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Behavior Change Communications during Antenatal Visits Using Pictorial Cards Improves Institutional Delivery Rates: Evidence from Matlab, Bangladesh

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Authors' contributions

This work was carried out in collaboration between all authors. Author AR contributed in organizing data, developing the analysis plan, undertaking detailed analysis and preparing the first draft of the manuscript. Author IA was involved in data analysis and review of the manuscript. Both the authors read and approved the final manuscript.

Research Article

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ABSTRACT

Aims: Behavior change communication (BCC) has been recommended in maternal health however, little is known about its effectiveness in improving knowledge and utilization of services. This paper presents findings from Matlab, a rural area of Bangladesh to inform policy about the effect of focused BCC on maternal knowledge and institutional delivery rates.
Study Design: Cohort Study.
Place and Duration of Study: The study took place in Matlab, Bangladesh from the period 2003 to 2006.
Method: The International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b) introduced pictorial cards in 1996 to monitor all pregnant women in Matlab service area and to provide BCC during routine antenatal visits on pregnancy danger signs, birth planning and maternal nutrition. Maternal knowledge was measured by asking about complications shown on the pictorial cards during 1st and 2nd (or successive) antenatal visits. The pictorial card data were linked with the birth file data and the socioeconomic

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survey data of the year 2005 of Matlab Health and Demographic Surveillance Systems (HDSS) for analysis.
Results: HDSS recorded 11,150 births during the study period but pictorial cards covered 10,657 women, and maternal knowledge data was available from 6,624 of these. Knowledge about all 5 danger signs increased from 8.9% to 34.2% between 1st and 2nd (or successive) antenatal visits (*P* <.001). Women with complete knowledge of all five pregnancy danger signs were 1.13 (Adjusted Odds: 1.13, 95% CI, 1.01-1.27) times more likely to have institutional deliveries than those without knowledge when the effect of socio-demographic co-variates were held constant.
Conclusion: Focused BCC using pictorial cards during antenatal visits improves knowledge regarding 5 pregnancy danger signs which has clear implications for improving institutional delivery rates. We recommend implementation research to demonstrate the effect of focused BCC in improving knowledge and practice to address high maternal mortality in resource-poor settings.

Keywords: Danger sign; health education; pregnancy; institutional delivery; Bangladesh.

ABBREVIATIONS

ANC: Antenatal care; APH: Antepartum Haemorrhage; BCC: Behavior Change Communication; CEmOC: Comprehensive Emergency Obstetric Care; CHRW: Community Health Research Worker; DFID: Department for International Development; EU: European Union; HDSS: Health and Demographic Surveillance System; icddr,b: International Centre for Diarrhoeal Disease Research, Bangladesh; MCH-FP: Maternal, Child Health & Family Planning; MDG: Millennium Development Goal; MMR: Maternal Mortality Ratio; OR: Odds Ratio; PC: Pictorial Card; PPH: Postpartum Haemorrhage; SBA: Skilled Birth Attendant; SES: Socio Economic Survey.

1. INTRODUCTION

Millennium Development Goal 5 (MDG) is an explicit call to 'improve maternal health' by achieving a target of 75% reduction in the maternal mortality ratio (MMR) between 1990 and 2015 [1]. Currently, the global consensus is that all deliveries are at risk for developing life-threatening complications and therefore should always be conducted by a skilled birth attendant (SBA) supported by referral linkages with comprehensive emergency obstetric care (CEmOC) facilities [2]. Experts have formulated several conceptual frameworks to understand the causal pathways for high MMR and have emphasized strengthening health systems to improve supply and stimulate demand to increase utilization of maternal health care services [2,3]. There are many cultural and religious barriers to seeking appropriate care for maternal and neonatal complications.

The knowledge of pregnant women about maternal and newborn danger signs is limited [4]. Behavior change communication (BCC) is one of the key demand interventions for improving knowledge and use of skilled delivery care services. Antenatal care (ANC) is widely established and pictorial cards have been used in many resource-poor settings to educate pregnant women on pregnancy danger signs, birth-preparedness, and maternal nutrition [5]. The literature suggests that when a new message is communicated to the target audience using appropriate media and in a favorable environment, it is internalized and creates certain positive changes in knowledge, perception and attitude of the recipient that is ultimately

reflected in positive changes in behaviors [6,7]. Pictorial communication has been proven effective in improving knowledge and altering behaviour in many areas such as vaccination [8] and care-seeking for diabetes mellitus [9]. However, there is a paucity of evidence that demonstrates the success of pictorial communication in maternal health [5,7,8]. In this study we have analyzed routine monitoring data of Matlab Maternity Care Program of icddr,b to explore the effect of pictorial communication in improving knowledge about pregnancy danger signs and institutional delivery rates.

2. MATERIALS AND METHODS

2.1 Study Setting

This study was conducted in Matlab, a rural area of Bangladesh where icddr,b has maintained a well-organized Health and Demographic Surveillance Systems (HDSS) since 1966 covering a population of about 225,000 (in 2006). The HDSS collects information on births, deaths, marriages and migration through routine home-visits by trained community health research workers (CHRWs). In Matlab HDSS area, socio-economic censuses are conducted periodically (1974, 1982, 1996, and 2005) [10].

A Maternal, Child Health & Family Planning (MCH-FP) program was initiated in one half of the Matlab HDSS area in 1978. Since then, the MCH-FP intervention area is known as icddr,b service (treatment) area and the remaining half is known as the government service (comparison) area. A home based maternity care program using trained nurse-midwives was initiated in one half of the icddr,b service area in 1987. During 1990, the program was expanded to the rest of the icddr,b service area and in 1996, the home-based strategy was gradually replaced by a facility based strategy deploying the same nurse-midwives in 4 health sub-centres upgraded to provide 24/7 basic obstetric care services. Since 2001, icddr,b has been providing basic obstetric care services from 4 health sub-centres and its Matlab hospital with strong referral linkages with comprehensive emergency obstetric care facilities (public and private) in neighboring Chandpur district town 17 kilometer away from Matlab. In addition, basic obstetric care services were available from the Matlab government upazila health complex and public and private hospitals in Chandpur district town [11-14]. Antenatal and post-natal care services are also provided by nurse-midwives from the icddr,b sub-centres and Matlab hospital. Providing BCC during ANC visits was always an integral in the Matlab maternity care program.

2.2 Pictorial Cards

A women-based pictorial card (PC) was introduced in 1996 to monitor all women in the icddr,b service area during pregnancy, delivery, and 42 days post-partum. These cards are distributed to all new pregnant women (identified on the basis of three successive missed menstrual cycles) during pregnancy registration by CHRWs when background information of the pregnant woman is also recorded. Pregnant women are requested to preserve these cards carefully and submit them to service providers while seeking care during pregnancy, delivery and postnatal periods. Service providers record service statistics on these cards and use them for providing BCC to pregnant women. These cards have pictures of five important pregnancy danger signs (Box 1) and room to record whether the pregnant woman could recognize them accurately without prompting.

Box 1. Pictorial depiction of five pregnancy danger signs

1. Ante Partum Hemorrhage
2. Pre-Eclamptic Toxemia
3. Prolonged Labor
4. Mal-Presentation
5. Post Partum Hemorrhage

The icddr,b nurse-midwives during 1st ANC visit shows all 5 pictures on the PCs and asks the pregnant woman to describe them one by one. The nurse-midwife records the responses in the specified space below each picture. In case someone fails to recognize any of the pregnancy danger signs correctly, the nurse-midwife teaches the pregnant woman about the complication and its consequences and advises her to visit CEmOC facilities urgently for treatment in case such a complication arises anytime during pregnancy, delivery, or the post-partum period. During the second or successive ANC visit the same procedure is followed to elicit each woman's correct knowledge about pregnancy danger signs. There is room for collecting such knowledge information only twice during the entire pregnancy period (during 1st and 2nd or successive visits). All PCs are collected after 42 days of delivery of women by the CHRWs or by the nurse-midwives when the mother comes into contact with them. After collecting the PCs, one assigned midwife checks them and sends them to the Matlab field office of icddr,b for computer entry. Before entry, all text responses for pregnancy danger signs are coded as 'correct' or 'incorrect' by a trained medical doctor in Matlab.

2.3 Statistical Analysis

Institutional delivery is the 'outcome' variable and women's knowledge about 5 pregnancy danger signs is the 'exposure' variable in this study. The effects of socio-demographic factors were controlled statistically using multivariable logistic regression analysis in SPSS 16 [15]. A woman was classified as having institutional delivery if she delivered in icddr,b or any other health facility. We used PC data after validation with the HDSS birth records. A composite knowledge variable was created combining all 5 knowledge questions in the PCs. A woman was considered knowledgeable if she could mention all 5 pregnancy signs correctly without prompting. Economic status was measured in asset quintiles rather than in terms of income or consumption [16,17]. Assets included durable goods (e.g., table, chair, watch, television, or bicycle), housing facilities (e.g., type of toilet, or source of drinking water), housing materials (e.g., type of wall or roof), and possession of farming land. Socio-economic survey data of year 2005 was used to construct asset quintiles. Equity was defined as equal use for equal need [18]. Women's educational status was not included in the index as it was treated as an independent variable. We linked HDSS, PC and socioeconomic survey data using unique identification numbers of mothers and date of birth of the index child.

We analyzed PC data from 2003 to 2006 that included 10,657 pregnant women while HDSS recorded 11,150 women with known pregnancy outcome during that period. Thus a total of 493 mothers were missing in the PCs. Of 10,657 mothers with PCs, knowledge information was available for 6,624 mothers. Therefore, the final analysis was confined to 6,624 cases only and the sample size (N) varied throughout the analysis.

The difference of knowledge between first and second (or successive) ANC visit was tested by McNemar test to assess the effect of BCC interventions in improving knowledge about pregnancy danger signs. We modeled data for multivariable logistic regression analysis where facility delivery was the outcome variable and knowledge about pregnancy danger

signs was the exposure variable while age, parity, year of delivery, education and economic status were covariates whose confounding effects were controlled statistically. The relationship between exposure and outcome variable was measured in terms of odds ratios (OR) and 95% confidence intervals (CI) of odds ratios adjusting for socio-demographic covariates.

2.4 Conceptual Model

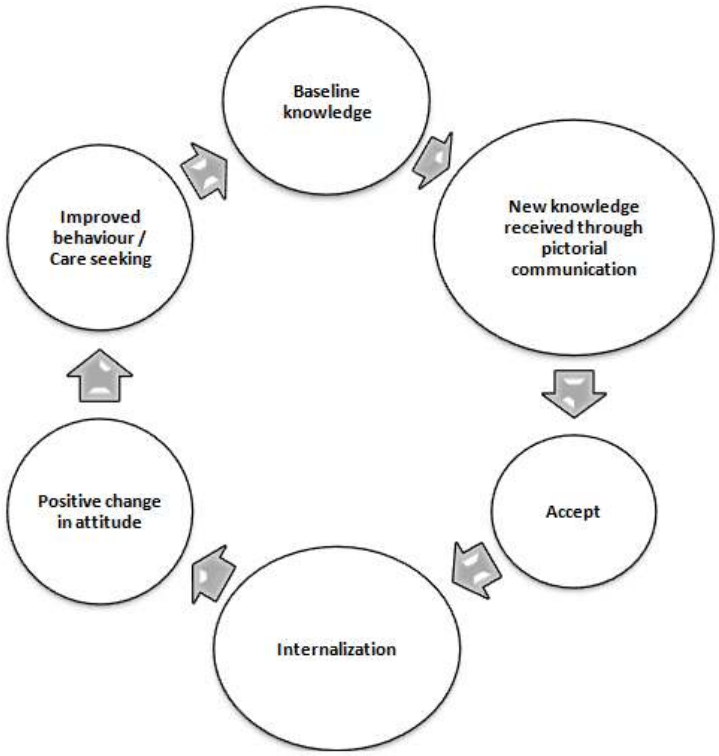

Fig. 1. Theoretical model used in analysis of the current study

The theoretical model (Fig. 1) has been adapted from Piotrow et al. [19] to explain the pathways for changing behaviour due to pictorial communication. The model postulates that new knowledge when communicated through pictorial cards to pregnant women, the key messages are accepted first, then gets internalized and make certain positive changes in the perception and attitude of the recipients which is ultimately reflected by desired healthy behaviour or care seeking such as using health facilities for complicated and normal deliveries.

3. RESULTS AND DISCUSSION

3.1 Socio-Demographic Characteristics

The mean age of pregnant women in Matlab icddr,b service area was 25.6 (SD; ±6.0) years while the mean parity was 1.3 (SD; ±1.4). About 17% women delivered their index child at age below 20 years while 9.5% delivered at age 35 years or above. Mean years of schooling

was 5.3 (SD; ±3.8) years while 24% of pregnant women were illiterate. An increasing trend is observed in maternal education in the study area (Table 1).

Table 1. Socio-demographic characteristics of the study population

Variables	2003 (N=2863) %	2004 (N=2670) %	2005 (N=2610) %	2006 (N=2523) %	Total (N=10657) %
Age in years					
13-19	16.7	16.6	16.1	17.3	16.6
20-24	31.3	29.9	32.2	32.8	31.5
25-29	25.8	26.9	25.1	25.3	25.8
30-34	16.6	17.2	16.8	15.4	16.5
≥35	09.6	09.5	09.8	09.2	09.5
Mean age	25.7 (±6.1)	25.7 (±6.0)	25.7 (±5.9)	25.4 (±5.9)	25.6 (±6.0)
Women's education					
None	28.6	24.9	21.9	19.9	24.0
1-4 years	27.3	26.5	27.2	26.2	26.8
5-8 years	19.6	21.5	21.5	23.0	21.3
≥9 years	24.4	27.0	29.4	31.0	27.9
Mean years of schooling	4.8 (±3.9)	5.2 (±3.8)	5.4 (±3.7)	5.7 (±3.6)	5.3 (±3 .8)
Parity					
0	35.6	35.4	35.3	38.5	36.2
1-2	45.5	46.9	49.1	46.4	46.9
≥3	18.9	17.7	15.6	15.1	16.9
Mean parity	1.4 (±1.4)	1.3 (±1.3)	1.2 (±1.3)	1.2 (±1.3)	1.3 (±1.4)
Asset quintile					
Poorest	17.9	19.4	15.7	16.7	17.5
2nd	18.0	17.8	18.0	17.4	17.8
3rd	21.3	21.9	18.7	20.0	20.5
4th	24.0	22.4	23.9	22.0	23.1
Richest	18.9	18.6	23.7	23.8	21.1

3.2 Knowledge about 5-Pregnancy Danger Signs

Table 2 shows that knowledge about all 5-pregnancy danger signs increased from 9.3% to 39.4% in 2003, from 9.2% to 31.7% in 2004, from 7.3% to 28.5% in 2005 and from 9.4% to 35.5% in 2006 from 1st to 2nd or successive ANC visits. In total (all years), during 1st ANC visit, only 8.8% mothers could recognize all 5-pregnancy danger signs correctly without prompting while it increased to 34% during 2nd (or successive) ANC visits. This increase in knowledge between two ANC visit was always statistically significant (P <.001) which suggests the effectiveness of pictorial communication in enhancing knowledge of women about 5-pregnancy danger signs (Table 2).

Table 2. Changes of knowledge on pregnancy danger signs among pregnant women during 1st and succeeding Antenatal visit during 2003-2006 in the study area

Knowledge about 5 danger signs	2003		2004		2005		2006		Total	
	1st ANC N=2190	2nd ANC N=2159	1st ANC N=1551	2nd ANC N=1528	1st ANC N=1660	2nd ANC N=1622	1st ANC N=1346	2nd ANC N=1315	1st ANC N=6747	2nd ANC N=6624
0	01.1	00.0	01.2	00.3	02.4	00.7	02.8	00.3	01.8	00.3
1	03.6	00.3	03.8	00.9	05.1	01.0	04.5	00.2	04.2	00.6
2	08.7	01.3	08.3	01.6	10.8	02.3	10.0	01.2	09.4	01.6
3	23.8	07.5	25.3	09.8	24.7	11.0	23.8	07.1	24.4	08.8
4	53.5	51.5	52.4	55.8	49.6	56.5	49.4	55.7	51.5	54.5
5	09.3	39.4*	09.2	31.7*	07.3	28.5*	09.4	35.5*	08.8	34.2*

**p <.001 in McNemar test*

In simple model (one predictor and one outcome variable), knowledge was found to vary significantly by age, parity, education and asset index of women. In multivariable logistic regression analysis (one dichotomous outcome variable and multiple predictor variable), [20] when the effects of all covariates (in the model) were controlled for statistically, asset-quintile lost its significant relationship while women's education, parity and age of women maintained a significant relationship with the outcome variable (knowledge about 5 pregnancy danger signs). Our analysis suggests that education, age and parity are significant predictors of knowledge while asset-index is not. Knowledge was found to increase with education and decrease with increasing age (Table 3).

3.3 Institutional Delivery

During 2003-2006, about 47.3% deliveries were conducted in health facilities in the icddr,b service area. In simple model an increasing trend is observed over time; the facility delivery rate increased from 38.4% in 2003 to 58.2% in 2006. Facility delivery rate was found to vary by age, parity, asset-index, women's education and knowledge about pregnancy danger signs. The facility delivery rate increased significantly with increase of women's education and asset quintile while the rate decreased with increasing age and parity. Knowledge about 5 pregnancy danger signs significantly influenced the use of health facilities for conducting deliveries: utilization was 50.3% among mothers who did not have knowledge about all 5 danger signs while the same rate was 54.6% among mothers who had knowledge about 5 pregnancy danger signs (Table 4). Of all 5 danger signs, only knowledge about prolonged labour was a significant predictor of institutional delivery independently (data not shown).

Table 4 shows that a mother with knowledge about all 5-pregnancy danger signs was 1.13 times (OR 1.13; 95% CI 1.01, 1.27) more likely to deliver in a health facility than a mother without knowledge of all 5-pregnancy danger signs which implies that knowledge is a significant predictor of use even after controlling the effect of socio-demographic factors such as age, parity, education, asset quintile and delivery year (Table 4).

Table 3. Logistic regression results from pictorial card data for socio-demographic correlates of 5-pregnancy danger signs during 2nd (or successive) ANC visit by pregnant women in ICDDR, B service area, 2003-2006

Independent variables (Predictors)	Have knowledge about all 5 danger sign in % (N=6624)	Dependant variable: knowledge about 5-pregnancy danger signs			
		Simple model		Multivariable model	
		Crude OR	95% CI for Crude OR(P value)	Adjusted OR	95% CI for adjusted OR (P value)
Age in years					
13-19	37.0	1.00	Reference category	1.00	Reference category
20-24	38.8	1.09	0.95-1.23 (0.22)	1.02	0.87-1.20 (.59)
25-29	33.6	0.86	0.74-0.99 (0.03)	0.85	0.70-1.03 (.09)
30-34	27.6	0.65	0.55-0.77 (<.001)	0.73	0.58-0.91 (.005)
≥35	25.3	0.57	0.46-0.71 (<.001)	0.70	0.53-0.93 (.01)
Parity					
0	36.9	1.00	Reference category	1.00	Reference category
1-2	35.1	0.92	0.83-1.03 (.15)	1.18	1.03-1.36 (.02)
≥3	24.8	0.56	0.48-0.66 (<.001)	0.95	0.76-1.20 (.64)
Women's education					
No education	26.6	1.00	Reference category	1.00	Reference category
1-4 years	31.3	1.26	1.08-1.46 (.003)	1.19	1.02-1.39 (.03)
5-8 years	35.7	1.53	1.31-1.79 (<.001)	1.37	1.15-1.62 (<.001)
≥9 years	42.0	2.00	1.73-2.31 (<.001)	1.82	1.54-2.14 (<.001)
Asset score					
Poorest	32.3	1.00	Reference category	1.00	Reference category
2	30.0	0.91	0.76-1.08 (.29)	0.88	0.73-1.05(.15)
3	34.8	1.12	0.95-1.32 (.17)	1.02	0.86-1.21 (.81)
4	35.4	1.15	0.98-1.35(.09)	1.00	0.85-1.19 (.93)
Richest	37.0	1.23	1.05-1.46 (.01)	1.05	0.88-1.25 (.55)
Year					
2003	39.4	1.00	Reference category	1.00	Reference category
2004	31.7	0.72	0.62-0.82 (<.001)	0.69	0.61-0.79 (.002)
2005	28.5	0.61	0.53-0.70 (<.001)	0.58	0.50-0.66 (.08)
2006	35.5	0.65	0.74-0.94 (.02)	0.79	0.68-0.92 (<.001)

Table 4. Logistic regression outputs from pictorial card data for exploring the effects of knowledge about 5-pregnancy danger signs and other socio-demographic variables upon institution delivery in icddr,b service area, 2003-2006

Independent variables (Predictors)	Institutional delivery rate (%)	Dependant variable: Delivered in facility			
		Simple model		Multivariable model	
		Crude OR	95% CI for Crude OR (P value)	Adjusted OR	95% CI for adjusted OR (P value)
knowledge about 5 danger signs	N=6624				
No	50.3	1.00	Reference category	1.00	Reference category
Yes	54.6	1.19	1.07-1.31(.009)	1.13	1.01-1.27(.02)
Age group	N=10657				
13-19	52.5	1.00	Reference category	1.00	Reference category
20-24	48.8	0.86	0.77-0.96 (.007)	1.13	0.96-1.33 (.12)
25-29	47.4	0.82	0.72-0.92 (<.001)	1.72	1.50-1.98 (<.001)
30-34	41.7	0.65	0.57-0.74 (<.001)	2.04	1.72-2.41 (<.001)
35-51	43.3	0.69	0.59-0.81 (<.001)	2.90	2.36-3.55 (<.001)
Parity	N=10657				
0	58.7	1.00	Reference category	1.00	Reference category
1-2	44.0	0.55	051.-0.60 (<.001)	0.49	0.44-0.55 (<.001)
≥3	32.3	0.34	0.30-0.38 (<.001)	0.27	0.23-0.32 (<.001)
Woman's education	N=10657				
None	30.8	1.00	Reference category	1.00	Reference category
1-4 years	42.1	1.64	1.46-1.83 (<.001)	1.49	1.32-1.67 (<.001)
5-8 years	49.4	2.19	1.95-2.47 (<.001)	1.92	1.69-2.18 (<.001)
9 & above years	65.1	4.21	3.76-4.71 (<.001)	3.16	2.78-3.58 (<.001)
Asset score	N=10657				
Poorest	34.2	1.00	Reference category	1.00	Reference category
2	43.3	1.47	1.29-1.68 (<.001)	1.40	1.22-1.60 (<.001)
3	45.7	1.62	1.42-1.84 (<.001)	1.38	1.21-1.58 (.003)
4	53.0	2.17	1.92-2.46 (<.001)	1.65	1.45-1.88 (<.001)
Richest	57.0	2.56	2.25-2.90 (<.001)	1.77	1.54-2.01 (<.001)
Year	N=10657				
2003	38.4	1.00	Reference category	1.00	Reference category
2004	43.0	1.21	1.09-1.35 (<.001)	1.37	1.19-1.57 (<.001)
2005	51.1	1.68	1.51-1.87 (<.001)	1.91	2.67-2.19 (<.001)
2006	58.2	2.24	2.01-2.50 (<.001)	2.54	2.19-2.95 (<.001)

All socio-demographic variables sustained their significant relationship with institutional delivery rates even after controlling the effects of all covariates in the model. However, the direction of association changed with age of mothers. In simple model, use of health facility for conducting deliveries was found to decrease with increase of age, while in multivariable analysis when the confounding effects of covariates (particularly that of parity) were controlled for statistically, age had a positive influence on institutional delivery rates. The apparent decrease in use with increasing age is an artifact of parity. The probability of delivering in a health facility decreases with increased parity. A woman with 3 or more parity was 73% less likely to deliver in a health facility than a nulliparous woman. A similar finding was also reported in another analysis from Matlab Bangladesh [21]. Education and asset index had similar positive effects upon utilization of services. Of all socio-demographic variables, woman's education was the most powerful predictor for institutional delivery (Table 4).

3.4 Discussion

Our study has clearly demonstrated that BCC with pictorial cards during ANC visits is effective in improving knowledge of women about pregnancy danger signs and more importantly, the enhanced knowledge can significantly improve the institutional delivery rates even after controlling for socio-demographic confounders. The study findings have important policy implications for safe-motherhood programs in Bangladesh and elsewhere in low and middle income countries.

The effectiveness of BCC in increasing the use of services is not well studied in maternal health although evidence of success with BCC is reported in other areas of health such as breast feeding [22], family planning [23], improved hygienic practices [6] and care-seeking for sick neonates [24]. Fewer studies have reported success of BCC interventions using PCs in increasing knowledge and uptake of skilled delivery care services. One study in South Uganda reported a 50% increase in the use of skilled birth attendants for conducting deliveries among women with birth-preparedness interventions than women without birth-preparedness interventions [25]. Similar successful results with demand-side interventions have been reported from Burkina Faso [26] and Bangladesh [27].

About two-thirds of the women in Matlab icddr,b service area were not aware of all five pregnancy danger signs. Similar levels of poor knowledge of pregnant women have been reported from Burkina Faso, Gambia, Nepal and Tanzania [25, 28-30]. However, these studies reported recall information from women after their delivery and did not analyze all 5 pregnancy danger signs together. A study in one northern district of Bangladesh [27] reported that about 45% of women had knowledge of 3 or more pregnancy danger signs but the study did not explore the effect of knowledge on institutional delivery rates. Our study suggests that there is further scope to enhance knowledge of pregnant women to increase institutional delivery rates in Matlab, and elsewhere in Bangladesh.

The knowledge of pregnant women about 5 pregnancy danger signs increased significantly in the present study due to BCC intervention with PCs by nurse-midwives. Similar success with BCC has been reported in enhancing knowledge about pregnancy danger signs from other settings [31]. The literature suggests that improved knowledge about pregnancy danger signs reduces the 1st and 2nd delay of the 3 Delay Model [3] and in Bangladesh the first delay was found to be the most important barrier for accessing obstetric care from appropriate EmOC facilities [7]. Failure to recognize the gravity of the situation and lack of money for transport were important reasons for 1st delay in seeking care. To reduce delays

in care seeking and to improve access to EmOC in rural Bangladesh, interventions should be intensified to enable communities to recognize 'pregnancy-danger signs'. This strategy should be combined with ongoing community-based SBA and decentralization of EmOC efforts to contribute to reductions in high maternal mortality ratios [7,32,33].

The current study has documented that pregnant women with knowledge about all five danger signs are 13% more likely to deliver in a facility than those without knowledge of all five pregnancy danger signs. It is logical that having specific knowledge about the risks of childbirth and the benefits of skilled attendance should increase preventive care seeking, while recognition of danger signs and knowledge about available beneficial interventions should increase care-seeking for obstetric complications. Our study has shown that enhanced knowledge can increase the rate of institutional delivery. A similar positive effect of enhanced knowledge on institutional delivery is reported from Africa and Asia. Women in Zambia who knew danger signs in pregnancy were more likely to deliver in a health facility as compared to those without such knowledge [34] and a similar but not significant tendency was observed in Southern Laos [35]. Also, in Mali and Tanzania, women who were informed of complications during antenatal care were more likely to give birth in a facility [29, 36]. Currently, Bangladesh is focusing on increasing the institutional delivery rates to facilitate achieving the MDG 5 targets [37].Therefore, appropriate BCC during ANC using PCs should be initiated to enable women, their gatekeepers, and communities to reduce delays in care seeking. This is especially required for women with life-threatening obstetric complications such as APH, PPH, eclampsia and prolonged/obstructed labour. Given this context, we recommend implementation research to demonstrate the effectiveness of BCC with pictorial cards during ANC in a real life context and to understand the challenges related to national scale-up in Bangladesh.

Maternal education emerged as the most powerful indicators for both knowledge and use of services. Hence there is a need to strengthen ongoing female education program to secure gain in maternal and neonatal health. Data also suggests that primigravidae and high parity mothers should be targeted for maternal health interventions.

The major limitation of this analysis is that a considerable proportion of women who delivered in the area during the study period were not captured through PCs and more importantly, relevant information on 5 danger signs were missing for many women in the PCs. However, the SES of women with PC was similar to those without PC suggesting minimal bias in estimating effect size of interventions. Furthermore, there is no comparable group in this study which may limit the generalisability of the study findings. This analysis is based on data from Matlab which has been criticized for not being representative of other rural areas of Bangladesh because of its many and long-term interventions in the field of health, population and nutrition [38]. Therefore, there is a need to demonstrate these results in districts outside Matlab. During the study period the women could get information on pregnancy danger signs from other sources such as television, radio and newspapers which may have affected the study results and were difficult to control for. However, this external exposure was similar to all women under study.

4. CONCLUSION

Focused BCC using PCs during routine ANC improves knowledge of pregnant women and their use of health facilities for conducting deliveries which may contribute in achieving MDG 5 targets by 2015. Bangladesh and other low income countries should test the effectiveness

of BCC interventions with pictorial cards in different contexts to improve maternal health outcomes.

CONSENT

Not Applicable as we have analyzed the programme monitoring data. But we sought permission for the use of data according to the centre rules.

ETHICAL APPROVAL

Not applicable as we used programme monitoring data in this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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