



Research Article

Factors Affecting Maternal Mortality and Morbidity in Bangladesh

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Abstract

Maternal health knowledge is a critical indicator to prevent maternal mortality and morbidity in Bangladesh. This study explores the associated factors influencing maternal health knowledge among women of reproductive age and caregivers of mothers. A cross-sectional survey was conducted among 120 women aged 13–49 years and beyond in a three purposively selected region of Bangladesh along with 12 KIIs with health workers, community members and local representatives. Data were analyzed using descriptive statistics, bivariate and multivariable logistic regression. Findings indicate that over 95% respondents could not identify key danger signs or the appropriate healthcare provider for maternal complications. While 65.8% had sought emergency obstetric care (EmOC), 99.2% had gone to wrong facilities. Findings also revealed that educational attainment and understanding of antenatal and postnatal care emerged as the strongest predictor of maternal health knowledge, with women holding secondary and higher secondary certificates and a bachelor degree being over 46 times and 58 times more likely to be informed compared to those without formal education. Beyond individual education, government performance in delivering maternal healthcare services were also found significant influence. Women living in 'medium' performing area reported to have more than 8 times better knowledge compared to those in 'best' performing areas, suggesting possible disparities in service delivery data and awareness across contexts. Additionally, correct understanding of the purposes of antenatal and postnatal care was positively associated (AOR: 5.99) with maternal health knowledge, highlighting the importance of health education in promoting informed care-seeking behavior.

Keywords

Maternal Health, Danger Signs, Healthcare Providers, Mortality, Odds Ratio, Bangladesh.

1. Introduction

Maternal mortality and morbidity still remain a significant public health concern in Bangladesh. Despite claims of substantial progress in reducing maternal mortality over the past three decades, we observe a serious lack of authentic data on maternal mortality and morbidity, which complicates policy formulation and monitoring. The Bangladesh Maternal Mortality and Health Care Survey (NIPORT, 2016), the only the largest-scale and notionally representative source, reported that the maternal mortality ratio (MMR) has declined from 322 deaths per 100,000 live births in 2001 to 194 in 2010 and

196 in 2016. However, there are some other sources who present different estimates. For example, UN inter-agency figures suggest a decline from 523 in 2000 to 115 in 2023 (UNICEF et al., 2025), while the Government's Sample Vital Registration System (SVRS) reported 178 in 2016 and 136 in 2023. On the other hand, UN estimates indicated the ratio at 176 in 2015 and 123 in 2023. Interestingly, Bangladesh was using BMMS data from 1994 to 2015 but it shifted away from the 2016 round and started to use other alternative sources that reflected lower estimates refusing BMMS 2016 survey data, questioning its methodology and create an official narrative that BMSS understate the country's progress. Nonetheless, the current reduction confirms a downward trend that surpasses global averages (342 in 2000 and 211 in 2017 (World Health Organization, 2019) and reflects the impact of the interventions in maternal and neonatal health. However, despite such achievement, there are still far to go to reduce the systemic, social, and informational barriers that impedes to ensure an equitable access to maternal healthcare.

The factors affecting maternal mortality and morbidity in Bangladesh is attributed to both clinical and non-clinical issues. Clinically, postpartum and antepartum hemorrhage, eclampsia and pre-eclampsia, obstructed labor, and sepsis remain the leading causes of maternal death. On the other hand, the non-clinical dimensions also play a significant role to exacerbate the overall condition of preventable deaths and life-long complications that are linked to the "three delays" in care-seeking, decision-making, and reaching appropriate facilities (Thaddeus & Maine, 1994). These delays are often influenced by structural deficiencies in the health system, socio-cultural norms, and individual-level knowledge gaps. In Bangladesh particularly for women the underlying factors include the lack of autonomy, limited mobility, and poor awareness of maternal health risks including mistrust in public healthcare services, inadequate or non-functional referral systems, and reliance on unqualified private healthcare providers, compounding vulnerability.

Women's knowledge on danger signs of pregnancy is a critical non-clinical factor. On time recognition of signs and symptoms such as heavy bleeding, convulsions, extremely high blood pressure, high fever, blurred vision or prolonged labor can significantly improve the likelihood of seeking and receiving appropriate care starting within an hour or as early as possible. Unfortunately, evidence shows persistently low awareness: over 70% of rural women failed to identify even one key danger sign (Akther et al., 2021), and only 4% demonstrated sufficient awareness to act on early warning (Pervin et al., 2021). Similarly, underutilization of emergency obstetric care (EmOC) remains widespread, with many rural women with poor economic status continuing to give birth at home. (Ahsan et al., 2023). Factors such as fear of mistreatment, lack of female providers, and prior negative experiences further discourage institutional delivery. Alarming, less than 15% of rural women could correctly identify a qualified EmOC provider or facility (Haque et al., 2022).

Knowledge on antenatal care (ANC), postnatal care (PNC), and birth planning further influence outcomes. An effective birth plan includes selection a place of delivery, arranging emergency transport, saving money, and identifying blood donors-are directly linked to safe motherhood, yet less than one-third of rural women prepare birth plans, and less than half understand the purpose of ANC or PNC services (Pervin et al., 2021). Sociodemographic and structural factors also play a critical role. For instance, education of the woman and the decision-maker significantly predict health seeking behavior, while age and reproductive experience increase awareness of maternal health risks (Ahmed et al., 2023). Poverty further limits access to quality care, with poorer families often unable to act on health knowledge (Uddin et al., 2023).

Community trust in government performance is another emerging factor. A 2025 policy report showed that government health facilities accounted for only 6% of deliveries, substantially down from previous years (Daily Star, 2025), a decline attributed to chronic underutilization of maternal healthcare on account of bureaucratic delay, underfunding, poor staffing, and supply shortages that erode community confidence. Consequently, families increasingly turn to informal or private providers as they are available despite their unregulated or underqualified status. Besides, household decision-making patterns, often mediated by husbands, mothers-in-law or senior relatives, also critical. Educated husband doubled the likelihood of women seeking ANC and PNC (Jeong et al., 2023), while less-educated or conservative decision-makers were associated with delayed or avoidance of care.

While existing studies have investigated individual components such as ANC use, danger sign knowledge, or institutional delivery, and few have adopted a mixed -methods approach to capture the interconnections. This study addresses this gaps by combining quantitative analysis with qualitative insights to examine ten key factors including government performance in delivering maternal healthcare services, education, age, occupation, and income, and their association with three maternal health domains: women's knowledge of pregnancy danger signs, EmOC service-seeking behavior and awareness of appropriate healthcare providers or centers, and knowledge, attitudes, and practices toward ANC, PNC, and birth planning. Through surveys and key informant interviews (KIIs), the research aims to provide a nuanced, context-specific understanding of the behavioral and structural drivers that influence maternal health outcomes in Bangladesh.

2. Literature Review

Maternal mortality and morbidity remain critical public health issues in Bangladesh, importantly due to inadequate access to appropriate healthcare providers or facilities and very limited knowledge of maternal health risks (NIPORT, 2022). Although, it is claimed that significant interventions have been made in decreasing maternal deaths and complications, persistent inequities in providing appropriate services, healthcare awareness, and health-seeking behavior still remain. Recent researches show that efforts made through integrated maternal and neonatal health (MNH) interventions have demonstrably reduced wealth-driven inequities in maternal health service utilization, yet national data reveal that improvement in coverage have not translated into better quality as facility-based care is alarmingly very low (Uddin et al., 2023). These mixed patterns underscore the need for examining both clinical and non-clinical factors of maternal health outcomes, while the following review addresses under four thematic sub-sections.

2.1. Knowledge of Danger Signs

In Bangladesh women frequently have limited knowledge on danger signs of pregnancy which is a key factor contributing to maternal morbidity and mortality (Akther et al., 2021). A 2021 cross-sectional survey revealed that approximately 70% of respondents could not mention any danger signs of pregnancy. However, opposite situation was observed among those with more educated or with previous facility births. In the similar area another study found that only 4% women could recognize danger signs even among those with higher formal education (World Health Organization, 2019). Therefore, it is assumed that formal schooling alone does not necessarily lead to functional maternal health literacy. Limited or without recognition of danger signs not only delays timely care-seeking but also shapes how women perceive and engage with emergency obstetric services.

2.2. Access to and Use of EmOC

Knowledge of appropriate healthcare providers and the ability to utilize them in emergencies are critical to reducing the second delay (Thaddeus & Maine, 1994). However, women often rely on unqualified providers due to cultural norms or lack of accurate information. In a study, correct knowledge of skilled EmOC providers was strongly associated with prior facility delivery ($p < 0.001$), underscoring the role of practical exposure and community trust (Amadi et al., 2022). As a result, despite the claimed development in the healthcare system in Bangladesh, reliance on traditional providers continues to undermine maternal outcomes (Jamee, 2022).

Besides, birth Plan is a crucial behavioral factor of maternal health outcomes. Pervin et al. (2021) found that only ~30% of rural women have birth plan (e.g., identifying delivery location, transport, emergency funds, and blood donors), compared to ~34% among urban women ($p < 0.001$). Knowledge of birth plan significantly correlated with ANC attendance and birth in facilities. Similarly, Khatun et al. (2023) reported that women who recognized ANC/PNC purposes were twice as likely to complete four or more ANC visits ($aOR \approx 2.1$, 95% CI: 1.3–3.4). However, only about 50% of surveyed women accurately identified ANC/PNC services and purposes of birth planning. Yet, the ability to utilize EmOC services is further conditioned by broader sociodemographic determinants, which strongly influence health knowledge and decision-making (Afroja, 2022).

2.3. Sociodemographic Predictors

Key demographic predictors such as education, age, income, occupation, and household decision-maker characteristics were also found to be consistently associated with maternal health knowledge and behaviors (Khan et al., 2023). These factors influence both cognitive awareness and access to maternal healthcare providers/centers. Multiple studies report a positive association between formal female education and maternal health service utilization; however, findings also suggest that education alone is not sufficient rather specific health education is of better useful in bridging between knowledge and behavior gaps (World Bank, 2022).

Age and parity also influence maternal health behavior, with middle-aged women (36–49 years) more likely to demonstrate awareness and correctly identify healthcare providers and centers, likely due to accumulated previous reproductive experience and exposure to health services (Ahmed et al., 2023). On the other hand, the influence of economic status of the family and occupation of family members is more mixed as some studies show that women from poorer households face significant barriers in accessing maternal care (Uddin et al., 2023; NIPORT, 2020).

Additionally, Family decision-making power plays a vital role in maternal health outcomes. For instance, a baseline survey revealed that women with educated husbands were twice as likely to utilize ANC and PNC services, whereas those

living in families with older, less-educated decision-makers experienced reduced maternal healthcare engagement (Jeong et al., 2023). These individual and household-level characteristics intersect with systemic determinants, specifically people's trust in healthcare providers and institutions to shape maternal health outcomes.

2.4. Trust in Healthcare Systems

Trust in government performance has also emerged as a significant determinant of healthcare-seeking behavior. Because it is evident that in 2025, public health facilities accounted for only 6% of deliveries which is substantially declined compare to the previous years due to manpower shortages, inadequate infrastructure and equipment, ruthless behavior of hospital staffs and ultimately create mistrust among community that leading to increased reliance on familiar informal or private providers such as clinics, chambers, and private hospitals (Daily Star, 2025; Akter et al., 2022).

2.5. Knowledge Gaps

Most studies treat maternal health components in isolation. While the three-delay model continues to guide research, there is limited investigation into how perception of government performance or family decision-making interacts with knowledge and behavior domains. Our study addresses these gaps by simultaneously assessing ten predictors including perception of government performance in maternal healthcare services, education of women and family's decision-maker, age, occupation, economic status and their associations with three maternal health domains: women's knowledge of pregnancy danger signs, EmOC service-seeking behavior and awareness of appropriate healthcare providers or centers, and knowledge, attitudes, and practices toward ANC, PNC, and birth planning. The integration of survey and KII data will enable a comprehensive understanding of both underlying factors and ongoing lived experience that may be useful to develop culturally appropriate programs.

3. Methodology

This study employed a mixed-methods cross-sectional design to examine the factors influencing women's maternal health knowledge and seeking behavior in Bangladesh. The primary aim was to assess how sociodemographic and structural factors affect knowledge of pregnancy danger signs, EmOC seeking behavior, awareness of appropriate healthcare providers or centers, and knowledge, attitudes, and practices (KAP) related to ANC, PNC, and birth planning. Based on the low, medium, and high performing scores for maternity care, mortality ratio i.e., the districts where maternal mortality is high, medium, and low were selected. Population includes the total households of 3 selected villages of cold spot, medium, and hotspot areas. Respondents group were the women in reproductive age (15-49), caregivers for household survey. The following formula is used for sample size determination.

$$\frac{Z^2 * p (1-p)}{e^2}$$

$$\frac{(1.96)^2 \times 0.196 (1 - 0.196)}{(0.10)^2}$$

$$=60.53$$

Using design effect 1.9, the estimated sample size becomes 115~120.

Where, n= Sample size

Z= 1.96 at 95% Confidence level

p = Prevalence rate = MMR 196/1,00,000 live birth (BMMS, 2016) = 0.196

e = margin of error = 10% = 0.10

The following steps was followed and the target sampled households (120) were interviewed with semi-structured questionnaire.

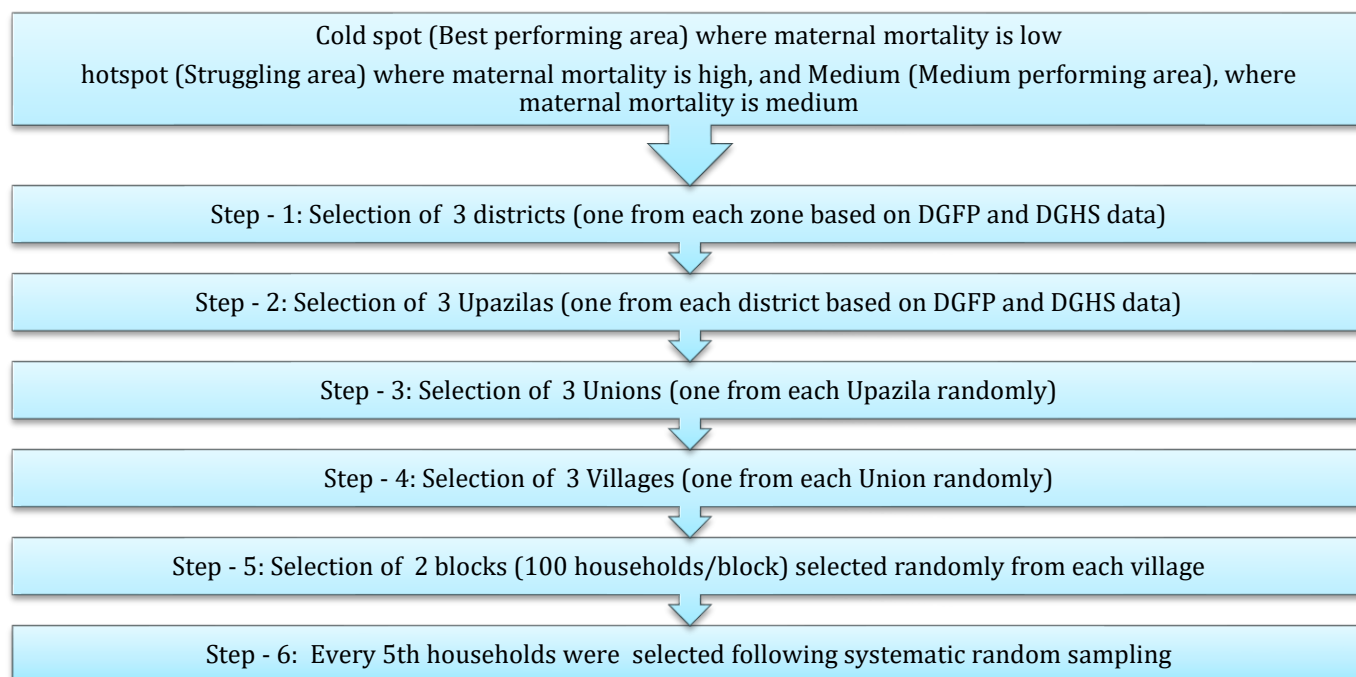


Figure 1: Steps for Household Selection for Questionnaire Survey

Study participants i.e., 120 rural women of reproductive age (15–49 years) and their caregivers from three villages in a rural subdistrict were reached through multistage systematic random sampling. Additionally, 12 Key Informant Interviews (KIIs) were conducted with community health workers (n=3), community leaders (n=3), and women with maternal care experience (n=6) to contextualize survey findings. Survey data were collected using a pre-coded semi-structured questionnaire which was initially developed in Bengali and pretested for clarity and cultural appropriateness. It included sections on background characteristics (age, education, occupation, income, decision-maker education), knowledge of maternal danger signs, health-seeking practices, and perceptions of government healthcare services. Qualitative data were gathered using interview guide, covering barriers to maternal care, service trust, and household decision-making dynamics. In this study, the main outcome variables were: (1) knowledge of pregnancy danger signs, (2) EmOC-seeking behavior and awareness of appropriate healthcare providers or centers, and (3) KAP related to ANC, PNC, and birth preparedness. Key factors included perception of government performance in maternal healthcare services, education of women and family's decision-maker, age, education of respondents and household decision-maker, prior service use, and birth plan knowledge.

Quantitative data were analyzed using SPSS (v27). Descriptive statistics (frequencies, percentages, standard deviation and variances) were used followed by cross-tabulations and Chi-square tests to examine bivariate associations. Binary logistic regression was used to calculate Unadjusted Odds Ratios (UORs) and Adjusted Odds Ratios (AORs) with 95% confidence intervals to identify significant factors/predictors. We considered a significance level of $p < 0.05$ in this analysis. On the other hand, qualitative data were analyzed thematically through manual coding. Transcripts were reviewed to identify patterns related to health system access, trust on healthcare, and decision-making norms. Select quotations were used to enrich and explain quantitative trends. This mixed-methods approach enabled a deeper understanding of which and to what extent the social, structural, and behavioral factors influence maternal health outcomes in Bangladesh.

Ethical approval was obtained from the Institute of Bangladesh Studies, University of Rajshahi. Informed consent was collected from every participant. In addition to that we ensured confidentiality and voluntary participation of study participants.

4. Results

Table 1 shows equal number of participants selected for interviews from three areas where government performance in delivering maternal healthcare service was best, medium and poor/struggling. Age distribution was skewed toward younger women of reproductive age. Education indicated sharp contrasts which underscoring the persistent influence of limited educational attainment on maternal health decisions. Occupation patterns highlight traditional roles as the vast majority (81.7%) were housewives-revealing a disconnect between educational attainment and labor force participation.

Notably, the overwhelming majority (92.5%) perceived themselves as middle class with a very few identifying as poor, an anomaly that may obscure underlying income disparities. Variance was found greatest in education, suggesting more heterogeneity in schooling levels than in age, occupation, or family economic condition.

Table 1: Socio-Demographic Characteristics of the Respondents

Characteristics	No. of observation (n)	Percentage (%)	S.D.	Variance
Govt. performance level in MHCS				
Best	40	33.3	0.82	0.672
Medium	40	33.3		
Struggling	40	33.3		
Age of respondent				
13-35 years	57	47.5	0.74	0.551
36-49 years	43	35.8		
50 years/above	20	16.7		
Education level of respondent				
No Education	22	18.3	1.46	2.13
Primary	16	13.3		
SSC-HSC	52	43.3		
Bachelor/Degree/above	30	25		
Education level of decision maker				
No Education	33	27.5	1.56	2.442
Primary	19	15.8		
SSC-HSC	44	36.7		
Bachelor/Degree/above	24	20		
Occupation of respondent				
Services	9	7.5	0.43	0.184
Housewife	98	81.7		
Students/unemployed	13	10.8		
Family's economic condition				
Middle Class	111	92.5	0.26	0.07
Poor	9	7.5		

Source: (Sample Survey, 2024)

*MHCS: Maternal Health Care Services

Findings reveal critical knowledge gaps in maternal health. Table 2 shows that almost all women (96%) lacked knowledge of pregnancy danger signs and appropriate healthcare providers or facilities for EmOC services, while only 13% knew availability of the maternal healthcare providers/facilities in their area. Although two-thirds sought EmOC, nearly all went to the wrong providers (99%), reflecting systemic failure in referral and information/guidance. Knowledge of birth planning shows relatively higher, but recognition of ANC/PNC necessity was too low (8%). Awareness of ANC/PNC purposes was equal, indicating substantial heterogeneity and a persistent disconnect between care-seeking and knowledge/awareness in maternal healthcare information. These results align with the Three Delay Model and the KAP Framework, where informational deficits and structural barriers jointly impede timely and appropriate maternal healthcare.

Table 2: Awareness of Respondents on Danger Signs of Pregnancy and Healthcare Providers

Characteristics	No. of observation (n)	Percentage (%)	S.D.	Variance
Knowledge on danger signs in pregnancy				
No	115	95.8	0.2	0.04
Yes	5	4.2		
Knowledge on appropriate Healthcare Provider (HCP) /Healthcare Center (HCC) for treatment of danger signs				
No	114	95	0.22	0.048
Yes	6	5		
Knowledge on maternal healthcare providers in their area				
No	104	86.7	0.34	0.116
Yes	16	13.3		

Visited HCP/HCC for EmOC				
No	41	34.2	0.48	0.227
Yes	79	65.8		
Took mother to appropriate HCP				
Yes, but wrong HCP/HCC	119	99.2	0.09	0.008
Yes, to appropriate HCP/HCC	1	0.8		
Know purposes of Birth Plan				
No	17	14.2	0.35	0.123
Yes	103	85.8		
Necessity of ANC/PNC				
No	110	91.7	0.28	0.077
Yes	10	8.3		
Know purposes of ANC/PNC				
No	60	50	0.5	0.252
Yes	60	50		

Source: (Sample Survey, 2024)

The bivariate analysis presented in Table 3 identifies a few significant predictors of maternal health knowledge. Women residing 'medium' performing area significantly more likely to demonstrate knowledge than those from 'best' or 'struggling' area, an unexpected non-linear pattern. This non-linear pattern may reflect variations in reporting practices rather than genuine differences in government healthcare performance. During conducting a KII with a frontline health worker, he reported, "A few months ago, a mother died in my neighborhood. I had advised the family decision-maker, the mother-in-law, to take her to the nearest Union Health and Family Welfare Center. However, the mother-in-law, who was herself a traditional birth attendant, refused. After several hours of delay, the mother passed away. I did not record this death in the MIS, as my district supervisor takes every maternal death very seriously and I feared of avoidable punishment." This statements clearly indicate that 'best' performing areas may face greater administrative pressure to maintain favorable statistics, which can encourage underreporting of maternal deaths and mask ongoing service gaps. This discrepancy also highlights how performance classifications may not always reflect lived realities of service coverage, care access and awareness.

Respondent education also showed a robust association ($p=.004$), where women with no formal education reported the highest awareness-a counterintuitive anomaly that may reflect reliance of experiential knowledge over formal education and/or formal education does not add value to develop maternal healthcare awareness in Bangladesh. Similarly, awareness of ANC/PNC purposes was significantly associated with knowledge ($p=.022$), while awareness of birth plan also highly predictive ($p < .001$). Other variables, including age and occupation of respondent, economic condition of family, prior maternal healthcare-seeking behavior, and education level of decision-maker in the family, were not statistically significant which suggest that knowledge gaps are driven more by perception, targeted awareness and specific informational exposure than by broad sociodemographic determinants.

Table 3: Knowledge on Danger Signs in Pregnancy

Predictor Variable	Yes: n (%)	No: n (%)	χ^2	df	p-value	Sig.?
Govt. performance level in MHCS						
Best	0 (0.0)	40 (100)	10.435	2	.005	Yes
Medium	5 (12.5)	35 (87.5)				
Struggling	0 (0.0)	40 (100)				
Respondent age						
13-35 yrs	2 (3.5)	55 (96.5)	0.122	2	.941	No
36-49 yrs	2 (4.7)	41 (95.3)				
50+ yrs	1 (5.0)	19 (95.0)				
Education of respondent						
No Education	4 (18.2)	18 (81.8)	13.478	3	.004	Yes
Primary	0 (0.0)	16 (100)				
SSC-HSC	1 (1.9)	51 (98.1)				
Bachelor+	0 (0.0)	30 (100)				
Family's decision maker's education						
No Education	4 (12.1)	29 (87.9)	7.494	3	.058	No

Primary	0 (0.0)	19 (100)				
SSC-HSC	1 (2.3)	43 (97.7)				
Bachelor+	0 (0.0)	24 (100)				
Occupation of respondent						
Services	0 (0.0)	9 (100)	1.171	2	.557	No
Housewife	5 (5.1)	93 (94.9)				
Student/Unemployed	0 (0.0)	13 (100)				
Economic condition						
Middle Class	4 (3.6)	107 (96.4)	1.175	1	.278	No
Poor	1 (11.1)	8 (88.9)				
Ever gone to HCP/HCC for EmOC						
No	1 (2.4)	40 (97.6)	0.466	1	.495	No
Yes	4 (5.1)	75 (94.9)				
Took mother to appropriate HCP						
Yes, but wrong HCP/HCC	5 (4.2)	114 (95.8)	0.044	1	.834	No
Yes, to appropriate HCP/HCC	0 (0.0)	1 (100)				
Knows purpose of Birth Plan						
No	4 (23.5)	13 (76.5)	18.596	1	.000	Yes
Yes	1 (1.0)	102 (99.0)				
Do you feel any necessary of ANC and PNC in pregnancy?						
No	5 (4.5)	105 (95.5)	.474	1	.491	No
Yes	0 (0.0)	10 (100)				
Do you know what the purposes of ANC and PNC are?						
No	5 (8.3)	55 (91.7)	5.217	1	.022	Yes
Yes	0 (0.0)	60 (100)				

Source: (Sample Survey, 2024)

Table 4 presents bivariate associations between respondent characteristics (socioeconomic and knowledge and practice towards maternal healthcare issues) and their knowledge of the appropriate healthcare provider (HCP) for treating pregnancy danger signs. A statistically significant association was observed with respondent age ($p = .043$), where the highest awareness was found among women aged 36–49 years compared to younger women (13–35 years), suggesting middle-aged women, likely to have recent reproductive experience, may have more exposure to maternal health messaging. A few women who took mothers to the appropriate healthcare providers had markedly higher knowledge, underscoring the value of accurate referrals and prior exposure to skilled services. Similarly, knowledge of birth planning purposes was significantly associated with awareness ($p = .010$), indicating that practical preparedness reinforces maternal health literacy. In contrast, education, economic condition, occupation, previous use of EmOC services, and perceptions of antenatal and postnatal care, did not demonstrate statistically significant associations. This points to the persistence of knowledge gaps even among more educated or economically advanced groups. These findings emphasize the role of experiential and behavioral factors over structural predictors.

Table 4: Knowledge on Appropriate Healthcare Provider for Treatment in Danger Signs

Predictor Variable	Yes: n (%)	No: n (%)	χ^2	df	p-value	Sig.?
Govt. performance level in MHCS						
Best	2 (5.0)	38 (95.0)	1.053	2	.591	No
Medium	3 (7.5)	37 (92.5)				
Struggling	1 (2.5)	39 (97.5)				
Respondent age						
13–35 yrs	1 (1.8)	56 (98.2)	6.293	2	.043	Yes
36–49 yrs	5 (11.6)	38 (88.4)				
50+ yrs	0 (0.0)	20 (100)				
Education of respondent						
No Education	1 (4.5)	21 (95.5)	3.548	3	.315	No
Primary	2 (12.5)	14 (87.5)				
SSC-HSC	3 (5.8)	49 (94.2)				

Bachelor+	0 (0.0)	30 (100)				
Family's decision maker's education						
No Education	1 (3.0)	32 (97.0)	1.545	3	.672	No
Primary	2 (10.5)	17 (89.5)				
SSC-HSC	2 (4.5)	42 (95.5)				
Bachelor+	1 (4.2)	23 (95.8)				
Occupation of respondent						
Services	0 (0.0)	9 (100)	0.674	2	.714	No
Housewife	5 (5.1)	93 (94.9)				
Student/Unemployed	1 (7.7)	12 (92.3)				
Economic condition						
Middle Class	5 (4.5)	106 (95.5)	0.765	1	.382	No
Poor	1 (11.1)	8 (88.9)				
Ever gone to HCP for EmOC						
No	2 (4.9)	39 (95.1)	0.002	1	.965	No
Yes	4 (5.1)	75 (94.9)				
Took mother to appropriate HCP						
Yes, but wrong HCP/HCC	5 (4.2)	114 (95.8)	19.160	1	.000	Yes
Yes, to appropriate HCP/HCC	1 (100)	0 (0.0)				
Knows purpose of Birth Plan						
No	3 (17.6)	14 (82.4)	6.669	1	.010	Yes
Yes	3 (2.9)	100 (97.1)				
Perceives ANC/PNC as necessary						
No	6 (5.5)	104 (94.5)	0.574	1	.449	No
Yes	0 (0.0)	10 (100)				
Knows purpose of ANC/PNC						
No	5 (8.3)	55 (91.7)	2.807	1	.094	No
Yes	1 (1.7)	58 (98.3)				

Source: (Sample Survey, 2024)

The analysis identifies government performance and prior EmOC use were significant predictors of awareness of local maternal healthcare providers. Findings from Table 5 indicate that women from 'medium' performing areas were more likely to demonstrate awareness compared to those in 'best', or 'struggling' areas ($p = .003$), suggesting possible differences in reporting practices for maternal mortality data. Similarly, previous contact with healthcare providers for EmOC was positively associated with knowledge ($p=.010$), indicating the role of direct service exposure in enhancing maternal health literacy. By Contrast, age, respondent and decision-maker education, occupation, economic condition of family, and knowledge of birth plans and ANC/PNC - did not yield statistically significant associations. Interestingly, while education is often considered a strong determinant, no clear gradient was observed across schooling levels, pointing to persistent gaps in functional maternal health literacy. These findings highlight the importance of experiential and contextual factors over structural characteristics in shaping maternal health knowledge in Bangladesh.

Table 5: Awareness of Availability of Local Maternal Healthcare Providers

Predictor Variable	Yes: n (%)	No: n (%)	χ^2	df	p-value	Sig.?
Govt. performance level in MHCS						
Best	4 (10.0)	36 (90.0)	11.394	2	.003	Yes
Medium	11 (27.5)	29 (72.5)				
Struggling	1 (2.5)	39 (97.5)				
Respondent age						
13-35 yrs	6 (10.5)	51 (89.5)	1.172	2	.556	No
36-49 yrs	6 (14.0)	37 (86.0)				
50+ yrs	4 (20.0)	16 (80.0)				
Education of respondent						
No Education	2 (9.1)	20 (90.9)	0.750	3	.861	No
Primary	3 (18.8)	13 (81.2)				
SSC-HSC	7 (13.5)	45 (86.5)				

Bachelor+	4 (13.3)	26 (86.7)				
Family's decision maker's education						
No Education	4 (12.1)	29 (87.9)	0.406	3	.939	No
Primary	2 (10.5)	17 (89.5)				
SSC-HSC	6 (13.6)	38 (86.4)				
Bachelor+	4 (16.7)	20 (83.3)				
Occupation of respondent						
Services	3 (33.3)	6 (66.7)	3.540	2	.170	No
Housewife	11 (11.2)	87 (88.8)				
Student/Unemployed	2 (15.4)	11 (84.6)				
Economic condition						
Middle Class	14 (12.6)	97 (87.4)	0.665	1	.415	No
Poor	2 (22.2)	7 (77.8)				
Ever gone to HCP for EmOC						
No	10 (24.4)	31 (75.6)	6.589	1	.010	Yes
Yes	6 (7.6)	73 (92.4)				
Took mother to appropriate HCP						
Yes, but wrong HCP/HCC	16 (13.4)	103 (86.6)	0.155	1	.694	No
Yes, to appropriate HCP/HCC	0 (0.0)	1 (100)				
Knows purpose of Birth Plan						
No	3 (17.6)	14 (82.4)	.319	1	.572	No
Yes	13 (12.6)	90 (87.4)				
Perceives ANC/PNC as necessary						
No	13 (11.8)	97 (88.2)	2.622	1	.105	No
Yes	3 (30.0)	7 (70.0)				
Knows purpose of ANC/PNC						
No	11 (18.3)	49 (81.7)	2.596	1	.107	No
Yes	5 (8.3)	55 (91.7)				

Source: (Sample Survey, 2024)

The regression analysis revealed respondent education as the strongest predictor of maternal health knowledge about pregnancy danger signs, planning for childbirth, and appropriate healthcare-seeking behavior and practices. Compared with women with no formal education, those with SSC/HSC (AOR = 46.05, $p = .015$) and bachelor's or higher degrees (AOR = 58.25, $p = 0.020$) were substantially more likely to demonstrate adequate knowledge which underscoring the transformative effect of advanced schooling. Even primary education showed improvement as well (AOR = 27.14, $p = .060$), though with a weaker statistical significance or borderline significant. Similarly, women in 'medium' performing areas showed greater awareness than those in the 'struggling' or 'best' performing areas (AOR = 5.99, $p = .038$), highlighting the role of health and family planning intervention in shaping the informed behaviors. By contrast, age, decision-maker education, occupation, economic condition of family, and prior exposure to EmOC services did not yield statistically significant associations. These results suggest that individual level knowledge and perception matter more than structural or demographic variables in shaping maternal health knowledge in Bangladesh. These insights also highlight the importance of investing in health education and building trust in public health systems to improve maternal and reproductive health knowledge in the community.

Table 6: Factors Associated with KAP towards Danger Signs and Necessary Maternal Health Issues

Factors	Unadjusted Model			Adjusted Model		
	UOR	95% CI	p-value	AOR	95% CI	p-value
Govt. performance level in MHCS						
Best			Ref.			Ref.
Medium	15.54	3.29–73.42	0.001	8.72	1.24–61.56	0.030
Struggling	3.35	0.63–17.74	0.155	4.79	0.66–34.82	0.121
Age of respondent						
13–35			Ref.			Ref.
36–49	0.49	0.14–1.72	0.266	0.49	0.05–3.33	0.400
50/above	1.30	0.39–4.33	0.669	0.79	0.13–4.95	0.800
Education level of respondent						

No education			Ref.			Ref.
Primary	3.03	0.76–12.10	0.116	27.14	0.87–851.62	0.060
SSC-HSC	1.74	0.50–6.06	0.381	46.05	2.13–997.61	0.015
Bachelor/above	2.17	0.46–10.16	0.327	58.25	1.88–1808.09	0.020
Education of HH decision maker						
No education			Ref.			Ref.
Primary	1.43	0.41–4.96	0.578	0.35	0.03–4.54	0.423
SSC-HSC	0.71	0.15–3.45	0.674	0.17	0.01–2.62	0.205
Bachelor/above	0.98	0.29–3.34	0.971	0.15	0.01–1.79	0.134
Occupation of respondent						
Services			Ref.			Ref.
Housewife	0.86	0.22–3.40	0.824	0.50	0.05–4.58	0.539
Student/Unemployed	1.67	0.25–11.07	0.597	8.43	0.35–202.59	0.189
Economic condition of family						
Middle			Ref.			Ref.
Poor	0.31	0.08–1.25	0.099	0.31	0.08–1.25	0.099
Visit to HCP for EmOC						
No			Ref.			Ref.
Yes	2.36	0.97–5.72	0.058	2.34	0.65–8.46	0.196
Took mother to appropriate HCP						
No			Ref.			Ref.
Yes		0.00 -.	1		0.00 -.	1
Knowledge of Birth Plan						
No			Ref.			Ref.
Yes	5.69	1.92–16.85	0.002	2.65	0.51–13.71	0.245
Feel necessity of ANC/PNC						
No			Ref.			Ref.
Yes	0.62	0.15–2.57	0.507	0.16	0.01–1.67	0.125
Knowledge of ANC/PNC purpose						
No			Ref.			Ref.
Yes	4.50	1.66–12.23	0.003	5.99	1.10–32.57	0.038

Source: (Sample Survey, 2024)

5. Discussion

This study reveals complex and intersecting factors influencing maternal health knowledge among women of reproductive age, particularly regarding awareness of pregnancy danger signs and appropriate healthcare providers. Despite many participants were young and had formal education, critical gaps in their health knowledge and decision-making still exist and these findings are similar to what other studies have found in Bangladesh. The analysis also showed that women's knowledge about pregnancy danger signs was significantly linked to how government is performing in providing maternal healthcare services, their education level, and their understanding of why antenatal and postnatal care (ANC/PNC), birth planning are important.

Although many women in the study had formal education, over 80% were housewives, showing that traditional gender roles still limit women's involvement in work and decision-making. This was echoed by a woman from the community who said, *"I face many health problems during pregnancy, but I can't tell my husband. If he finds out that I have health problem or unwell, he might see it as a reason to second marriage. Basically, my mother-in-law decides when to seek care, often very late. Before that, she calls local faith healer, traditional birth attendant or medicine sellers."* Similar findings in Bangladesh and South Asia show that education alone does not always help to increase women's power unless it comes with broader social support and empowerment (Story et al., 2012). Other findings show that most of the study participants mentioned their family's economic status as 'middle class' with a very little difference in economic status, which may reflect that how people see their own financial situation rather than actual income levels. However, education is often used as a factor of health awareness according to our results and those of earlier studies (Koblinsky et al., 2010). It is also suggested that having formal education does not always mean people understand key maternal health issues. Our results also identified that even women with bachelor's degrees and above, struggled to name danger signs in pregnancy or the right places to seek care. This shows the need for practical, locally relevant health education that connects with people's daily lives and is supported by both communities and health systems. While education showed no significant association

with maternal health knowledge in the bivariate analysis, the multivariate model demonstrated a strong independent effect. This suggests that the influence of education may be confounded by other factors such as healthcare access and service perceptions (Ferdos & Islam, 2022). Once these are controlled for, education emerges as a key determinant, indicating its underlying role in shaping maternal health literacy (Kilfoyle et al., 2016).

One of the most critical findings in this study is that 95% of women could not identify the danger signs of pregnancy and childbirth or the appropriate facility for maternal emergencies. These findings echo existing research findings conducted in rural Bangladesh (Anwar et al., 2015) and urban slums. Another serious concern identified in this study which is 65.8% of respondents reported that they have visited healthcare facilities/centers or providers for EmOC. But nearly all (99.2%) had gone to inappropriate facilities/providers. This is really pointing to a serious misalignment between care-seeking behavior and health literacy. Besides, this is a complete failure of community level MNH and FP services provisions. It is evident that health messages need to be clear, targeted, and delivered in a way that fits the cultural context, community driven. Our findings also revealed that women who were able to identify and visit the correct healthcare providers in their life were more likely to recognize danger signs during pregnancy. This shows that practical experience is often more effective than classroom learning alone (Lincetto et al., 2020).

Although most of the respondents (85.8%) claimed that they are aware of birth plans, surprisingly only 8.3% of the respondents perceived ANC/PNC services are necessary during and after pregnancy. The findings indicate a low as well as inconsistent understanding of maternal health among women in Bangladesh, which has also been found in other studies (Ahmed et al., 2023). It was a core duty of community health workers to aware couple and pregnant mother about the basic information on maternal healthcare. However, reality depicts another picture which is supported by a quotation of a local representative: *"Field-level health workers rarely visit households, which limits the dissemination of basic information on maternal healthcare, service utilization, ANC/PNC and birth planning particularly among rural women"*. This finding also supports newer evidence that trust in maternal healthcare systems and positive past experiences with healthcare services can strongly influence what people know about maternal health (Shimamoto & Gipson, 2017; Bowser & Hill, 2020).

Age was another important factor. Women aged 36–49 had better knowledge about healthcare providers, likely because of their life experience and repeated exposure to pregnancy-related situations. This is similar to findings in recent studies showing that older women often have more practical maternal health knowledge (Bintabara et al., 2021). Still, when all the factors were analyzed together in a multivariable model, none remained statistically significant. This is consistent with newer research that shows individual factors like age or education are often less important than bigger social issues such as gender inequality, weak health systems, and poor access to reliable information (Say et al., 2014).

Surprisingly, using EmOC services in the past did not consistently predict better knowledge. In fact, some women who never used EmOC services were more informed about what was available. This might reflect negative experiences with care that reduce trust in the system and discourage people from seeking more information. Other studies also show that the quality and responsiveness of health services play a big role in whether people stay engaged with care (Kruk et al., 2018; Leslie et al., 2021).

The weak or inconsistent results in some of the statistical models may be due to the small number of positive cases in some areas, which is a common problem in community-based studies. Wide confidence intervals and unstable factors such as education, occupation, or income also suggest that formal demographic traits may not fully explain how women learn about maternal healthcare (Nzinga et al., 2019). In addition to that knowledge about birth planning showed a strong link to other positive maternal health factors in the unadjusted models. From this finding it can be concluded that birth preparedness can help develop general awareness in women and encourage them for better health practices (Souza et al., 2020). However, this connection disappeared when other variables are added in the model. This means that simply promoting birth plans isn't enough. Programs must also address larger social and structural barriers such as corruption, poverty, lack of transport, qualified manpower, logistic or poor quality of care if Bangladesh want to make a real difference.

The findings of this study reaffirm the importance of context-driven maternal health education in Bangladesh that moves beyond traditional demographic targeting. Women's maternal health knowledge is more influenced by experience, perception, and exposure than by age, income, or education alone. Integrated interventions such as community health worker programs, culturally appropriate health education into both community platforms and formal schooling. Expanding the capacity and accountability of frontline health and family planning workers is also critical to ensure reliable, household-level dissemination of information, while also addressing systemic barriers such as poor service quality, referral failures, and weak trust in public facilities. It is also necessary to build trust through improved responsiveness, respectful care, culturally appropriate communication, and community-driven engagement can help minimize the persistent gap between women's knowledge and their actual care-seeking behaviors and practices. Together, these measures point to the urgency

of linking education, service quality, and community empowerment to achieve meaningful reductions in maternal mortality and morbidity in Bangladesh.

6. Conclusions

This study highlights significant gaps in maternal health knowledge among women of reproductive age, despite relatively high levels of formal education and reported healthcare utilization. The findings also reveal a persistent disconnection between knowledge and action, with most respondents unable to identify pregnancy danger signs or appropriate healthcare providers/facilities, even after seeking care. Structural barriers such as gendered decision-making, limited workforce participation, and lack of autonomy of women further compound these knowledge deficits. Importantly, traditional sociodemographic factors like education, age, and income did not consistently predict maternal health awareness. Rather, practical exposure, prior correct referral behavior, and government performance in providing maternal healthcare service emerged as more influential. This suggests that experiential learning and institutional trust are stronger determinants of actionable health knowledge than formal schooling alone.

6.1. Theoretical Implications

The findings cover several established frameworks by revealing the integrated role of informational and structural barriers. Initially, the Three Delay Model remains relevant, as knowledge deficits and referral failures are found key determinants to delayed decisions and access to appropriate care. Besides, the Andersen's Behavioral Model is also reinforced by the findings, showing how predisposing (education, age), enabling (government performance), and experiential (prior referrals) factors shape health literacy among the rural women in reproductive age. Then the Knowledge–Attitude–Practice framework is expanded by evidence that behavior-focused education is more impactful than formal schooling alone. In addition, the Social Ecological Model as well underscores the interplay of individual knowledge and awareness, family decision-making, and systemic performance.

6.2. Practical Implications

To reduce maternal mortality and morbidity, interventions should prioritize culturally relevant and behavior-focused health education through integrated health communication strategies that includes both women and family decision-makers. It is important to strengthening community trust in government health services by ensuring responsive and respectful service delivery, alongside accountability for quality gaps. Prioritize and emphasis on expanding the capacity of frontline health workers to provide household-level information and reliable referral pathways to reduce misdirected care-seeking. Moreover, community-driven and experiential interventions should be mainstreamed into maternal health programs to reduce the gaps between knowledge and practice.

6.3. Limitations

This study is limited by a relatively small sample size ($n=160$) and purposive selection of rural sites, which restrict generalizability. Besides, reliance on self-reported knowledge and practices at times may introduce recall or social desirability bias. Additionally, the cross-sectional design often limits causal inference, while potential underreporting of maternal deaths in “best performing” areas may distort comparisons with medium and poor performing areas.

6.4. Future Research

Future research can use larger and more diverse samples and examine the effectiveness of culturally relevant, interactive, and behavior-focused health education methods perform in Bangladesh. Longitudinal research can capture the evolution of maternal health knowledge among rural women through repeated exposure to healthcare services.

Declarations

Author Contributions

Conceptualization: Mohammed Misbah Uddin, Md Ashraful Islam Khan, Mahjabin Mim. **Data processing:** Mohammed Misbah Uddin, Mahjabin Mim. **Analysis:** Mohammed Misbah Uddin, Md Ashraful Islam Khan, Mahjabin Mim. **Supervision:** Mohammed Misbah Uddin. **Writing-original draft:** Mohammed Misbah Uddin, Mahjabin Mim. **Writing, Review and Edit:** Mohammed Misbah Uddin, Md Ashraful Islam Khan, Mahjabin Mim.

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Conflict of Interest

There is no conflict of interest as this research was conducted without any commercial or financial relationships.

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