant women, 445 women with a first-born child aged <6 months, and 845 husbands. Twenty-seven husbands were absent at the time of the study. All respondents were interested in using 4% chlorhexidine and participated in the willingness to pay bidding game, but their responses differed in relation to each of the three products.

Although 65% (1,109) of the respondents preferred the gel preparation, their overall willingness to pay the preset prices we asked was lowest (31%). Twenty-six percent were willing to pay Taka 45-60, and 5% were willing to pay more than Taka 61. The remaining 69% of our respondents' willingness to pay ranged between Taka 15-44 (Table 1).

Table 1: Percentage of responses based on preset prices and separately reported maximum willingness to pay for gel preparation of 4% chlorhexidine

Price category	Unit price willing to pay (Taka)	% respondents willing to pay			
		Abhoynagar (n=605)	Mirsarai (n=504)	Overall % (n=1109)	
Less than preset prices (<45 Taka)	≤15	7	3	5	69
	16-25	33	25	29	
	26-35	19	27	23	
	36-44	11	13	12	
Equivalent to preset prices (45-60 Taka)	45-60	27	25	26	31
More than preset prices (>60 Taka)	61+	3	7	5	
Total		**100**	**100**	**100**	**100**

The remaining 35% (608) of the respondents preferred the liquid products. For the single-dose liquid preparation, 41% of our respondents were willing to pay the preset prices we asked, with 39% willing to pay Taka 27-35, and 2% willing to pay more than Taka 36-50. The remaining 59% of our respondents were willing to pay between Taka 15-26 (Table 2).

Table 2: Percentage of responses based on preset prices and separately reported maximum willingness to pay for single-dose liquid preparation of 4% chlorhexidine

Price category	Unit price willing to pay (Taka)	% respondents willing to pay			
		Abhoynagar (n=163)	Mirsarai (n=196)	Overall % (n=359)	
Less than preset prices (<27 Taka)	≤15	21	13	17	59
	16-26	44	41	42	
Equivalent to preset prices (27-35 Taka)	27-35	34	43	39	41
More than preset prices (>35 Taka)	36-50	1	3	2	
Total		**100**	**100**	**100**	**100**

For the multi-dose liquid preparation, 33% of our respondents were willing to pay the preset prices we asked, with 30% willing to pay 45-60 Taka, and 3% willing to pay more than 61 Taka. The remaining 67% of our respondents' willingness to pay ranged between 15-44 Taka (Table 3).

Table 3: Percentage of responses based on preset prices and separately reported maximum willingness to pay for multi-dose liquid preparation of 4% chlorhexidine

Price category	Unit price willing to pay (Taka)	% respondents willing to pay			
		Abhoynagar (n=86)	Mirsarai (n=163)	Overall % (n=249)	
Less than preset prices (<45 Taka)	≤15	8	2	4	67
	16-25	29	28	29	
	26-35	19	25	23	
	36-44	10	11	11	
Equivalent to preset prices (45-60 Taka)	45-60	29	31	30	33
More than preset prices (>60 Taka)	61+	5	3	3	
Total		**100**	**100**	**100**	**100**

The majority of respondents were not willing to pay the preset prices asked for any of the products, but all respondents were willing to pay some amount of money for the product they preferred.

In cases where the price bids were higher than the maximum willingness to pay, the majority of respondents reported that they would cope with the shortfall by borrowing money because they did not want their children to suffer. However, for prices ranging from Taka 15-25, respondents did not report the need to borrow (Table 4). Overall, 33% of the respondents were willing to pay Taka 15-25 for the multi-dose chlorhexidine liquid and the remaining 67% were willing to pay an amount ranging from Taka 25 to more than Taka 60. It is expected that all of the 67% of respondents would be willing to pay lower prices ranging between Taka 15-25 because originally they were willing to pay more (Table 4).

Following cross-matching of responses to multi-dose liquid preparation, only 33% of the respondents were willing to pay the preset prices ranging between Taka 45 and 60 (Table 3). When the unit price was set between Taka 45 and 60 for this product, 67% of the respondents reported that they would borrow money (Table 4). This might have resulted from respondents' high-level of motivation for the product to ensure their children survived.

Table 4: Price implications of multi-dose liquid preparation of 4% chlorhexidine

Unit price in Bangladesh Taka	% willing to pay	Demand side implications
Taka 15-25 (USD 0.21-0.35)	33	Borrowing money is not required by any respondent
Taka 26-35 (USD 0.37-0.50)	23	Borrowing money is required for 33% of the respondents
Taka 36-44 (USD 0.51-0.63)	11	Borrowing money is required for 56% of the respondents
Subtotal	**67**	
Taka 45-60 (USD 0.64-0.85)	33	Borrowing money is required for 67% of the respondents
Total	**100**	

Reported by: Health Systems and Economics Unit, icddr,b.

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Comments

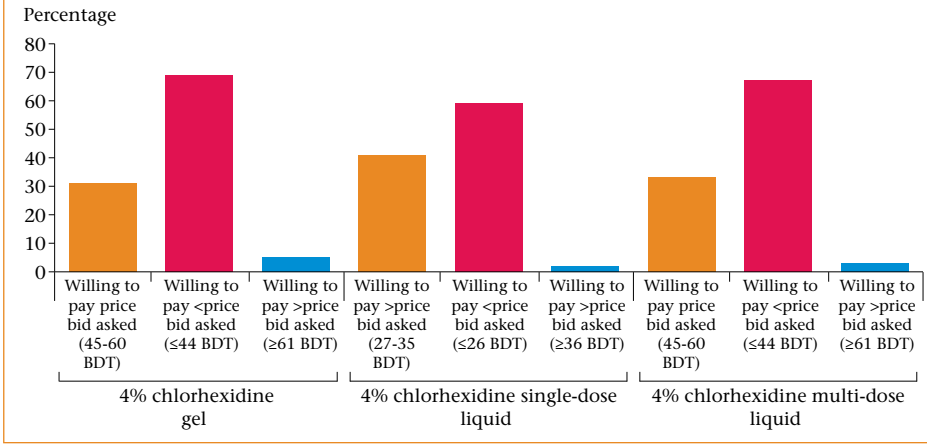
Identifying an affordable unit price of the three types of 4% chlorhexidine products is a necessary step as none are currently available in the local market. Given the pattern of responses for willingness to pay for a particular type of 4% chlorhexidine product, and the coping mechanism proposed as a reaction to higher prices, this study found that a unit price of a 4% chlorhexidine product between Taka 15-25 (USD 0.21-0.35) would be affordable and acceptable to the majority of the target population.

We implemented this survey before we knew the results of the community-based effectiveness trial in Bangladesh (7). Therefore, all three types of 4% chlorhexidine preparation were included in the survey. However, given the proven effectiveness of multi-dose liquid preparation in the Bangladesh trial, we have highlighted the price implication of this product only.

The most popular product that we introduced into this willingness to pay study was the gel preparation. Although this particular product was not used in the trials performed in Nepal, Bangladesh and Pakistan, it is currently being used in a pilot study in Nepal. Results from a hospital-based randomized non-inferiority trial of chorhexidine gel and solution suggest that satisfaction and compliance were high for both products and that the gel formulation was not inferior to the liquid (8). For this reason, we chose to include a gel option in our survey as the gel could be an option for Bangladesh in the future, subject to increasing demand and production capability of the local manufacturer. The preference for 4% chlorhexidine gel demonstrated by a large majority of the study participants (Table 1) could be indicative of impending demand.

Although not everyone was willing to pay the preset prices we asked for, some amount of money was offered by all (Figure 2). This could be because the preset prices asked were higher compared to the respondents' maximum willingness to pay in the majority of cases. However, to prevent newborn cord infections, the majority of our respondents were willing to cope with higher prices by borrowing money if needed. While respondents' willingness to borrow money indicates a high level of motivation of the potential users, it also highlights a crucial issue for pharmaceutical marketing in rural Bangladesh: finding the 'right' price for a product that could prevent

Figure 2: Willingness to pay responses based on price bid asked and separately reported value by type of 4% chlorhexidine product



neonatal morbidity and mortality. As borrowing money for this simple antiseptic could add to the economic burden of households, the range of unit prices recommended by this study should be carefully considered by all supply-side stakeholders. A unit price of multi-dose 4% chlorhexidine liquid between Taka 15-25 (USD 0.21-0.35) would be affordable to primary target population in rural Bangladesh, and so if the product could be produced and delivered at this price it would be expected to generate a large market. However, this pricing might require subsidies to reach optimal coverage.

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Inequity in utilization of maternal health services: a challenge for achieving Millennium Development Goal 5 in Bangladesh

Bangladesh is on track to achieve the target to reduce the maternal mortality ratio by three-fourths as indicated in the Millennium Development Goal (MDG) 5 but better understanding of inequity in maternal health indicators could improve progress. This study reported trends of inequity in the use of maternal health services using Bangladesh Demographic and Health Survey data. Though coverage of antenatal care increased in 2007, 31% of women in the lowest wealth quintile received antenatal care compared to 84% in the highest wealth quintile. In the rural lowest wealth quintile, there was a 2% decline in the proportion of home deliveries between 2004 and 2007 compared to a 12% decline in the urban highest wealth quintile. There are similar trends for postnatal care. Inequity in use of maternal health services is remaining static or increasing; government, non-government organizations, and donors should prioritize access to maternal health services, especially for the poorest populations in rural and urban areas.

Approximately 1,500 women die each day around the world from complications of pregnancy and childbirth, with an estimated 536,000 maternal deaths in 2005 (1). Most of these deaths occurred in low income countries, and most were avoidable (1). In Bangladesh, approximately 12,000 women die each year from such complications (2). Millennium Development Goal (MDG) 5 focuses on improving maternal health including eliminating inequity by ensuring universal access to maternal health services. The MDG 5 target for Bangladesh is to reduce the maternal mortality ratio to 143 per 100,000 live births by 2015. During 1990 to 2010, the maternal mortality ratio in Bangladesh decreased from 570 to 194, providing encouraging evidence that Bangladesh is on track to achieve MDG 5 (3). However, while Bangladesh has made significant progress in improving maternal health during the last two decades, the challenge of eliminating the inequity in utilization of maternal health services remains.

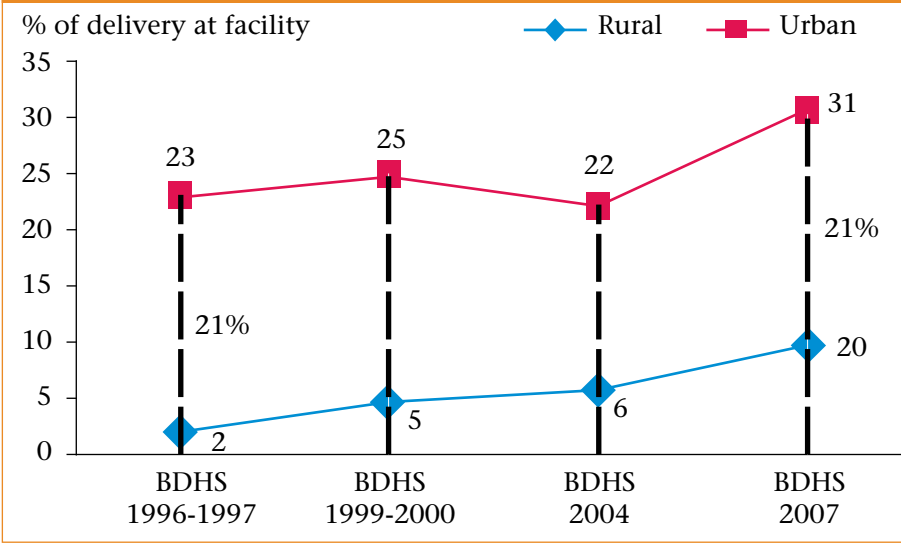
We performed a secondary analysis of the Bangladesh Demographic and Health Survey (BDHS) data from 1993 to 1994, 1996 to 1997, 1999 to 2000, 2004, and 2007. These were a series of national-level population and health surveys conducted as part of the global Demographic and Health Surveys (DHS) programme. We analyzed the data focusing on three broad aspects

of utilization of maternal health services: antenatal, delivery and postnatal. We focused on the context of rural-urban and rich-poor inequities. Data on service utilization by wealth quintile were not available from 1993 to 2000. Therefore, only data from 2004 and 2007 were analyzed to investigate rich-poor inequities.

The overall coverage for completing at least one visit for antenatal care increased from 28% in 1993 to 1994 to 60% in 2007 (4,5). Although the proportion of women receiving antenatal care increased, the gap between rural-urban areas and poor-rich populations remained high. The difference between rural and urban in antenatal care coverage was 30% in 1993/94, 35% in 1996/97, 31% in 1999/2000, 28% in 2004, and 20% in 2007. So the rural-urban difference in antenatal care coverage has decreased somewhat, albeit with some fluctuations. In 2007, 42% of women in the lowest wealth quintile received antenatal care compared to 86% in the highest wealth quintile; the difference between these two wealth quintiles was 44%, only slightly lower than that of 50% in 2004 (5,8).

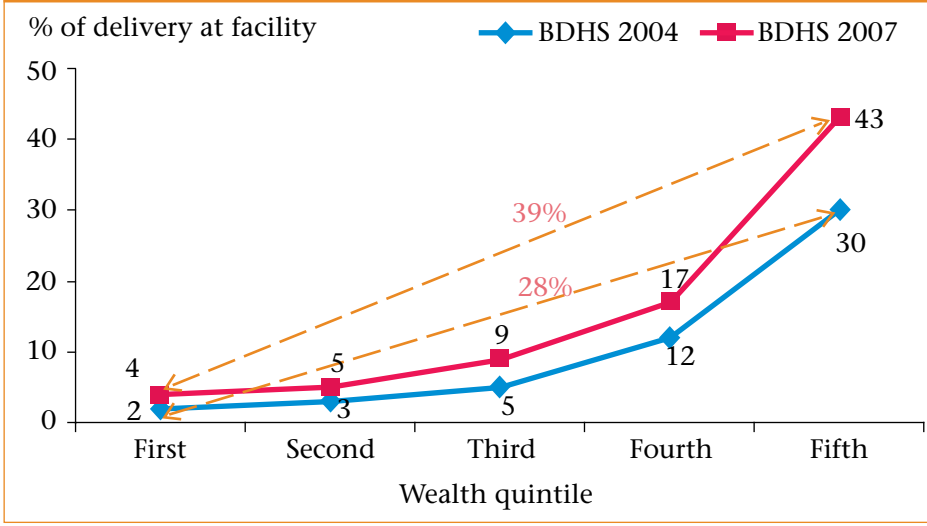
In 2007, 89% of childbirths occurred at home in rural areas compared to 69% in urban areas. Only 2% of deliveries occurred in a facility in rural areas in 1996 to 1997 as opposed to 23% in urban areas. In 2007, 10% of deliveries took place in facilities in rural areas compared to 30% in urban areas. The rural-urban gap for facility delivery remained unchanged between 1997 and 2007. As shown in Figure 1, the gap was consistently about 20% between 1996 and 2007.

Figure 1: Rural-urban gap in facility delivery



Only 2% of deliveries occurred at facilities in the lowest wealth quintile in 2004, compared to 30% in the highest wealth quintile. Similarly, in 2007 only 4% of deliveries in the lowest wealth quintile occurred in a facility compared to 43% in the highest wealth quintile. Therefore, the gap in facility delivery between these two wealth quintiles increased from 28% in 2004 to 39% in 2007 (Figure 2).

Figure 2: Poor-rich gap in facility delivery during 2004 to 2007



In terms of delivery by skilled attendants, the gap between rural and urban areas has, overall, decreased since 1997, but it has fluctuated over time. Data from BDHS 1996 to 1997 showed only 5% of deliveries were conducted by a medically trained provider in rural areas, while 35% of deliveries in urban areas were conducted by a medically trained provider. Between 1999 and 2004 the rate of skilled attendance declined or remained static in urban areas, while it continued to improve at each time point for rural areas. However, the rural-urban gap was estimated to be 21% in 2004 and it increased to 24% in 2007, and this gap did not decrease between 2000 and 2007 (Figure 3). While the rate of improvement for delivery by medically trained provider in rural areas has improved, the difference between urban and rural has not decreased since 2000.

Similarly, mothers from wealthier households were more likely to have their children delivered with the support of medically trained providers. In 2004, only 3% of deliveries in the lowest wealth quintile were attended by medically trained providers versus 40% in the highest wealth quintile. The difference between these two wealth quintiles for skilled attendance during delivery was 37% in 2004, which increased to 46% in 2007 (Figure 4).

Figure 3: Rural-urban gap in delivery by a medically trained provider

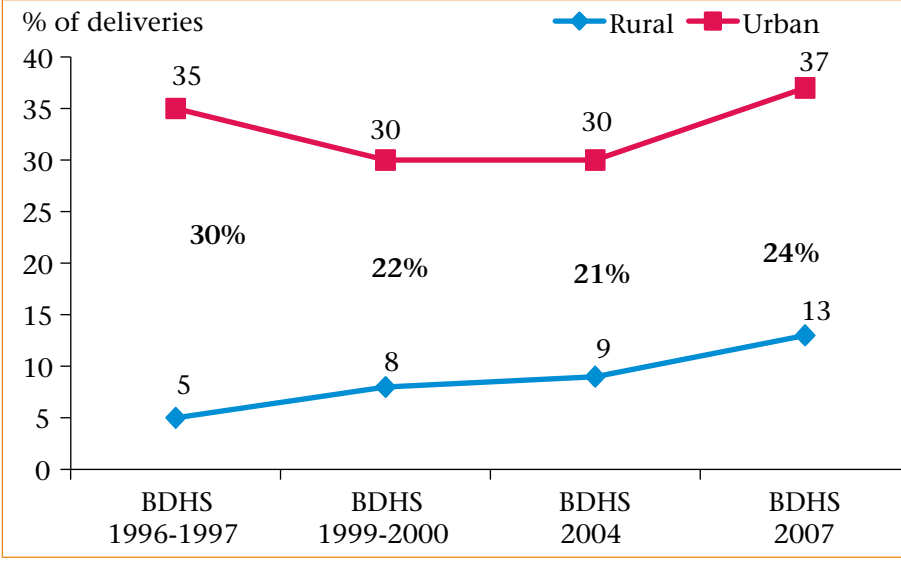
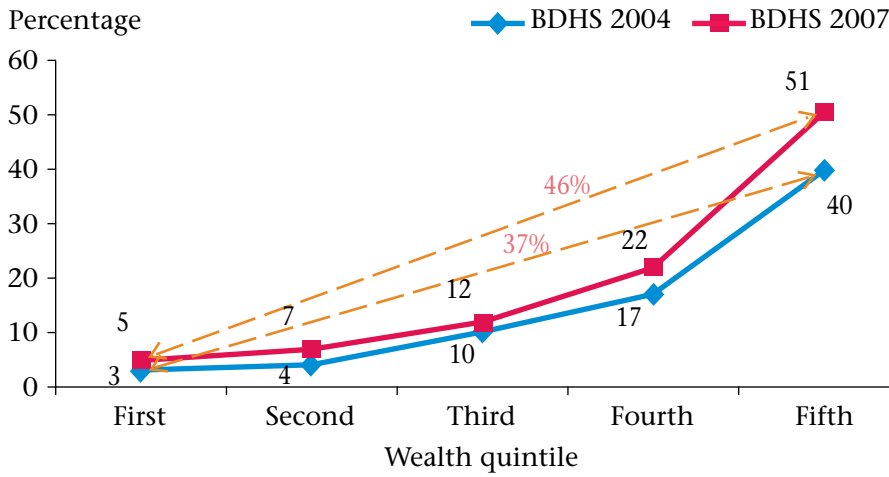


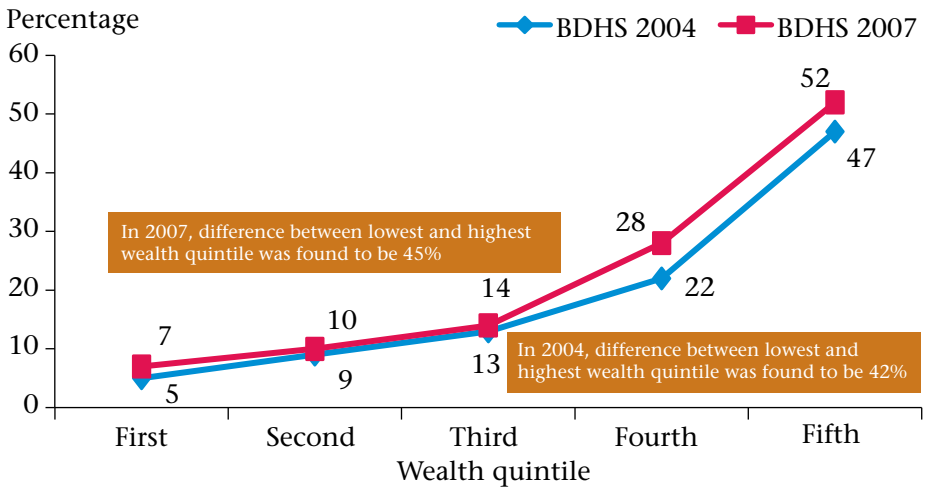
Figure 4: Poor-rich gap in delivery by medically trained provider



There were similar disparities in utilization of postnatal care between rural and urban areas and between the rich and poor population. Only 13% of women received any postnatal care in rural areas in 2004 compared to 34% in urban areas; in 2007, 16% of women received any postnatal care in rural areas compared to 36% in urban areas. In 2007, the proportion of women

receiving postnatal care increased slightly and the rural-urban gap of 21% in 2004 remained almost the same (20%). Likewise, in 2004 only 5% of women received postnatal care in the lowest wealth quintile compared to 47% of women in the highest wealth quintile. This remained the same in 2007 (Figure 5).

Figure 5: Comparing postnatal care utilization by wealth quintile in 2004 and 2007



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Comments

Despite encouraging progress in improving maternal health, this upward trend masks underlying and persistent inequities in the use of maternal health services. Although the proportion of women receiving antenatal care, delivering in facilities, and receiving skilled assistance during delivery has increased over time, the inequity in utilization of services has remained static. The analysis presented here shows that Bangladesh is achieving MDG 5 targets in higher socio-economic quintiles, but is lagging behind in lower socio-economic quintiles. Utilization of maternal health services is better in urban areas than in rural areas, but a similar trend of a gap between rich and poor remains.

Facility delivery increased by 13% in the highest wealth quintile between 2004 and 2007, while it only increased by 2% in the lowest wealth quintile (Figure 2). Additionally, assistance during delivery by trained providers increased by 11% in the highest wealth quintile, six times higher than in the lowest wealth quintile (Figure 4). This analysis suggests that the gap in

utilization of facility delivery and skilled assistance during delivery increased between poor and rich. The cost of services and unavailability of services in the rural areas might have contributed to increasing the gaps. Chowdhury *et al*. noted that less than 20% of health facilities at the sub-district level are adequately staffed to provide emergency care and that retaining skilled birth attendants, especially in rural areas, is a major problem (9).

Simply providing free services does not ensure equity. Other indirect costs such as transportation, referral, and attendants' lost time can also affect the utilization of maternal health services (10). There are also some demand and supply-side factors that hinder people from getting maternal health services in government facilities of Bangladesh. These include payment of bribes to get services, patient dissatisfaction with provider behaviour, lengthy waiting times, limited space, lack of cleanliness, unavailability of female and specialist doctors in rural areas, lack of caesarian service in rural areas, and poor transportation systems (11). In addition, an overall lack of confidence in the health care system and lack of knowledge about the need for maternal care in rural areas present additional barriers to equitable utilization of maternal health services (10). As rural and poor people mostly rely upon government facilities, these hindering factors have likely contributed to the inequities in utilization of maternal services. Along with the government, the private sector also plays a vital role in maternal health services in Bangladesh. Therefore, the government, non-government organizations, and donors should prioritize universal access to maternal health services, especially for rural areas and the poorest populations in both rural and urban areas. Otherwise, inequity in utilization of maternal health services will persist and present grave challenges to MDG 5 achievement.

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Nipah transmission from bats to humans associated with drinking traditional liquor (*tari*) in northern Bangladesh, 2011

The most common transmission pathway of Nipah virus from fruit bats to humans in Bangladesh is through drinking raw date palm sap. In July 2011, the Institute of Epidemiology, Disease Control and Research (IEDCR) and icddr,b investigated a cluster of 7 encephalitis patients in Rangpur district; 4 (57%) died. Among 4 collected blood specimens, 1 case had IgM antibodies against Nipah and 3 had anti Nipah IgG. The primary cases regularly purchased and drank traditional liquor (*tari*) made from date palm sap from a common source prior to their illness. The *tari* was likely contaminated with bat urine or saliva during sap collection and fermentation, and was the most likely source of Nipah virus infection for these cases. Rural people should be informed about transmission of Nipah virus through drinking *tari*. Interventions are also needed to limit bat access to *tari*-producing date palm trees.

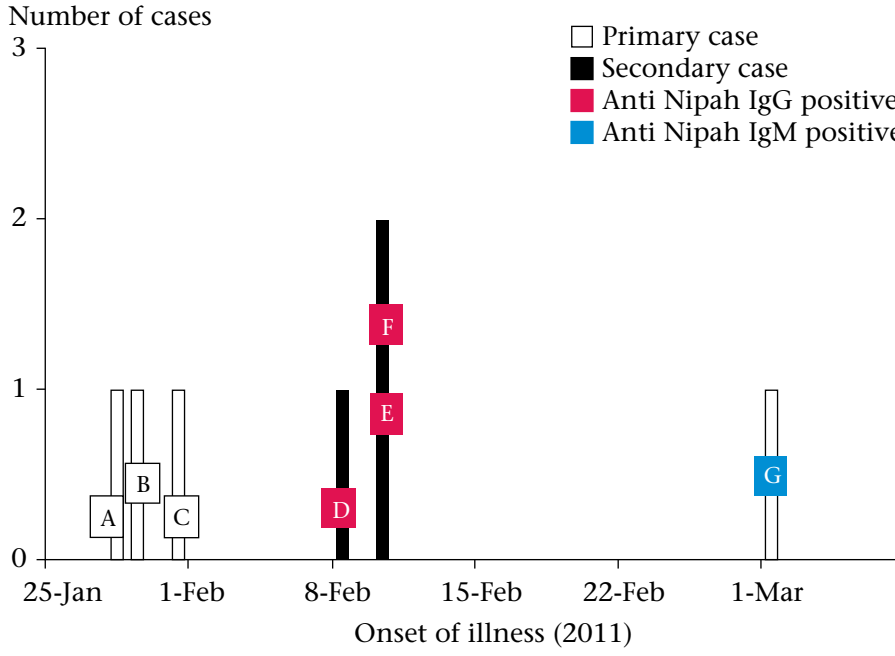
Nipah virus is a bat-borne emerging infection that causes fatal outbreaks of encephalitis almost yearly in Bangladesh (1). The most common transmission pathway of Nipah virus from fruit bats to humans in Bangladesh is through consumption of raw date palm sap, a national delicacy consumed during the cool, winter months (2,3). Human to human transmission of Nipah virus has also been repeatedly noted in Bangladesh (1,4).

There is some evidence that date palm liquor may also transmit Nipah virus. In 2007, a human Nipah case was identified in India with a history of drinking a traditional liquor derived from the sap of the palm tree, which produces sap similar to the sap of the date palm (5). In Bangladesh, the traditional liquor derived from date palm sap is called *tari* and low income people from rural areas often drink this liquor. Bats visit date palm trees and occasionally shed Nipah virus through their saliva and urine which can contaminate the sap (6). In bat urine, the virus can survive up to four days, and in sap contaminated with bat urine, the virus is likely to survive for over a day (7). Generally, enveloped (lipophilic) viruses like Nipah are susceptible to alcohol and approximately 60-70% alcohol is recommended to sterilize contaminated objects (8,9).

Since 2006, IEDCR and icddr,b have been conducting encephalitis surveillance in Nipah-prone areas in Bangladesh. As part of the surveillance activities, a physician working in Rangpur Medical College Hospital collected blood from patients admitted with encephalitis during March 2011. The virology laboratory of IEDCR tested the blood samples for Nipah IgM antibodies. We

found a case-patient that had IgM antibodies to Nipah virus and investigated his exposures that may have led to the infection. This case-patient (case G) was a 25-year-old male. He was a regular *tari* drinker and prior to his illness he purchased and drank *tari* from a commercial source in a peri-urban area of Rangpur district. While investigating case G, we found three more encephalitis patients in the same area who died within 6 weeks of this patient's death, and who all had a history of drinking *tari* from the same commercial source. We collected blood samples from sick individuals who came into close physical contact with these cases during their illness. We identified seven Nipah cases through this investigation (Figure 1).

Figure 1: Date of onset for primary and secondary Nipah cases, Rangpur District, 2011



In August 2011, we investigated this cluster to explore in detail the exposure and illness history of the cases. We interviewed the surviving cases, family members and friends of the deceased, and explored the *tari* consumption pattern and travel history of the cases. In addition, we explored *tari* production, processing and selling patterns in the community. Our team interviewed date palm sap collectors and *tari* producers and explored the production, processing and selling patterns of *tari*. We also explored the presence of bats in the community and their contact with date palm sap.

Case exposures and illness history

We identified 7 cases in this cluster; 4 were males. Three cases (A, B and C) developed onset of fever that subsequently led to headache, altered mental status, respiratory distress and oral frothy discharge. Cases A and G were family friends. Cases B and C were also friends and relatives. Cases A, B, C and G regularly purchased and drank *tari* in the evenings from a common source prior to their illness. None of these cases had either a history of drinking fresh date palm sap nor any exposure to sick humans or animals in the month before they became ill. After caring for case C, three of his family members, including his wife (case D), daughter (case E) and sister-in-law (case F) became infected. All these three family caregivers (cases D, E and F) survived.

***Tari* production, processing and selling patterns in the community**

This Nipah-affected area is famous for *tari* and is the largest *tari*-producing area in Rangpur district. *Tari* is produced commercially in the area and the producers harvest date palm trees for *tari* throughout the year. The men who harvested date palm trees and collected sap for *tari* are known as *pashi* by the local community. *Tari* businessmen from different areas come to this community and buy *tari* at wholesale prices from the *pashi*. *Tari* is called *rosh* (juice) by local residents. They called fresh date palm sap *misti rosh* (sweet juice). The process of collecting date palm sap for *tari* was nearly identical to the process for collecting date palm sap for fresh consumption.

The villagers reported that they did not have regular access to fresh date palm sap in the community because it was all made into *tari*. If they wanted to drink fresh date palm sap, they would have needed to inform the *pashi* at least a week prior to the date they intended to drink it. The *pashi* mentioned that for fresh date palm sap, they needed to clean and dry the earthen pot after each time they collected it. On the other hand, for *tari*, they used the same earthen pot for several months without cleaning it to encourage the fermentation of the date palm sap while it hangs on the tree. Over time, a thick white sediment called *gad* forms at the bottom of the pot, which acts like yeast to ferment the fresh date palm sap into *tari* as it flows into the pot overnight. There were two bat roosts in the community, and *pashi* frequently observed bats flying near the date palm trees. The *pashi* reported filtering *tari* with a net or cloth before selling it.

Every day between 10 a.m. and noon, the *pashi* collected the *tari* from all the hanging earthen pots and combined it in one container, leaving the used pots in the tree. The *tari* was then immediately sold to consumers from morning to until late at night. We observed the wives of the *pashi* selling *tari* at their household premises. Occasionally, the consumers took *tari* away with them in plastic bottles.

Reported by: Rangpur Medical College Hospital, Rangpur; Institute of Epidemiology Disease Control and Research, Ministry of Health and Family Welfare, the Government of the People's Republic of Bangladesh (GoB); Surveillance and outbreak response research group, Centre for Communicable Diseases, icddr,b.

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Comments

The findings of this cluster investigation suggest that the illness was caused by Nipah virus. The four primary Nipah cases had neither a history of drinking fresh date palm sap nor any exposure to sick humans or animals that are commonly described as the source of Nipah infection (1,2,4). However, they regularly purchased and drank *tari* in the evenings from a common *tari* production area prior to their illness. Our epi-curve suggests that there might be two separate spillover events for these cases. The presence of bat roosts in the community and the frequent presence of bats in the *tari*-producing date palm trees indicate the implicated *tari* were likely contaminated with bat urine or saliva during collection and fermentation, and that contaminated *tari* were the most likely source of Nipah infection for these cases (5). In a study conducted in India, the alcohol content in traditional liquor derived from date palm sap was only 4 percent (10). Therefore, the alcohol concentration in the implicated *tari* may not have been high enough or sufficiently evenly distributed throughout the *tari* to inactivate the virus.

Tari is commercially produced in the outbreak-affected area, which suggests there are a substantial number of *tari* consumers in the community who may be at risk for Nipah virus infection. Regular *tari* drinkers might not be aware of the risk of Nipah virus transmission through drinking *tari*. It is important to disseminate messages describing these risk exposures in date palm sap producing areas. Date palm sap is collected for raw consumption only during the cool winter months, but *tari* is collected year-round, possibly posing a risk for Nipah transmission outside of the previously noted Nipah season. Future research should systematically look for *tari* exposures among suspected Nipah cases, and evaluate the alcohol concentration in *tari* and its impact on Nipah virus survival. Interventions are also needed to limit bat access to *tari*-producing date palm trees.

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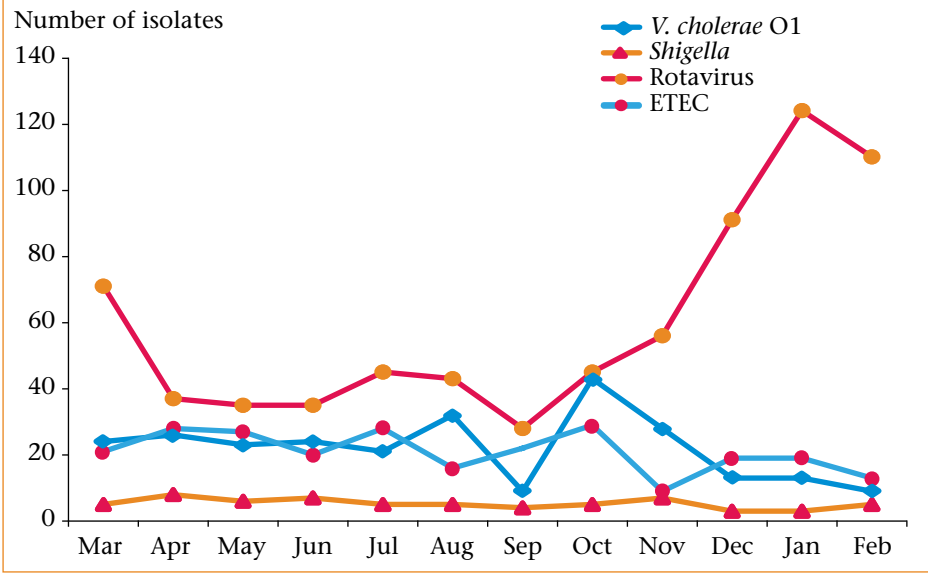
Surveillance updates

With each issue of HSB, updates of surveillance data described in earlier issues are provided. These updated tables and figures represent the most recent observation period available at the time of publication. We hope these updates will be helpful to health professionals who are interested in current patterns of disease and drug resistance in Bangladesh.

Proportion of diarrhoeal pathogens susceptible to antimicrobial drugs: March 2011-February 2012

Antimicrobial agents	*Shigella* (n=63)	*V. cholerae* O1 (n=265)
Nalidixic acid	Not tested	Not tested
Mecillinam	77.8	Not tested
Ampicillin	61.9	Not tested
TMP-SMX	27.0	2.6
Ciprofloxacin	57.1	99.6
Tetracycline	Not tested	60.2
Erythromycin	Not tested	100.0
Furazolidine	100.0	Not tested

Monthly isolation of* V. cholerae *O1*, Shigella, *Rotavirus and ETEC: March 2011-February 2012



Antimicrobial resistance patterns of 52 M. tuberculosis *isolates: February 2011-January 2012*

Drugs	Resistance type		Total n=52 (%)
	Primary n=47 (%)	Acquired* n=5 (%)	
Streptomycin	8 (17.0)	2 (40.0)	10 (19.2)
Isoniazid (INH)	3 (6.4)	1 (20.0)	4 (7.7)
Ethambutal	1 (2.1)	1 (20.0)	2 (3.8)
Rifampicin	3 (6.4)	1 (20.0)	4 (7.7)
MDR (INH+Rifampicin)	0 (0.0)	1 (20.0)	1 (1.9)
Any drugs	11 (23.4)	2 (40.0)	13 (25.0)

() column percentage *Antituberculous drugs received for 1 month or more

Antimicrobial susceptibility pattern of S. pneumoniae *among children <5 years during January 2012-March 2012*

Antimicrobial agents	Total tested (n)	Susceptible n (%)	Reduced susceptibility n (%)	Resistant n (%)
Ampicilin	4	4 (100.0)	0 (0.0)	0 (0.0)
Cotrimoxazole	4	1 (25.0)	0 (0.0)	3 (75.0)
Chloramphenicol	4	4 (100.0)	0 (0.0)	0 (0.0)
Ceftriaxone	4	4 (100.0)	0 (0.0)	0 (0.0)
Ciprofloxacin	4	4 (100.0)	0 (0.0)	0 (0.0)
Gentamicin	4	0 (0.0)	0 (0.0)	4 (100.0)
Oxacillin	4	4 (100.0)	0 (0.0)	0 (0.0)

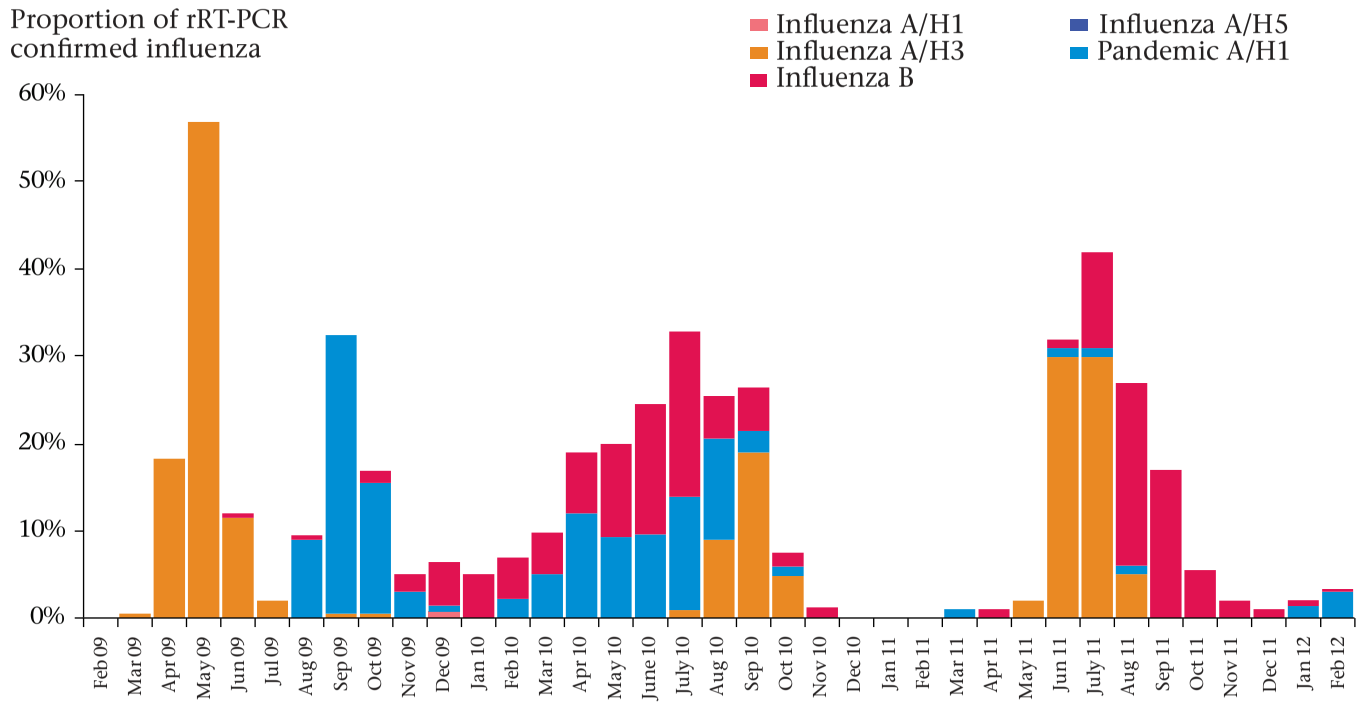
Source: icddr,b's urban surveillance in Kamalapur (Dhaka).

Antimicrobial susceptibility pattern of S. typhi *among children <5 years during January 2012-March 2012*

Antimicrobial agents	Total tested (n)	Susceptible n (%)	Reduced susceptibility n (%)	Resistant n (%)
Ampicilin	15	10 (66.7)	0 (0.0)	5 (33.3)
Cotrimoxazole	14	10 (71.4)	0 (0.0)	4 (28.6)
Chloramphenicol	14	10 (71.4)	0 (0.0)	4 (28.6)
Ceftriaxone	14	14 (100.0)	0 (0.0)	0 (0.0)
Ciprofloxacin	15	0 (0.0)	15 (100.0)	0 (0.0)
Nalidixic Acid	15	0 (0.0)	0 (0.0)	15 (100.0)

Source: icddr,b's urban surveillance in Kamalapur (Dhaka).

Proportion of laboratory confirmed influenza among hospitalized severe acute respiratory illness (SARI) and outpatient influenza like illness (ILI) cases between February 2009 and February 2012



Source: Patients participating in hospital-based influenza surveillance in Dhaka National Medical College Hospital, Community-based Medical College Hospital (Mymensingh), Jahurul Islam Medical College Hospital (Kishoregonj), Rajshahi Medical College Hospital, Shaheed Ziaur Rahman Medical College Hospital (Bogra), LAMB Hospital (Dinajpur), Bangabandhu Memorial Hospital (Chittagong), Comilla Medical College Hospital, Khulna Medical College Hospital, Jessore General Hospital, Jalalabad Ragib-Rabeya Medical College Hospital (Sylhet) and Sher-e-Bangla Medical College Hospital (Barisal)

Photo 1: Tari producing pot hanging in the tree

Photo 2: Sediment at the bottom of the pot

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