A multilevel assessment of the influence of education on women's uptake of institutional delivery services during childbirth in Bangladesh

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ABSTRACT

Objectives: Despite a significant decline over time, maternal mortality remains high in Bangladesh. Institutional delivery during childbirth is crucial to reducing maternal mortality, but uptake of institutional delivery services (IDS) remains suboptimal in Bangladesh. Though women's education plays a crucial role in the use of IDS, the educational status of the household head and area-level literacy rate also appear to act as predictors of IDS uptake. This study aims to assess the effect of the educational status of women and household heads as well as district-level adult literacy rates on the use of IDS during childbirth among women in Bangladesh.

Design: This study analyzed nationally representative cross-sectional survey data from the 2019 Bangladesh Multiple Indicator Cluster Survey.

Setting: Bangladesh.

Participants: 9,207 currently married women aged 15-49 years who had at least one live birth in the two years preceding the survey were included in the study. The outcome measure was women's use of IDS during their last childbirth. A multilevel logistic regression model was used to explore the association between education status of women and household heads, and district (i.e., area unit) adult literacy rates and uptake of IDS among women in Bangladesh by controlling for other sociodemographic covariates and clustering.

Results: About 53% of women used IDS during childbirth. Adjusting for other factors and clustering, women with higher educational status, those living in households with higher-educated heads, and those in districts with greater adult literacy rates are more likely to use IDS, after controlling for key sociodemographic variables including wealth.

Conclusions: Uptake of IDS in Bangladesh remains low, with education playing an important independent role in determining rates. The findings of the study provide empirical evidence for policymakers to design multi-modal educational programs targeted not only at literate women but also at household head (especially male) and communities where literacy (and equally importantly health literacy) may be variable or absent.

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Introduction

Over half a million all-cause maternal deaths—defined as those occurring within 42 days of termination of pregnancy—occurred globally in the first year of the 21st century according to World Health Organisation estimates (AbouZahr, 2003). While this number appears to be falling (Bustreo et al., 2013), maternal mortal-

ity remains one of the most important public health concerns in the world. Recent estimates suggest that sub-Saharan Africa accounts for around two-thirds of estimated global maternal deaths, but a significant concentration (around 20%) of deaths occurring in Southern Asia (World Health Organization, 2019), the target of this study Leading causes of maternal deaths included postpartum hemorrhage, obsteructed labour, pregnancy-related hypertension, obstretic sepsis, and unsafe abortions (Kassebaum et al., 2015)—all offering avenues for intervention, and it is estimated that more than 50% of maternal deaths in developing countries are directly related to unsafe delivery practice (Bhandari, Kutty, Sarma, and Dangal, 2017; Say et al., 2014).

Bangladesh, a developing country in South Asia, has made significant progress in reducing maternal deaths. Yet, the maternal mortality ratio is still very high—about 173 per 100,000 live births in 2017 (World Health Organization, 2019). Evidence shows that increasing rates of delivery with a skilled attendant and a well-equipped facility, are essential to reducing maternal mortality (Koblinsky et al., 2006). While uptake of institutional delivery services (IDS) in Bangladesh increased from 17% in 2007 to 50% in 2017-18 (NIPORT, 2019), the proportion remains suboptimal. Earlier studies have assessed the use of IDS and associated factors in the context of Bangladesh (Huda, Chowdhury, El Arifeen, and Dibley, 2019; Kamal, 2009, 2013; Kamal, Hassan, and Alam, 2015; Shahabuddin, Delvaux, Utz, Bardají, and De Brouwere, 2016; Yaya, Bishwajit, and Ekholuenetale, 2017). However, these studies mostly investigated the association of utilizing IDS with different socioeconomic factors, such as women's education, husband's education and occupation, household wealth status, residential community-level women's education, wealth status, and residence type (rural, urban). Utilisation of health services (e.g., IDS) is a function of demand-side (accessibility and acceptability) and supply-side (availability and quality) factors that fall under the availability, accessibility, acceptability, and quality (AAAQ) framework (World Health Organization, 2016). Demand-side factors are those that influence individuals', households', or communities' ability to use health services, whereas supply-side factors are those that are inherent in the health system and impede service uptake by individuals, households, or communities. As far as Bangladeshi literature is concerned, most of these factors are related to the demand side, while relatively little is known about the supply-side. Clearly, the demand in Bangladesh varies sharply by region: for instance in the Bandaraban district, IDS use has its lowest prevalence (15.4%) contrasting with the Meherpur district where IDS use rises to 93.7% (Bangladesh Bureau of Statistics BBS and UNICEF 2019a). This variation may be attributed to variation in district-level environmental factors (e.g., lireacy rate, poverty, availability of clinics, and relative affordability).

Individuals' health behavior (i.e., utilisation of IDS) is not only shaped by individual-level characteristics but also by the environmental features of family and residential areas in which they live, work and interact. This does not discount the importance of individual-level factors, but rather highlights the importance of multi-level factors (such as family, residential area i.e., community and region) that influence individuals' health behaviour. For example, at the family level, socioeconomic status can influence women's IDS use by enhancing or limiting opportunities, whereas at the community level, socioeconomic status can reflect community familiarity with maternal health services while also shaping community awareness and acceptance of maternity services, and women'sautonomy. At the regional level, socioeconomic factors may influence health behaviour by altering the social and economic contexts and policies, availability of resources and their allocations, and opportunity structures. These characteristics could also explain why women's use of IDS varies at different levels

(family, residential area). This "multilevel" structure has not been evaluated systematically in prior research.

Education status is a basic socioeconomic feature, operationalized at different levels (e.g., individual, household, and residential area) may influence the utilisation of IDS through complex pathways. A multilevel assessment of education with the use of IDS can illuminate the degree to which delivery services are available to mothers and pathways to access. Earlier research revealed that more highly educated women are more likely to utilize IDS in Bangladesh (Huda et al., 2019; Kamal, 2013; Kamal et al., 2015; Shahabuddin et al., 2016; Yaya et al., 2017). This may not simply be about greater capacity to pay. Educated women have greater knowledge that determines willingness to access such services. In cultures where women's ability to determine their their own health choices, however, it is possible that the educational levels of household heads comes into play . In patriarchal societies the head of the household is influential in the decision-making process (Vallières et al., 2013). In the socio-cultural context of Bangladesh, household heads are predominantly male. Since male household heads often exercise signfcant power over women through control of financial resources, transportation, and even act as a gateway in giving 'permission' to access (male-dominated) health facilities (Amooti-Kaguna & Nuwaha, 2000; Waiswa et al., 2008), an exploration of the impact of household head education on utilisation of IDS in the context of a patriarchal society like Bangladesh is important.

Finally, beyond the education status of mothers and household heads, it is worth considering the social context of the residential areas. Education measured at a residential arealevel is a key socioeconomic indicator in this regard. The size or scale of residential areas is crucial for understanding environmental influences (e.g. education) operationalized at the area-level. Bangladesh is divided regionally at a number of levels (e.g. by increasing size, wards, sub-districts, and districts), but for individuals what is a 'meaningful' cluster, in terms of social influence, is less easily delineated.

Person-place interactions and outcomes are also likely to vary depending on the various size of the areas (Daniel, Moore, and Kestens, 2008). Small residential areas (e.g., communities) may better reflect meso-structural influences such as social networks, while large residential areas (e.g., district) may better reflect macro-structural asymmetry in resource availability such as public services (e.g. health care, transports)(Daniel et al., 2008), which may associate with the use of IDS. Macro-level factors influence the entire population and have indirect effects on individuals and families. However, there is a lack of research to assess the contribution of residential area educational features on the use of IDS. Recent studies reported that women residing in a community with a greater concentration of educated women are more likely to use IDS (Huda et al., 2019; Setu, Islam, Halim, and Bin, 2022). These studies focused on community-level (defined by survey cluster) female education, but with the greater mobility of Bangladeshi society, as infrastructure improves, district level variables may become of greater influence. For instance, a district with a lower percentage of literate peoplemay determine districts levels of health literacy, which may influence the degree to which it becomes a normative behaviour to access IDS. The impact of lower prevailing literacy levels can be distributed through individual's use of lay networks for health information (Stoller & Wisniewski, 2003).

Bangladesh has a pluralistic health care system that includes government, non-governmental organisations, and private providers in a wide range of facilities, from community healthcare clinics to hospitals (Pulok, Uddin, Enemark, and Hossin, 2018). Health workforces consist of professionals (such as doctors, nurses and midwives), allied professionals (such as medical assistants, pharmacists), and informal provoders (such as traditional birth attendants, village doctors, drug vendors/retailers) (World Health Or-

ganization, 2015). Health-care facilities and workforces differ by region, and accessibility to these resources also varies due to geographical, sociocultural, and economic barriers, contributing to socioeconomic inequality in health-care services and regional variation in Bangladesh (World Health Organization, 2015). Also, the quality of both public and non-public services is substandard because there is lack of evaluation and auditing of care and professional experience (World Health Organization, 2015). As a result, in addition to other initiatives, providing quality health services (e.g., midwifery) could be a potential channel to improve maternal health service use, with targeted interventions focusing on regions with low service coverage and high socioeconomic inequality. Midwives are a vital component of the health care workforce and are regarded as essential to the delivery of high-quality care to women during early and late pregnancy, as well as during and after childbirth (Directorate General of Nursing and Midwifery, 2018a, 2018b), not only providing quality care during the course of pregnancy and childbirth, but having a vital role in informing women about reproductive health, rights, nutrition, immunisation, and institutional delivery (Directorate General of Nursing and Midwifery, 2018b). Furthermore, logically, mothers are nested within households, and households nested within residential areas, hence multilevel modelling may well be a more appropriate technique to assess the influence of factors (operationalized at different levels) on women's use of IDS during childbirth. However, studies to assess the relationship between the individual, household, residential area-level factors and women's use of IDS in Bangladesh using the multilevel model are limited. This study offers an exploration of the influence of education status (including mothers, household head education status, and district-level adult literacy rate) on women's use of IDS during childbirth using multilevel models, after adjusting for other covariates and clustering effects.

Materials and methods

Data

This study takes advantage of the latest Bangladesh Multiple Indicator Cluster Survey (MICS) 2019 and the Bangladesh Sample Vital Registration System (SVRS) 2019 datasets to assess the associations between individual, household and area-level educational status and women's usage of institutional delivery services in Bangladesh. Data were compiled from the Bangladesh MICS 2019. The MICS 2019 is a nationally representative cross-sectional survey that employs two-stage stratified cluster sampling (see detailed methodology in the MICS report (Bangladesh Bureau of Statistics BBS and UNICEF, 2019b). The MICS 2019 collected information from 61,242 households and 64,378 women aged between 15 and 49 (Bangladesh Bureau of Statistics BBS and UNICEF, 2019b). Among these women, 9,285 women had at least one live birth in the two years preceding the survey. Administrative district-level adult literacy rate was derived from the Bangladesh Sample Vital Registration System (SVRS) 2019 report (Bangladesh Bureau of Statistics BBS, 2020) and merged with individual-level data. A total of 78 women were excluded due to missing data in outcome, exposure, and/or covariates measures. The final analytical sample thus comprises 9,207 women.

Measures

Outcome measure

Women's use of IDS during childbirth for the last child was defined as whether the last delivery occurred at a government hospital, government clinic or health center, community clinic, private hospital, private clinic, private maternity home, NGO clinic or hospital, or other private or public medical institution. By contrast, non-institutional delivery was defined as cases where the delivery occurred at respondents', relatives' or others' homes, or in other non-professional facilities.

Predictors and covariates

Primary predictors of interest were education status of the respondent (none or pre-primary, primary, secondary, higher secondary), education status of household head (none or pre-primary, primary, secondary, higher secondary), and district-level adult literacy rate (chosen as a representative measure of aggregate educational level). For average adult literacy, we drew on a Bangladesh Bureau of Statistics variable, the percentage of the population (aged ≥ 15 years) capable of writing a letter, as a proportion of the total population of the same age group (Bangladesh Bureau of Statistics BBS, 2020).

Additionally, a set of covariates drawn from MICS 2019 were considered in this study–age at first marriage (<18 years, ≥ 18 years), exposure to media (yes/no), birth order (1st, 2nd, and third or higher), household wealth status (poor, middle, rich), age of household head, gender of household head (female, male), and place of residence (urban/rural). Women were considered as having exposure to media if they watch television, listen to the radio, or read newspapers at least once a week. Household wealth status was calculated based on household-level asset variables using principal component analysis (Bangladesh Bureau of Statistics BBS and UNICEF, 2019b).

Analytical strategy

This study's analyses were divided into three parts–Descriptive, bivariate, and multivariate. Descriptive statistics (frequency, percentage, average, standard deviation) were used for all variables. Bivariate associations between the use of IDS and predictors were performed using the Rao-Scott Chi-square test (Rao & Scott, 1987). A multivariable binary logistic model was used to estimate the association of education status of individuals (women, household head) and districts-level literacy rate with IDS utilisation adjusted for other covariates. A multilevel modelling approach was applied to adjust household and district-level clustering examining women as nested within households, and households as nested within an administrative district. The intra-cluster correlation (ICC) of the likelihood of the use of IDS was used as a measure of household and district-level clustering. The sampling weights and survey features (cluster and strata information) were used in all analyses to provide the nation-level estimate. All analyses were conducted using STATA version 14.0 (StataCorp., 2015).

Results

Table 1 describes the distribution of the analytic sample. Overall, about 53% of the study population used a form of IDS during childbirth. More than one-third of cases were primiparous (first) births (34.56%). The majority of the respondents were secondary educated (50.17%), married before 18 years (59.44%), and exposed to media (65.34%). Women lived in households with an average age of heads of households of 43 years, the majority being male, however, only 27.94% of the household heads had secondary education. This suggests that while literacy rates amongst men may be higher, prevalence of education beyond primary level remains a concern. Moreover, roughly an equivalent proportion of women (around 40%) belonged to the highest and lowest categories of wealth, 78.10% were from rural areas, and the average district-level adult literacy rate was 72.30%.

Bivariate relationships between women's use of IDS and predictors (i.e., women's education status, education status of household head, and area-level adult literacy rate) are presented in Table 2.

Table 1
Description of analytic sample.

Measures	Categories/Unit	
Individuals (n=9,207)		Weighted prevalence (%)
IDS	Yes	53.47
	No	46.59
Women education	Pre-primary or none	9.09
	Primary	23.16
	Secondary	50.17
	Higher secondary or above	17.57
Age at first marriage	< 18 years	59.44
	≥18 years	40.56
Media exposure	No	34.65
	Yes	65.34
Birth order	1st	34.56
	2nd	34.15
	3rd or higher	31.29
Household wealth status	Poor	40.03
	Middle	18.99
	Rich	40.97
Household head age (average, SD)	Years	42.63 (14.67)
Household head sex	Male	92.98
	Female	7.02
Household head education	Pre-primary or none	30.30
	Primary	29.46
	Secondary	27.94
	Higher secondary or above	12.29
Place of residence	Rural	78.10
	Urban	21.90
District-level adult literacy rate (n=64)	Un-weighted average (standard deviation [SD])	72.30 (SD=7.41)

Table 3
Multilevel analyses of the association of women and household head education, and district level adult literacy with women's use of institutional delivery services.

	Use of IDS[1]	
Measures	AOR (95% CI)	p-value
Individual level		
Women education (ref.: Pre-primary or none)	1.00	
Primary	1.21 (0.86, 1.71)	0.2800
Secondary	1.83 (1.30, 2.56)	<0.001
Higher secondary or above	3.05 (2.15, 4.32)	<0.001
Household head education(ref.: Pre-primary or none)	1.00	
Primary	1.36 (1.12, 1.65)	0.0020
Secondary	1.88 (1.32, 2.67)	<0.001
Higher secondary or above	2.52 (1.86, 3.41)	<0.001
District-level adult literacy rate	1.02 (1.00, 1.04)	0.0160
$ICC_{household}$	0.1091	
$ICC_{district}$	0.0766	

AOR–Adjusted odds ratio; CI: confidence interval; ICC: intra-cluster correlation; ref.: reference category.
[1] Adjusted for age at first marriage in years, media exposure, birth order, household wealth status, household head age, household head sex, and place of residence.

CI=1.30,2.56, p-value<0.001) and higher secondary (AOR=3.05, 95% CI=2.15,4.32, p-value<0.001) education had higher odds of using IDS, compared to the women with no or pre-primary level education.

Household head education

The use of IDS also substantially varied as a function of household-head education status. Among women, those residing in households with secondary or above educated household heads had a higher prevalence of IDS (i.e., 79.80% for higher secondary or above educated household heads and 63.45% for secondary educated household heads) than households with a primary, pre-primary, or non-educated household heads.

Education of the household head was also significantly associated with the use of IDS in multilevel analysis. Relative to women from households with a household head having no or pre-primary education, the odds of using IDS were higher among women from households with a household head who had primary education (AOR=1.36, 95% CI=1.12, 1.65, p-value=0.0020), secondary education (AOR=1.88, 95% CI=1.32, 2.67, p-value<0.001), and higher secondary or above education (AOR=2.52, 95% CI=1.86, 3.41, p-value<0.001) .

Table 3 presents the multivariable multilevel analyses of the association between education status and area literacy rate with the utilisation of IDS adjusting for sociodemographic covaraites (i.e., age at first marriage, birth order, media exposure, household head age, household head sex, household wealth status, and place of residence) as well as household and area clustering.

Women's education

The majority of secondary (57.48%) and more highly-educated (80.69%) women reported using IDS during childbirth, whereas only 24.26% and 35.58% of pre-primary or non-educated and primary educated women used IDS (Table 2). Differences in the utilisation of IDS between women from different educational levels was statistically significant. In multilevel model, utilisation of IDS was significantly associated with women education status (Table 3). Women who attained the secondary (AOR=1.83, 95%

Table 2
Bivariate association of women and household head education, and district level adult literacy with women's use of institutional delivery services.

Measures		Use of IDS		P-value
		No (%)	Yes (%)	
Women education	Pre-primary or none	75.74	24.26	<0.001
	Primary	64.42	35.58	
	Secondary	42.52	57.48	
	Higher secondary or above	19.31	80.69	
Household head education	Pre-primary or none	60.60	39.40	<0.001
	Primary	52.52	47.48	
	Secondary	36.55	63.45	
	Higher secondary or above	20.20	79.80	
District-level adult literacy rate		71.70	74.09	<0.001

District level adult literacy

Finally, district-level adult literacy rate was substantially higher (i.e., 74.09%) for women who used IDS than for those who did not use IDS (71.70%). according to multilevel model, women residing in districts with a greater proportion of literate adults had higher odds of using IDS (AOR=1.02, 95% CI=1.00, 1.04, p-value=0.0160).

Household and district level clustering

It is important to note that a greater proportion of the total individual-level variance in the likelihood of using IDS was at the household level (ICC = 0.1091 or 10.91%), rather than district level (ICC = 0.0766 or 7.66%).

Discussion

In Bangladesh, some 53% of women used IDS during childbirth, indicating that births outside a formal institutional medical setting are still extremely common. This study demonstrates that the educational status of mothers, the household head and indeed the district in which the household is placed, are all associated with women's use of IDS. Substantial clustering of the likelihood of the use of IDS is observed at household- and district-level; clustering at household-level was greater than district-level clustering. In itself this finding is unremarkable: education is consistently and strongly related to wealth, which drives capacity to access higher cost services, which in turn plausibly drives the supply side: where there are customers with capacity to pay, services will be established. However, the result holds when wealth is controlled for: education levels of the individual, the family and the residential district makes an independent difference to access to IDS. Again, although the relationship between women's education level and IDS use is well established, the finding that the level of education of the head of household (frequently a key decision maker) and adult literacy rate of a district are also significant independent factors is a valuable contribution to the literature.

Women's education

This study supports earlier work (Huda et al., 2019; Kamal, 2009, 2013; Kamal et al., 2015; Shahabuddin et al., 2016; Yaya et al., 2017) showing that women with secondary or higher secondary level education are more likely to attend an IDS setting. Education status of women may lead to the use of formal health facilities for childbirth through a variety of pathways, such as making women better informed, aware of resources available, and enabling women to make better decisions about the place of delivery (Anya, Hydara, and Jaiteh, 2008; Paul & Rumsey, 2002) and possibly through associates with female empowerment. Educated women are likely to have a a more influential position within the household, which is a potential determinant of the utilisation of available maternal health care facilities (Furuta & Salway, 2006). Higher education may provide better access to information through exposure to media, can delay the age of marriage and age at first birth, can give the holder higher earning power and thus improve ability to access IDS, and may empower women to make decisions regarding using IDS.

Household head education

Household heads in Bangladesh, however, are predominantly male (e.g., 93% in this study) and typically have significant power in determining access to healthcare, even relating to pregnancy and child birth. In nuclear families (such as those made up of a

husband, wife, and child), the husband is usually the head of the home, whereas in joint families (such as those made up of a husband, wife, child, and in-laws), the role is usually filled by the husband or the father-in-law. Research shows that husband-only decision-making is negatively associated with antenatal care utilisation and health facility-based births in Bangladesh (Story & Burgard, 2012). A woman's autonomy (i.e., ability to make decisions about their own health and access to health care) in traditional Bangladeshi households, while critically important (Nigatu, Gebremariam, Abera, Setegn, and Deribe, 2014) may be significantly curtailed. The education of the head of households may correlate with greater health literacy on the part of a key decisionmaker, as well as more liberal attitudes towards and greater acceptance of women's autonomy in decision making in relation to their health. Also, education levels of household heads are likely associated with higher household income, resulting in the greater capacity to use of IDS. Our findings support previous research in Uganda indicating that educational attainment of household heads served as a "gateway" to women's use of IDS, that is, in determining or dictating access to resources (transport, money) to access IDS. (Vallières et al., 2013).

As noted earlier, variables such as household wealth and other sociodemographic factors and clustering were controlled for, so there appears to be an independent effect of education.it is interesting to speculate on the multiple pathways in which education may influence uptake of IDS. Education may subtly alter what is considered normative in terms of gender roles. For example, it is interesting to note the majority of counselling programs for facility births in Bangladesh are based on *antenatal* care, and that household heads do not typically accompany women during antenatal care visits for cultural reasons. Consequently, household heads tend are excluded from information that may inform their decisionmaking at childbirth. It might be advantageous to develop strategies or improve access and uptake of household heads to counselling programs related to maternal health services. Expecting to be able to 'convert' individuals from current practice through direct education programs may be naïve The finding that district levels of literacy impact on access to IDS indicates that a more inclusive, collective approach may be required.

District level adult literacy

Potential pathways of the association between women's use of IDS and district-level adult literacy rate have not been thoroughly elucidated. District literacy may be a proxy for a number of other factors, including lower density of traditional households, greater wealth, greater prevalence of IDS options, greater availability of health information, and greater awareness about women and child health. The current study does not have exhaustive control variables, but indicates that district-level literacy does have an independent effect. This does reinforce the common finding in the literature that literacy *per se* is a valuable outcome for the individual, family, and community. Short of achieving higher levels of literacy, the findings emphasise the potential for public health promotion in accessible forms for non-literate individuals. An educational intervention may be a viable strategy for addressing the problem, but such a strategy needs to be inclusive, and accessible not just to a relative elite of society. Increasing the density of midwives and public health professionals capable of educating communities on the value of IDS would appear valuable. Approaches that include the illiterate and indeed men appear to be critical in shifting cultural norms and community health literacy.

Accessibility and availability of healthcare services, as well as their quality, vary between rural and urban areas, with previous research showing that healthcare professionals in Bangladesh are

less likely to accept rural postings (Muurlink, Durga, Awan, and Taylor-Robinson, 2022). Specialists in particular, even when subject to mandatory duty in rural and remote areas by the government, are frequently absent from their postings. Despite strong top-down policy designed to ensure equity of access, people living in urban regions remain at a distinct advantage. In addition, the planning of selecting locations for healthcare private facilities is frequently not based on population needs, but population ability to pay. In other words, simply because services are 'present' does not imply they are either accessible or of adequate quality.

It is remarkable that a considerable proportion of total individual variance in the probability of the use of IDS is at the household level and district level. Intra-household correlation may reflect the presence of shared environmental factors such as the presence of similar learned behaviors within the household, while similar social and built environment features of district (e.g., income, number of health facilities, geographic access to health facilities, density of quality health care professionals, availability of public transport) may explain district-level clustering. Although district-level clustering is lower than household clustering, targeting households as well as admnirative district may help to enhance the IDS uptake. This finding suggests a need for a nuanced approach to public information campaigns, one that takes account of community and cultural mores in shifting opinion and behaviour.

Bangladesh is making substantial progress towards universal literacy, but this study provides indirect evidence of the shortfall and its consequences. This study showed the relatively lower levels of education amongst men (as majority of household heads were male, about 93%) bear a relationship with women's health, the uptake of IDS, and likely all-cause maternal deaths.

In conclusion, while it is possible to introduce public health measures targeted at IDS uptake in particular, where literacy rates are low and progress otherwise likely to lag, education bears a complex, multi-factorial relationship with health. The present study provides some important insights into women's use of IDS in Bangladesh. Specifically, the multilevel model provides insights about the influence of women's individual-level education, education status of household head, and district literacy on women's utilizing IDS during childbirth in Bangladesh. In parallel to specific environmental factors of household and residential districts, the multilevel analysis also suggests that social influence plays a role in determining uptake of public health measures such as IDS usage. However, further research is required to comprehend the mechanisms of the relationship between environmental features and IDS usage in Bangladesh.

Limitations

The study clearly has limitations. We used a cross-sectional data to explore association, which limits the scope of establishing the temporal relationship between the examined factors and the utilisation of IDS. Also, this study used secondary data, which limits the array of potentially important variables associated with IDS use such as attitudes of service providers, services respectful of the culture of people and communities, quality of health care, access to transportation, density of health care services, cost of services, and family history of using IDS. These are variables that are rarely captured in large-scale censuses and surveys, however can be captured in smaller scale studies able to access more granular detail. Furthermore, since literacy was only evaluated through only letter writing ability, the role of the district-level adult literacy rate should be considered as exploratory and suggestive. Future research would benefit from a more robust measure of the literacy rate. In Bangladesh, data quality remains a problem, at least in part due to lower levels of literacy.

Conclusion

The present study found that alongside women's education, household head education and district-level literacy rate are associated with women's use of IDS in Bangladesh. This study adds to the body of work that suggests the importance of mandatory education for both women and men (i.e., household head). Education leads to greater individual and group prosperity, but this study indicates that education likely independently leads to better health behaviours. This study indicates the importance of area-of group-level environmental factor, at family and district level, in determining IDS utilisation. National strategies and policies to enhance the use of IDS in Bangladesh should thus be multilevel and concentrate on improving not simply on female education. The study finally suggests that public health interventions should not be too heavily reliant on means that require higher levels of literacy. In the short term, educational interventions that rely on multiple modes of delivery are important. Literacy—whether in the broadest sense, or health literacy in particular—is not developed overnight, and meanwhile, women continue to be the casuality of sub-optimal care.

Data Availability Statement

The data sets used for the current study are publicly available at https://mics.unicef.org/.

Ethics approval

This study has used secondary data of Bangladesh MICS 2019 and this survey was approved by Bangladesh Bureau of Statistics institutional review board. All the participants were given a written consent about the survey before interviewing.

Author's contributions

JRK conceptualisation of the research problem, TA and MMR compiled data and performed the formal analysis with input from JRK; JRK, TA, and MMR prepared the original draft, MBH and OM critically reviewed and edited the manuscript. All authors have read and approved the final version.

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Prior knowledge

- Women with better education are more likely to use institutional delivery services (IDS).
- The role of household head in IDS utilisation is crucial.
- Women from wealthier households are more likely to use IDS.

What this study adds

- Women from households with higher educated heads are more likely to use IDS.
- District-level adult literacy rate has a significant positive impact on IDS utilisation.
- Substantial household- and district-level clustering occurs in IDS utilisation.

Declaration of Competing Interest

The authors declare that they have no competing interests.

Acknowledgments

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