Exploring the influencing factors for non-utilisation of healthcare facilities during childbirth: a special mixed-method study of Bangladesh and 13 other low- and middle-income countries based on Demographic and Health Survey data

Tanjim Siddiquee, Henry Ratul Halder ![ORCID], Md Akhtarul Islam

Statistics Discipline, Khulna University, Khulna, Bangladesh

Correspondence to
Md Akhtarul Islam;
akhtarulstat@ku.ac.bd

ABSTRACT

Objective To identify the associated factors affecting the decision regarding institutional delivery for pregnant women in 14 low- and middle-income countries (LMICs).

Design A special mixed-method design was used to combine cross-sectional studies for harmonising data from Bangladesh and 13 other countries to obtain extended viewpoints on non-utilisation of institutional healthcare facilities during childbirth.

Setting Demographic and Health Survey (DHS) data for 14 LMICs were used for the study.

Participants There are several kinds of datasets in the DHS. Among them *'Individual Women's Records'* was used as this study is based on all ever-married women.

Results In the binary logistic and meta-analysis models for Bangladesh, ORs for birth order were 0.57 and 0.51 and for respondents' age were 1.50 and 1.07, respectively. In all 14 LMICs, the most significant factors for not using institutional facilities during childbirth were respondents' age (OR 0.903, 95% CI 0.790 to 1.032) and birth order (OR 0.371, 95% CI 0.327 to 0.421).

Conclusion Birth order and respondents' age were the two most significant factors for non-utilisation of healthcare facilities during childbirth in 14 LMICs.

INTRODUCTION

Globally, maternal mortality and morbidity are an alarming public health issue. In 2015, despite advances in the medical and public health sector, approximately 830 women died worldwide every day due to pregnancy and childbirth-related complications.[1] Lack of access and utilisation of healthcare facilities at the time of delivery is one of the main reasons for the high maternal and neonatal mortality in low- and middle-income countries (LMICs).[2–5] At the primary level, antenatal care (ANC) helps detect complications

Key points

► The study aimed to identify the factors affecting the decision of pregnant women to not use healthcare facilities during childbirth in 14 low- and middle-income countries (LMICs).

► In 14 LMICs, the most significant factors for not using healthcare facilities during childbirth were the respondent's age and birth order.

► The study recommends raising awareness on the importance of institutional healthcare during childbirth in order to achieve the Sustainable Development Goal of targeted maternal mortality ratio.

► This study rigorously recognised the dominance of the respondents' age and birth order with regard to the non-utilisation of healthcare facilities during childbirth.

in the early period of pregnancy by providing a comprehensive range of health promotion and preventive healthcare services.[6 7] WHO recommend that throughout the pregnancy period at least four ANC visits are necessary for the safe and sound health of both the mother and the newborn.[8] Without any professional aid, there will be a high likelihood of mortality for both the mother and the child during pregnancy compared with those who have availed themselves of institutional healthcare services.[9–11] However, in LMICs, a striking number of women still lack the opportunity for childbirth under trained medical personnel at healthcare facilities, and 99% of maternal deaths occur in developing countries.[12–15]

A meta-analysis was conducted on the impact of place of delivery on maternal and
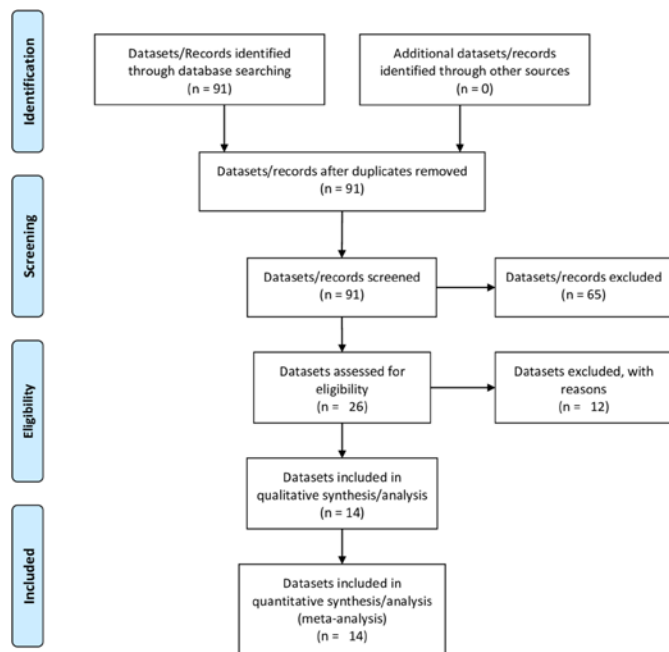
BMJ

Figure 1 Flow diagram of the process of identifying and including datasets for the random-effects meta-analysis.

perinatal mortality in sub-Saharan Africa, which was based on a limited number of studies, with some of them being population-based cohort studies.[16] Another meta-analysis on LMICs depicted that neonatal mortality is significantly affected by institutional deliveries, despite drawbacks due to study diversity and variation in context, limitation in data extraction, and incorporation of all risk factors.[17] In Bangladesh, diarrhoea and birth order were found to be the most significant risk factors for neonatal and child mortality, with a drawback being that the survey interviewed surviving women, which could lead to an underestimation of mortality rates and deficiency in the case of infant-specific variables.[18] Several studies have also aimed to explore the determinants of institutional delivery among women in Bangladesh; however, the studies were based on previously published Bangladesh Demographic and Health Survey (BDHS) datasets.[19 20] The trends and regional patterns of disparities on utilisation of healthcare services in Bangladesh have been investigated.[21–23] Furthermore, small-scale studies have also been conducted in rural settings and provided strong programme recommendations to raise awareness in remote areas such as Matlab and Sunamganj.[24 25] Nevertheless, the small sample size of these studies conducted in a specific area might have influenced the results and may not be similar to other rural parts of Bangladesh.

In this study, we attempted to determine the influencing factors for the non-utilisation of healthcare facilities during child delivery in Bangladesh and 13 other countries. We used a special mixed-method design to integrate data from Bangladesh and 13 other countries to provide additional insight beyond what might be gained from a simple cross-sectional survey and meta-analysis.

METHODS
Design
This was a special convergent designed mixed-method study. We performed both binary logistic regression and meta-analysis for the cross-sectional study of Bangladesh. We then compared the results from Bangladesh with the meta-analysis of 13 other LMICs. Using this approach, we could extensively explore the factors affecting the decision of pregnant women to not use healthcare facilities during childbirth. All data were based on the Demographic and Health Survey (DHS).

Data source and data extraction
This cross-sectional study extracted relevant information for analysis from a nationwide representative secondary dataset, BDHS 2014. Information was collected from all seven administrative divisions of the country.[26] We also used the latest available datasets (accessed in January 2018) from MEASURE DHS (Monitoring and Evaluation to Assess and Use Result, Demographic and Health Survey) (www.measuredhs.com) to conduct the meta-analysis. We obtained the latest available DHS data for Albania (2009), Azerbaijan (2006), Cameroon (2011), Egypt (2014), Haiti (2012), Jordan (2012), Kenya (2014), Lesotho (2014), Maldives (2009), Nepal (2011), Pakistan (2013), Peru (2012) and Tanzania (2016). One of the elementary goals of the DHS programme is to provide high-quality accessible data for analysis in the form of a questionnaire. For the analyst, this results in an information file containing incomplete or inconsistent data, considerably complicating the analysis. In order to avoid these problems, the DHS programme has adopted a policy of editing and imputation in order to reflect population studies accurately. Additionally, the DHS data can be used immediately. The DHS database contains information from 91 countries (http://dhsprogram.com/data/available-datasets.cfm), but we only had authorised permission to access the data from 26 of them. We excluded 12 more countries due to excessive missing values and the insignificance of particular independent variables with the place of delivery in any of the selected countries. Finally, we selected Bangladesh and 13 other LMICs, which are homogeneous in nature as similar probability sampling for data collection was applied to them.

PRISMA flow diagram for eligibility criteria of datasets
In figure 1, which shows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram, we get a clear illustration of the eligibility criteria of the DHS datasets for the random-effects meta-analysis.

Table 1 Categorisation of the dependent variable from original categories to recoded categories

Recoded category	Original categories
Home	Home, respondent's home, midwife's home, other home.
At the health facilities	Public sector, public hospital/health centre, Tirana maternity, other public, private sector, private hospital/clinic, other private medical, government hospital/maternity home, government polyclinic/ woman's consultation, government family planning centre/cabinet, private family planning centre/ cabinet/clinic, private doctor, NGO, district hospital, maternal and child welfare centre, district health and family welfare centre, community clinic, confessional hospital/health centre, urban/rural hospital, urban/rural health unit, health office, MCH centre, university hospital, royal medical services, church, TBA premises, dispensary, other.

MCH, maternal and child health; NGO, non-governmental organisation; TBA, traditional birth attendant.

Variables

The dependent variable for this study is the *place of delivery*, and we categorised this variable into two main categories: *'Home'* and *'At the Health Facilities'* (table 1).

A set of socioeconomic and demographic factors for the determination of place of delivery were purposely selected as independent variables based on previous literature. A test of association was conducted to check whether or not they were significantly associated with the dependent variable. Subsequently, only significantly associated variables were selected for binary logistic regression and meta-analysis. Beginning with the *type of place of residence*, the category remained the same as in the original datasets. For the purpose of the analysis, we subcategorised the rest of the independent variables. Respondents' age was converted into nominal scale. The categories for this variable were *up to 20* and *above 20*. In the meta-analysis, those who had at least one *ANC visit* were considered in the category *yes*, otherwise *no*, whereas for binary logistic regression we subcategorised this as *no visit, 1–3 visits* and *more than 3 visits*. In terms of *respondents' education level*, we merged *no education, primary* and *secondary* into *up to secondary*, and *higher education* consisted of *above secondary*, in the meta-analysis. For *wealth index, poorest, poorer* and *middle* fell under *poor*, whereas *richer* and *richest* formed the *rich* category in the meta-analysis. On the other hand, for binary logistic regression, *poorest* and *poorer* constituted *poor, middle* constituted *middle*, and the rest of the other categories constituted *rich*. Categories for *birth order* were *first order* with one birth only, and the rest of birth orders formed *other order*. Finally, for *body mass index* (BMI), worldwide commonly accepted BMI ranges were used: underweight ($<18.5 \text{kg/m}^2$), normal weight ($18.5–25 \text{kg/} \text{m}^2$), overweight ($25–30 \text{kg/m}^2$) and obese ($>30 \text{kg/m}^2$).[27] For convenience in our study, we kept *normal weight* under the category *normal*, and all other categories (*underweight, overweight, obese*) were classified as *not normal*.

Statistical analysis

Data analysis was carried out using SPSS V.23 (SPSS Inc, Chicago, USA) and R V.3.5.2 statistical software (Bell Laboratories, New Jersey, USA). For BDHS data, binary logistic regression was applied to mark off the relationship between place of delivery for women in Bangladesh and other associated factors.[28] Meta-analysis was performed on the DHS data from Bangladesh and 13 other countries. Heterogeneity among datasets was assessed by computing values from I^2 and p values.[29] As the test statistics showed there was significant heterogeneity among datasets, the random-effects model in the meta-analysis was used to estimate the DerSimonian and Laird's pooled effect.[30 31] 95% CI were shown in the forest plots for the most significant factors of all 14 LMICs. In the forest plots, the size of each box indicates the weight of the study, while each crossed line refers to 95% CI. OR was used as a summary measure, and all results were weighted to eliminate undersampling and oversampling bias.

RESULTS

The baseline characteristics of the selected variables for 14 LMICs are shown in table 2. For place of delivery, respondents who have child delivery at home ranged from 0.8% (Jordan) to 62.5% (Haiti). Maldives has the highest percentage (87.1%) of rural residents. With regard to respondents' age, Bangladesh has the highest (27.8%) percentage for age up to 20 years. In terms of ANC visit, Jordan has the lowest (0.7%) and Pakistan has the highest (25.7%) percentage of 'no' category. Furthermore, Jordan exhibits the lowest (66.4%) and Tanzania exhibits the highest (99.1%) percentage of mothers with up to secondary education. It is also seen that Egypt has the lowest (56.7%) and Maldives has the highest (76.5%) percentage with regard to poor wealth index. Jordan and Bangladesh demonstrate the lowest (15.2%) and the highest (40.6%) percentage with regard to first-order child. Egypt has the lowest (20.5%) and Nepal has the highest (71.8%) percentage of normal BMI.

Table 3 illustrates the various socioeconomic and demographic factors influencing the decision to choose the place of delivery for women in Bangladesh. The binary logistic regression model is statistically insignificant by the Hosmer and Lemeshow test (p=0.803), meaning that the model is a good fit. Also, the test of multicollinearity was conducted using the variance inflation factor (VIF). VIF concluded that most of the independent variables were moderately correlated (1<VIF<5) with each other, which can be neglected during regression analysis.

Determination of place of delivery is associated with the type of place of residence, with an adjusted OR of

Table 2 Baseline characteristics for selected determinants of 14 LMICs

Country	Place of delivery n (%)		Type of place of residence n (%)		Respondents' age n (%)		Antenatal care visit n (%)		Respondents' education level n (%)		Wealth index n (%)		Birth order n (%)		Body mass index n (%)	
Variables	Home	At the health facilities	Urban	Rural	Up to 20	Above 20	No	Yes	Up to secondary	Above secondary	Poor	Rich	First order	Other order	Normal	Not normal
Albania	47 (3.5)	1294 (96.5)	612 (45.6)	729 (54.4)	54 (4.0)	1287 (96.0)	59 (4.4)	1282 (95.6)	1194 (89.0)	147 (11.0)	832 (62.0)	509 (38.0)	369 (27.5)	972 (72.5)	764 (57.4)	567 (42.6)
Azerbaijan	331 (19.5)	1365 (80.5)	820 (48.3)	876 (51.7)	115 (6.8)	1581 (93.2)	429 (25.4)	1259 (74.6)	1510 (89.0)	186 (11.0)	1179 (69.5)	517 (30.5)	539 (31.8)	1157 (68.2)	870 (52.9)	776 (47.1)
Bangladesh	2693 (60.0)	1799 (40.0)	1450 (32.3)	3042 (67.7)	1248 (27.8)	3244 (72.2)	969 (21.6)	3523 (78.4)	3970 (88.4)	522 (11.6)	2654 (59.1)	1838 (40.9)	1824 (40.6)	2668 (59.4)	2610 (58.6)	1847 (41.4)
Cameroon	2555 (33.5)	5073 (66.5)	3256 (42.7)	4372 (57.3)	1258 (16.5)	6370 (83.5)	1007 (13.2)	6610 (86.8)	7384 (96.8)	244 (3.2)	4832 (63.3)	2796 (36.7)	1696 (22.2)	1532 (77.8)	2418 (61.4)	1521 (38.6)
Egypt	1347 (11.7)	10147 (88.3)	4769 (41.5)	6725 (58.5)	610 (5.3)	10884 (94.7)	1146 (10.0)	10347 (90.0)	9573 (83.3)	1921 (16.7)	6521 (56.7)	4973 (43.3)	2641 (23.0)	8853 (77.0)	2335 (20.5)	9079 (79.5)
Haiti	3382 (62.5)	2030 (37.5)	1968 (36.4)	3444 (63.6)	573 (10.6)	4839 (89.4)	531 (9.8)	4877 (90.2)	5263 (97.2)	149 (2.8)	3788 (70.0)	1624 (30.0)	1694 (31.3)	3718 (68.7)	2353 (66.2)	1203 (33.8)
Jordan	56 (0.8)	6755 (99.2)	4738 (69.6)	2073 (30.4)	192 (2.8)	6619 (97.2)	50 (0.7)	6761 (99.3)	4522 (66.4)	2289 (33.6)	5102 (74.9)	1709 (25.1)	1033 (15.2)	5778 (84.8)	1291 (29.6)	3075 (70.4)
Kenya	6013 (40.3)	8907 (59.7)	5154 (34.5)	9766 (65.5)	1487 (10.0)	13433 (90.0)	961 (6.4)	13955 (93.6)	13816 (92.6)	1104 (7.4)	10170 (68.2)	4750 (31.8)	3232 (21.7)	11688 (78.3)	4282 (60.4)	2809 (39.6)
Lesotho	598 (23.0)	1998 (77.0)	667 (25.7)	1929 (74.3)	370 (14.3)	2226 (85.7)	140 (5.4)	2456 (94.6)	2414 (93.0)	182 (7.0)	1690 (65.1)	906 (34.9)	987 (38.0)	1609 (62.0)	703 (52.4)	638 (47.6)
Maldives	106 (3.3)	3152 (96.7)	421 (12.9)	2837 (87.1)	85 (2.6)	3173 (97.4)	368 (11.3)	2881 (88.7)	3148 (96.6)	110 (3.4)	2491 (76.5)	767 (23.5)	1302 (40.0)	1956 (60.0)	1342 (50.7)	1304 (49.3)
Nepal	2397 (58.8)	1682 (41.2)	897 (22.0)	3182 (78.0)	465 (11.40)	3614 (88.6)	611 (15.0)	3468 (85.0)	3807 (93.3)	272 (6.7)	2731 (67.0)	1348 (33.0)	1248 (30.6)	2831 (69.4)	1420 (71.8)	558 (28.2)
Pakistan	3494 (46.9)	3960 (53.1)	3274 (43.9)	4180 (56.1)	505 (6.8)	6949 (93.2)	1917 (25.7)	5534 (74.3)	6554 (87.9)	900 (12.1)	4533 (60.8)	2921 (39.2)	1388 (18.6)	6066 (81.4)	1370 (52.7)	1232 (47.3)
Peru	1180 (14.8)	6820 (85.3)	4748 (59.4)	3252 (40.7)	852 (10.7)	7148 (89.4)	187 (2.3)	7813 (97.7)	6241 (78.0)	1759 (22.0)	6058 (75.7)	1942 (24.3)	2538 (31.7)	5462 (68.3)	3251 (40.6)	4749 (59.4)
Tanzania	2257 (32.0)	4793 (68.0)	1837 (26.1)	5213 (73.9)	878 (12.5)	6172 (87.5)	157 (2.2)	6893 (97.8)	6944 (99.1)	62 (0.9)	4187 (59.4)	2863 (40.6)	1616 (22.9)	5434 (77.1)	4602 (65.6)	2409 (34.4)

LMICs, low- and middle-income countries.

Table 3 Results of the BLR model affecting socioeconomic and demographic factors for non-utilisation of healthcare facilities during childbirth for women in Bangladesh

Variables	OR	P value	SE	95% CI for OR	
				Lower	Upper
Type of place of residence					
Urban (reference category)					
Rural	2.617	≤0.001	0.080	0.528	0.721
Respondents' age					
Up to 20 (reference category)					
Above 20	1.479	≤0.001	0.100	1.217	1.799
ANC visit					
No visit (reference category)					
1–3 visits	3.448	≤0.001	0.119	2.729	4.355
More than 3 visits	6.011	≤0.001	0.126	4.695	7.694
Respondents' education level					
No education (reference category)					
Primary	1.242	0.108	0.135	0.953	1.618
Secondary	1.799	≤0.001	0.129	1.397	2.315
Higher	3.946	≤0.001	0.168	2.838	5.488
Wealth index					
Poor (reference category)					
Middle	1.613	≤0.001	0.100	1.326	1.963
Rich	2.583	≤0.001	0.091	2.160	3.090
Birth order					
First order (reference category)					
Other order	0.567	≤0.001	0.092	0.473	0.679
BMI					
Normal (reference category)					
Not normal	1.101	0.179	0.072	0.957	1.267

ANC, antenatal care; BLR, binary logistic regression; BMI, body mass index.

2.617 (95% CI 0.528 to 0.721; p≤0.001) for the rural category. Similarly, respondents' age has a significant impact on place of delivery, with an adjusted OR of 1.479 (95% CI 1.217 to 1.799; p≤0.001) for category 'above 20'. The categories '1–3 visits' and 'more than 3 visits' with ORs of 3.448 (95% CI 2.729 to 4.355; p≤0.001) and 6.011 (95% CI 4.695 to 7.694; p≤0.001), respectively, show the association between place of delivery and ANC visit during pregnancy. Secondary and higher education of respondents have a relationship with place of delivery, where the adjusted OR is 1.799 (95% CI 1.397 to 2.315; p≤0.001) and 3.946 (95% CI 2.838 to 5.488), respectively. Respondents from middle-class families exhibit a notable influence on place of delivery, where the ORs is 1.613 (95% CI 1.326 to 1.963; p≤0.001) and 2.583 (95% CI 2.160 to 3.090; p≤0.001) for respondents from rich families. Birth order is likewise associated with place of delivery; when the birth order is *other order* the OR is 0.567 (95% CI 0.473 to 0.679; p≤0.001).

From tables 4 and 5, an estimate of the average treatment effect, which varies from study to study, can be obtained by the true treatment effect from the random-effects model. In this study, we have observed high heterogeneity and this is why the random-effects model was used. About 96.3% of the variation (I^2 = 96.3%) has been found for the type of place of residence. The overall OR is 4.020 (95% CI 3.217 to 5.024), meaning that urban residents have 4.020 times higher chance of using healthcare facilities as a place of delivery than rural residents. About 80.5% of the variation (I^2 = 80.5%) has been found for respondents' age, and the overall OR is 0.903 (95% CI 0.790 to 1.032), which suggests that as age increases the chance of using a healthcare facility as the place of delivery decreases. For ANC visit, I^2 has been found to be 96% for the overall model. The overall OR is 6.177 (95% CI 4.489 to 8.501), which means respondents have 6.177 times higher chance of using healthcare facilities as the place of delivery for those who have received ANC compared with those who have not. About 84.2% of

Table 4 Random-effects model estimation of OR for Bangladesh and 13 other LMICs

Country	Type of place of residence OR	Respondents' age OR	ANC visit OR	Respondents' education level OR	Wealth index OR	Birth order OR	BMI OR
Albania	13.04	1.66	5.00	12.21	29.73	0.24	0.96
Azerbaijan	3.51	0.65	4.46	6.05	6.31	0.41	1.44
Bangladesh	2.95	1.07	5.26	6.24	4.62	0.51	1.14
Cameroon	6.28	1.20	21.13	258.75	10.76	0.45	2.11
Egypt	2.84	1.18	4.46	5.62	4.65	0.38	1.42
Haiti	4.28	0.84	4.92	42.64	5.62	0.30	1.80
Jordan	0.56	2.69	8.08	5.21	2.36	0.93	1.59
Kenya	3.80	0.86	9.90	14.46	7.64	0.31	1.51
Lesotho	4.08	0.66	6.25	19.52	4.64	0.42	1.50
Maldives	16.14	0.17	0.64	3.76	5.30	0.13	0.95
Nepal	4.62	0.57	9.33	10.70	6.45	0.29	1.43
Pakistan	2.73	0.90	10.17	9.73	5.00	0.42	1.45
Peru	10.01	0.99	12.59	22.13	38.42	0.33	1.67
Tanzania	5.37	0.86	3.26	59.64	4.89	0.40	1.80
I^2	96.3	80.5	96.0	84.2	93.3	86.8	80.2
τ^2	0.148	0.041	0.327	0.253	0.096	0.043	0.027

ANC, antenatal care; BMI, body mass index; LMICs, low- and middle-income countries.

variation (I^2 = 84.2%) has been found for respondents' education level, and the overall OR is 11.161 (95% CI 7.910 to 15.748), which means that with an increment in education level, respondents have 11.161 times higher chance of using healthcare facilities during childbirth. For wealth index, I^2 has been found to be 93.3%, and the overall OR is 6.278 (95% CI 5.207 to 7.569), which reveals rich respondents have 6.278 times higher chance of using health facilities as a place of delivery compared with respondents who are poor. For birth order, I^2 has been found to be 86.8%, and the overall OR is 0.371 (95% CI 0.327 to 0.421).

Table 5 Random-effects model estimation (summary effect) for different variables in Bangladesh and 13 other LMICs

| | Random-effects model | | |
| | | 95% CI | |
Variables	Overall OR	Lower bound	Upper bound
Type of place of residence	4.020	3.217	5.024
Respondents' age	0.903	0.790	1.032
ANC visit	6.177	4.489	8.501
Respondents' education level	11.161	7.910	15.748
Wealth index	6.278	5.207	7.569
Birth order	0.371	0.327	0.421
BMI	1.512	1.364	1.676

ANC, antenatal care; BMI, body mass index; LMICs, low- and middle-income countries.

This suggests that respondents with more than one child have 0.371 times lower chance of using healthcare facilities. About 80.2% of the variation $\left(I^2 = 80.2\% \right)$ has been found for BMI, and the overall OR is 1.512 (95% CI 1.364 to 1.676). This suggests that respondents with a BMI that is not normal have 1.512 times higher chance of using healthcare facilities as a place of delivery.

Meta-analysis in the context of Bangladesh shown in table 5 portrayed that urban residents have 2.95 higher odds of using health facilities as the place of delivery than their rural counterparts. Likewise, respondents' age, ANC visit, respondents' education level, wealth index and BMI are positively associated with availing healthcare facilities during childbirth, with ORs of 1.07, 5.26, 6.24, 4.62 and 1.14, respectively. Here, the reference category for respondents' age is up to 20, yes for ANC visit, illiterate for respondents' education level, poor for wealth index, and normal for BMI. However, only birth order has a notable negative influence on the utilisation of healthcare facilities, with an OR of 0.51. All in all, birth order and respondents' age are the two most effective factors in the decision by respondents to avail themselves of healthcare facilities during childbirth for both the overall random-effects meta-analysis model and Bangladesh.

Figure 2 shows that in the Maldives respondents aged up to 20 are less likely to choose healthcare facilities as the place of delivery. In contrast, in Jordan the respondents show much more interest in choosing healthcare facilities. The summary estimate of this variable shows an OR of 0.90
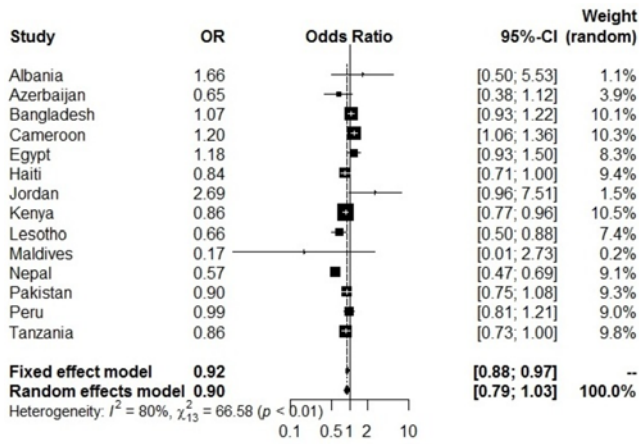
Figure 2 Forest plot for respondents' age. The size of each box indicates the weight of the study, while each crossed line refers to 95% CI.

and 95% CI of 0.79 to 1.03. Also, the overall estimate is statistically significant (p<0.01) at a 5% level of significance.

Figure 3 show a forest plot for birth order and depicts a summary estimate OR of 0.37 with 95% CI of 0.33 to 0.42, meaning that the overall estimate is statistically significant (p<0.01) at a 5% level of significance. Birth order therefore has a significant effect on non-utilisation of healthcare facilities during childbirth.

DISCUSSION

Motherhood is a memorable moment in the life of women and is positively related to the supreme goals of happiness, completeness and family integration.[32] Therefore, the decision of women to avail themselves of healthcare facilities during childbirth is very crucial and this is a definitive example.[33]

The key findings of the binary logistic regression model for Bangladesh depict that birth order and respondents' age are two significant factors for non-utilisation of healthcare facilities during childbirth. As respondents get older and birth order increases, their preference to choose healthcare facilities as the place of delivery decreases.
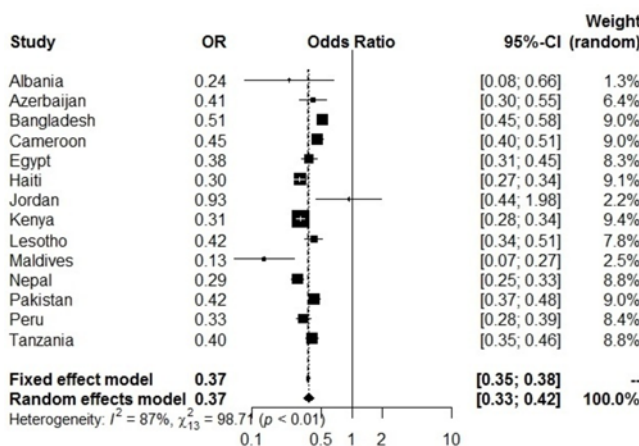

Figure 3 Forest plot for birth order. The size of each box indicates the weight of the study, while each crossed line refers to 95% CI.

The ORs of Bangladesh in both binary logistic regression and meta-analysis model for birth order are 0.57 and 0.51, respectively. The variation between these two values is negligible as they are close to each other. However, the overall OR of meta-analysis is 0.371 with an I^2 of 86.8%, which is much lower than both binary logistic regression and meta-analysis in Bangladesh. This means that multiparous women from Bangladesh tend to avail themselves of healthcare facilities more when compared with the overall meta-analysis model. Altogether the improvement of this factor is a dying need, especially in Maldives, Nepal and Albania. Primiparous women usually have a higher risk of pregnancy complications than multiparous women.[34] These primiparous women have a higher probability of accessing institutional delivery than multiparous women who have a preference for traditional birth attendants (TBAs).[35 36] Homogeneous results have been seen in previous literature.[37–41] On the flip side, when multiparous women had their first childbirth safely at home, they became less fearful about this and preferred to avoid facility delivery compared with primiparous women.[19 42]

Furthermore, the OR of respondents' age in Bangladesh for both models has a visible difference. The risk of mortality for both the mother and the child does not get any less as they grow older; the truth is the risk remains the same. The overall OR from meta-analysis for this factor is 0.903 with an I^2 of 80.5%, which suggests that respondents from Bangladesh aged above 20 are more likely to use healthcare facilities in comparison with the overall meta-analysis. Country-wise, respondents from Maldives aged above 20 have the lowest and Jordan the highest chance of choosing healthcare facilities for childbirth. Due to advancements in medicine and women's education in recent years, younger women are able to expand and update their knowledge regarding healthcare facilities and put their faith in contemporary medication rather than healthcare facilities.[43–45]

Also, respondents from rich families tend to have their children delivered at healthcare facilities because they have more social resources and can pick any facilities that offer healthcare services. It has also been observed that 70% of childbirths occur at home for the lowest two wealth indexes.[46] The most common reason for not delivering in a facility is quoted by the head of the household as 'not necessary', and this is influenced by the social and cultural beliefs at the household and community levels.[47] Research consistently showed that poor families could not bear the cost, and this is also an important constraint on service utilisation.[34 42 43 48–50] In the meta-analysis, Bangladesh has the second lowest OR to choose a health facility as the place of delivery than other selected countries. Due to the affordable cost and the benefit of payment negotiation, low-income families tend to undergo childbirth at home with the assistance of untrained TBAs.[51] By reducing out-of-pocket expenses for institutional delivery, this behaviour can be minimised especially for the poor.[52] Also, it requires time to change this practice, and maximum efforts should be made towards enhanced training of these birth attendants so that they can help during childbirth at home and make

referrals to the nearest healthcare facility when needed.[53] Yet there are some reasons why a larger number of women still have birth at home rather than at a healthcare facility. Among them, sudden labour pain, distance from home to healthcare facility and poor availability of transport are the noteworthy ones mentioned by women who had childbirth at home.[54–56]

To reduce the high maternal mortality rate in LMICs, the master plan can include easily reachable and accurate care for pregnancy complications and beneficial postnatal care within the first 24 hours of delivery.[57 58] Furthermore, the global health community has introduced two interventions to reduce maternal mortality. An emergency obstetric care service is the first intervention and is highly effective at reducing mortality from postpartum haemorrhage, infection, pre-eclampsia, obstructed labour and a range of other causes.[59] The second is community-based interventions for TBAs, which will provide them with intensive training and a chance to build better and stronger relationships with referral networks.[60] The key strategy for Bangladesh is to promote the rate and benefits of institutional delivery to reduce the burden of maternal and child mortality, with the aim of attaining maternal and child health-related goals, as suggested by previous studies.[26 61–63]

This study has some limitations and strengths. The first limitation is that we could only collect data from 14 of the 91 countries from the DHS database due to the requirement for authorised permission. The second limitation is that the DHS data used in this study covered a wider location and time points, which added selection bias. The third limitation is that each variable was categorised into two categories, and then a 2×2 cross-tabulation table was performed to calculate the OR. Also, we were not able to include all the potential risk factors due to missing values or the insignificance of particular independent variables in any of these countries. This can also cause bias.

However, despite these limitations, the strength of our study is that we innovatively used a special mixed-method design: we combined cross-sectional data based on national surveys with the meta-analysis data of 14 LMICs. New knowledge and insights were generated through their integration. This is a breakthrough in mixed-method methodology. By using this innovation, we effectively expanded the external validity of cross-sectional surveys and created a new research approach.

CONCLUSION

Institutional delivery is doubtlessly a vital factor for the reduction of maternal mortality and morbidity. This study rigorously recognised the dominance in the increment of respondents' age and birth order. The attitude and beliefs of multiparous women and the misconceptions surrounding increased age need change. Also, free-of-cost health schemes for poor families need to be introduced to reduce both maternal and child mortality. If incentives regarding institutional delivery can be implemented, then the targeted maternal mortality ratio of the Sustainable Development Goals can be fulfilled by 2030.

ORCID iD
Henry Ratul Halder http://orcid.org/0000-0002-1362-3077

REFERENCES

1 World Health Organization. Maternal mortality, 2016. Available: https://www.who.int/gho/maternal_health/mortality/maternal/en/ [Accessed Jan 2018].
2 Govindasamy P, Ramesh B. *Maternal education and the utilization of maternal and child health services in India*. Mumbai, India: Internat. Inst. for Population Sciences, 1997.
3 Khatun F, Rasheed S, Moran AC, *et al*. Causes of neonatal and maternal deaths in Dhaka slums: implications for service delivery. *BMC Public Health* 2012;12.
4 Målqvist M, Sohel N, Do TT, *et al*. Distance decay in delivery care utilisation associated with neonatal mortality. A case referent study in northern Vietnam. *BMC Public Health* 2010;10.
5 Alvarez JL, Gil R, Hernández V, *et al*. Factors associated with maternal mortality in sub-Saharan Africa: an ecological study. *BMC Public Health* 2009;9.
6 Abosse Z, Woldie M, Ololo S. Factors influencing antenatal care service utilization in Hadiya zone. *Ethiop J Health Sci* 2010;20:75–82.
7 USAID A. Focused antenatal care: providing integrated, individualized care during pregnancy. Available: http://www.accesstohealth.org/toolres/pdfs/ACCESStechbrief_FANC.pdf
8 World Health Organization. *New guidelines on antenatal care for a positive pregnancy experience. Sexual and reproductive health*. World Health Organization, 2016.
9 Medecins SANS Frontieres, 2012. Available: https://www.msf.org.uk/sites/uk/files/Maternal_Death__The_Avoidable_Crisis_201203145518.pdf [Accessed Jan 2018].
10 National Institute of Population Research and Training (NIPORT), Mitra and Associates, and Macro International. *Bangladesh demographic and health survey 2009*. Dhaka: NIPORT, Mitra and Associates, and ICF International.
11 Lwelamira J, Safari J. Choice of place for childbirth: prevalence and determinants of health facility delivery among women in Bahi district, central Tanzania. *Asian Journal of Medical Sciences* 2012;4:105–12.
12 Yegezu RT, Kitila SB. Assessment of factors affecting choice of delivery place among pregnant women in Jimma zone, South West Ethiopia: cross sectional study. *J Women's Health Care* 2014;4:2167–420.
13 Srivastava H, Das A. Factors governing maternal health care utilization in India: a cross cultural comparison. Available: www.safemotherhoodinitiative.org
14 World Health Organization. *World health statistics 2016: monitoring health for the SDGs sustainable development goals*. World Health Organization, 2016.
15 Alkema L, Chou D, Hogan D, *et al*. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with

scenario-based projections to 2030: a systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. *The Lancet* 2016;387:462–74.

16 Chinkhumba J, De Allegri M, Muula AS, *et al*. Maternal and perinatal mortality by place of delivery in sub-Saharan Africa: a meta-analysis of population-based cohort studies. *BMC Public Health* 2014;14:1014.

17 Tura G, Fantahun M, Worku A. The effect of health facility delivery on neonatal mortality: systematic review and meta-analysis. *BMC Pregnancy Childbirth* 2013;13:18.

18 Maniruzzaman M, Suri HS, Kumar N, *et al*. Risk factors of neonatal mortality and child mortality in Bangladesh. *J Glob Health* 2018;8.

19 Kamal SMM, Hassan CH, Alam GM. Determinants of institutional delivery among women in Bangladesh. *Asia Pac J Public Health* 2015;27:NP1372–88.

20 Yaya S, Bishwajit G, Ekholuenetale M. Factors associated with the utilization of institutional delivery services in Bangladesh. *PLoS One* 2017;12:e0171573.

21 Ahmed S, Hill K. Maternal mortality estimation at the subnational level: a model-based method with an application to Bangladesh. *Bull World Health Organ* 2011;89:12–21.

22 Anwar I, Sami M, Akhter N. Inequity in maternal health-care services: evidence from home-based skilled-birth-attendant programmes in Bangladesh. *Bull World Health Organ* 2008;86:252–9.

23 Hossain MI. Inequality in the utilization of maternal care and the impact of a macroeconomic policy: evidence from Bangladesh. *HEDG worNing paper* 2010;10.

24 Chowdhury ME, Ahmed A, Kalim N, *et al*. Causes of maternal mortality decline in Matlab, Bangladesh. *J Health Popul Nutr* 2009;27:108.

25 Sarker BK, Rahman M, Rahman T, *et al*. Reasons for preference of home delivery with traditional birth attendants (TBAs) in rural Bangladesh: a qualitative exploration. *PLoS One* 2016;11:e0146161.

26 National Institute of Population Research and Training (NIPORT), Mitra and Associates, and Macro International. *Bangladesh demographic and health survey*. Dhaka: NIPORT, Mitra and Associates, and ICF International, 2013.

27 National Heart, Lung, and Blood Institute. *Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: the evidence report*.

28 Cox D. The regression analysis of binary sequences. *J R Stat Soc: Series B* 1958;20:215–32.

29 Rücker G, Schwarzer G, Carpenter JR, *et al*. Undue reliance on I 2 in assessing heterogeneity may mislead. *BMC Med Res Methodol* 2008;8:79.

30 Borenstein M, Hedges LV, Higgins JPT, *et al*. A basic introduction to fixed-effect and random-effects models for meta-analysis. *Res Synth Methods* 2010;1:97–111.

31 DerSimonian R, Laird N. Meta-analysis in clinical trials. *Control Clin Trials* 1986;7:177–88.

32 Nyarko SH, Amu H. Self-Reported effects of infertility on marital relationships among fertility clients at a public health facility in Accra, Ghana. *Fertility Research and Practice* 2015;1.

33 Sialubanje C, Massar K, Hamer DH, *et al*. Understanding the psychosocial and environmental factors and barriers affecting utilization of maternal healthcare services in Kalomo, Zambia: a qualitative study. *Health Educ Res* 2014;29:521–32.

34 AN ML, Malonga F, Dramaix-Wilmet M, *et al*. Determinants of maternal health services utilization in urban settings of the Democratic Republic of Congo–a case study of Lubumbashi City. *BMC pregnancy and childbirth* 2012;12:66.

35 Puthuchira Ravi R, Athimulam Kulasekaran R, Ravi RP. Does socio-demographic factors influence women's choice of place of delivery in rural areas of Tamilnadu state in India. *Am J Public Health Res* 2014;2:75–80.

36 Esena RK, Sappor MM. Factors associated with the utilization of skilled delivery services in the GA East Municipality of Ghana Part 2: barriers to skilled delivery. *Int J Sci Tech Res* 2013;2:195–207.

37 Gabrysch S, Campbell OMR. Still too far to walk: literature review of the determinants of delivery service use. *BMC Pregnancy Childbirth* 2009;9:34.

38 Tebekaw Y, James Mashalla Y, Thupayagale-Tshweneagae G. Factors Influencing women's preferences for places to give birth in Addis Ababa, Ethiopia. *Obstet Gynecol Int* 2015;2015:1–7.

39 Ononokpono DN, Odimegwu CO. Determinants of maternal health care utilization in Nigeria: a multilevel approach. *Pan Afr Med J* 2014;17.

40 Tann CJ, Kizza M, Morison L, *et al*. Use of antenatal services and delivery care in Entebbe, Uganda: a community survey. *BMC Pregnancy Childbirth* 2007;7:23.

41 Simfukwe ME. Factors contributing to home delivery in Kongwa District, Dodoma - September 2008. *Dar Es Salaam Medical Students' Journal* 2011;18:13–22.

42 Do M, Soelaeman R, Hotchkiss DR. Explaining inequity in the use of institutional delivery services in selected countries. *Matern Child Health J* 2015;19:755–63.

43 Stanton C, Blanc ANNK, Croft T, *et al*. Skilled care at birth in the developing world: progress to date and strategies for expanding coverage. *J Biosoc Sci* 2007;39:109–20.

44 Mpembeni RNM, Killewo JZ, Leshabari MT, *et al*. Use pattern of maternal health services and determinants of skilled care during delivery in southern Tanzania: implications for achievement of MDG-5 targets. *BMC Pregnancy Childbirth* 2007;7:29.

45 Chakraborty N, Islam MA, Chowdhury RI. Determinants of the use of maternal health services in rural Bangladesh. *Health Promot Int* 2003;18:327–37.

46 Bustreo F, Harding A, Axelsson H. Can developing countries achieve adequate improvements in child health outcomes without engaging the private sector? *Bull World Health Organ* 2003;81:886–95.

47 Montagu D, Yamey G, Visconti A, *et al*. Where do poor women in developing countries give birth? A multi-country analysis of demographic and health survey data. *PLoS One* 2011;6:e17155.

48 Houweling TAJ, Ronsmans C, Campbell OMR, *et al*. Huge poor–rich inequalities in maternity care: an international comparative study of maternity and child care in developing countries. *Bull World Health Organ* 2007;85:745–54.

49 Kruk ME, Rockers PC, Mbaruku G, *et al*. Community and health system factors associated with facility delivery in rural Tanzania: a multilevel analysis. *Health Policy* 2010;97:209–16.

50 Say L, Raine R. A systematic review of inequalities in the use of maternal health care in developing countries: examining the scale of the problem and the importance of context. *Bull World Health Organ* 2007;85:812–9.

51 Atiqul Hoque Chowdhury M, Mehedi Hasan M, Ahmed S, *et al*. Socio-demographic factors associated with home delivery assisted by untrained traditional birth attendant in rural Bangladesh. *Am J Public Health Res* 2013;1:226–30.

52 Pal S. Impact of hospital delivery on child mortality: an analysis of adolescent mothers in Bangladesh. *Soc Sci Med* 2015;143:194–203.

53 Shabnam J, Gifford M, Dalal K. Socioeconomic inequalities in the use of delivery care services in Bangladesh: a comparative study between 2004 and 2007. *Health* 2011;03:762–71.

54 Envuladu EA, Agbo HA, Lassa S, *et al*. Factors determining the choice of a place of delivery among pregnant women in Russia village of Jos North, Nigeria: achieving the MDGs 4 and 5. *Int J Med Biomed Res* 2013:23–7.

55 Babalola S, Fatusi A. Determinants of use of maternal health services in Nigeria - looking beyond individual and household factors. *BMC Pregnancy Childbirth* 2009;9.

56 Idris S, Gwarzo U, Shehu A. Determinants of place of delivery among women in a semi-urban settlement in Zaria, Northern Nigeria. *Ann Afr Med* 2006;5:68–72.

57 Ngowi AF, Kamazima SR, Kibusi S, *et al*. Women's determinant factors for preferred place of delivery in Dodoma region Tanzania: a cross sectional study. *Reprod Health* 2017;14:112.

58 Adegoke AA, van den Broek N. Skilled birth attendance-lessons learnt. *BJOG* 2009;116:33–40.

59 Bhutta ZA, Ali S, Cousens S, *et al*. Interventions to address maternal, newborn, and child survival: what difference can integrated primary health care strategies make? *Lancet* 2008;372:972–89.

60 Lewin S, Lavis JN, Oxman AD, *et al*. Supporting the delivery of cost-effective interventions in primary health-care systems in low-income and middle-income countries: an overview of systematic reviews. *Lancet* 2008;372:928–39.

61 Anwar I, Kalim N, Koblinsky M. Quality of obstetric care in public-sector facilities and constraints to implementing emergency obstetric care services: evidence from high- and low-performing districts of Bangladesh. *J Health Popul Nutr* 2009;27:139.

62 Yaya S, Bishwajit G, Shah V. Wealth, education and urban–rural inequality and maternal healthcare service usage in Malawi. *BMJ Global Health* 2016;1:e000085.

63 Bishwajit G, Tang S, Yaya S, *et al*. Factors associated with male involvement in reproductive care in Bangladesh. *BMC Public Health* 2017;17:3.