



# Multilevel Analysis of Skilled Birth Attendant after ANC Follow Up in Ethiopia, 2023: Based on Ethiopian Mini Demographic and Health Survey Data

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## Abstract

**Introduction:** Receiving skilled health professional's care before, during and after childbirth is a key intervention to prevent maternal and newborn deaths. Despite the efforts being made by the Government of Ethiopia and other stakeholders to increase the institutional delivery by skilled birth attendant, most Ethiopian women are giving birth at home and skilled birth attendant remains low. Therefore, the main objective of our research was to determine the magnitude and to identify the positional predictors of skilled birth attendant among mother who gave birth after having ANC follow up.

**Methods:** An in-depth secondary data analysis was performed using the Interim Ethiopian Demographic and Health Survey (EMDHS) 2019 data set. A weighted sample of 2,888 mothers was included in the final analysis. Four models were fitted. Variables with p-value  $\leq 0.25$  in the bi-variable multilevel logistic regression model were included in the multivariable multilevel logistic regression model. The Adjusted Odds Ratio (AOR) with a 95% Confidence Interval (95% CI) was computed. Variables with a P-value of less than 0.05 in the multi-variable multilevel logistic regression were declared as statistically significant predictors.

**Result:** The overall magnitude of skilled birth attendance was 65.03% (CI: 63.3, 66.75). Residence (Rural; AOR: 0.32; 95% CI: 0.16, 0.65), educational status (No education; AOR: 0.33; 95% CI: 0.16, 0.72), religion (Muslim; AOR: 2.17; 95% CI: 1.30, 3.59, protestant; AOR: 0.57; 95% CI: 0.36, 0.90 and Others; AOR: 0.21; 95% CI: 0.07, 0.65), wealth index (Poor; AOR: 0.44; 95% CI: 0.32, 0.60, middle; AOR: 0.60; 95% CI: 0.44, 0.82), frequency of ANC visits (One ANC visit; AOR: 0.19; 95% CI: 0.11, 0.33, 2-3 ANC visits; AOR: 0.57; 95% CI: 0.45, 0.70), parity (Para 1; AOR: 3.11; 95% CI: 1.85, 5.25), community contraceptive use (High proportion of contraceptive non-use; AOR: 0.50; 95% CI: 0.29, 0.88), and age at first birth ( $\leq 15$ ; AOR: 1.38; 95% CI: 1.01, 1.89) are statistically significant factors.

**Conclusion:** The utilization of skilled birth attendant service is very low. We found that a higher level of women's, education, higher household wealth index, younger age at first birth, primipara, being a rural resident, living in a community with high proportion of contraceptive non-use and having few numbers of ANC visit were significant predictors of SBA. Therefore, improving women's education and household wealth, giving special attention for teenagers and primipara women as well as encouraging pregnant mothers to have frequent ANC visits are vital for the health policies aiming to increase SBA services utilizations in Ethiopia.

**Keywords:** Skilled birth attendant; ANC follow up; Ethiopia

## Abbreviations

AIC: Akaike's: Information Criterion; ANC: Ante Natal Care; AOR: adjusted Odds Ratio; BIC: Bayesian Information Criterion; CI: Confidence Interval; COR: Crude Odds ratio; EDHS: Ethiopia Demographic and Health Survey; ICC: Intra Class Correlation; MOR: Median Odds Ratio; PCV: Proportional Change in Variance; SBA: Skilled Birth Attendance; and WHO: World Health Organization

## Introduction

According to 2023 report of World Health Organization (WHO), about 800 women died from

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preventable causes related to pregnancy and childbirth every day [1]. The joint report of WHO, UNICEF, UNFPA, World Bank Group witnessed the reduction of maternal mortality due to pregnancy and childbirth related complications from 342 deaths per 100,000 live births in 2000 to 211 deaths per 100,000 live births in 2017 [2]. Nearly 95% of all maternal deaths occurred in low and lower middle-income countries [1]. Only sub-Saharan Africa region consisted of 62% death of universal mortalities [2].

According to WHO, skilled birth attendants are accredited health professionals like midwives, doctors, or nurses who have been educated and trained to manage normal pregnancies, childbirths and the immediate postnatal period, as well as the identification, management, and referral of complications in women and newborns [3]. The overall prevalence of Skilled Birth Attendance (SBA) in sub-Saharan African countries was 63.0% [4]. About 67.18% of SBA occurs in East African countries with the highest in Rwanda (90.68%) and the lowest in Tanzania (11.91%) [5]. The percentage of live births delivered by skilled providers in the 2005 EDHS, in the 2011 EDHS, in the 2016 EDHS, and in the 2019 EMDHS was 6%, 11%, 28% and 50% respectively. A similar trend was observed for the percentage of live births that occurred in a health facility, which increased from 5% in 2005 to 48% in the 2019 EMDHS [6].

Receiving skilled health professional's care before, during and after childbirth can considerably decrease maternal and neonatal mortality and improves birth outcomes by facilitating early detection of complications during the birth process and allows timely management [1,7]. Increased availability of skilled birth attendant during childbirth is a key intervention to prevent maternal and newborn deaths [7].

Skilled Birth Attendance (SBA) is largely influenced by socioeconomic, cultural and other related factors [8]. Residence [5,7-12], ANC visits [5,7-9,12], health education on ANC [9], decision on place of delivery with her partner [7,9], media exposure [8], higher decision making power [8], maternal education [5,7,8,10-12], husband/partner education [5,11,12], religion [8], wealth index [5,8,10-12], wife beating attitude [8], parity [5,8], travel time [5,7], birth preparedness and complication readiness [7], knowledge on obstetric danger signs after delivery [7] and knowledge of presence of maternity waiting home [7] were more frequently reported significant predictors of SBA.

Sustainable Development Goal (SDG) goal 3 target 3.1 targeted reduction of maternal mortality ratio less than 70 per 100,000 live births by 2030 [13]. Since then, Ethiopia adopted the SDGs and aspires to achieve these goals and targets. In the national five years Health Sector Transformation Plan (HSTP\_I), the Ethiopian government set a target of reducing Maternal Mortality Ratio (MMR) from 420 to 199/100,000 live births between 2015 and 2020. Thus, a set of high impact interventions and strategies including family planning, focused ANC, skilled birth service, early postnatal care, improved health facility coverage, and expansion of emergency obstetric services are being implemented to reduce maternal mortality [14]. In the HSTP\_II, Ethiopia planned to increase deliveries attended by skilled health personnel from 50% to 76% [15]. Despite thus efforts being made by the government of Ethiopia and other stakeholders to increase the institutional delivery by skilled birth attendant, studies in different parts of the country are showing that most Ethiopian women are giving birth at home and SBA remains low [7,11,16,17]. Even though, there are many studies conducted in Ethiopia on SBA

[7,10,11,16-21], most of those were local evidences [7,16,18-21], few of them used national data but somewhat older that is EDHS 2016 [11,17] and only one national study [10], used the 2019 EMDHS for trend analysis. This study is different from all the above-mentioned Ethiopian studies. Because, this evidence was generated using the most recent Ethiopian demographic data (EMDHS, 2019) using advanced statistical modeling and the population for the current study was delivered mothers after they had at least one ANC visit for the most recent pregnancy. While the study participants for the previous studies were all delivered mothers irrespective of their ANC follow up status. In Ethiopia, there is a huge gap between ANC follow up and skilled birth attendant. In the 2019 EMDHS 74% of women received an ANC at least once for their last pregnancy while only 50% were delivered by a skilled provider [6]. Mothers who had ANC follow up are expected to deliver in the health facility by skilled providers. Therefore, the main objective of our research was to determine the magnitude and to identify the positional predictors of SBA among mother who gave birth after having ANC follow up. The evidences from this study will provide insights to the development of strategies and policies to improve skilled delivery service uptake, and corresponding declines in maternal morbidity and mortality.

## Materials and Methods

### Study setting, Study Design, period and sampling

This study was conducted in Ethiopia using Ethiopian Mini Demographic and Health Survey data (EMDHS, 2019). The sampling technique in 2019 EMDHS was a stratified, two stages. Each region was stratified into urban and rural areas. Implicit stratification and proportional allocation were achieved at each of the lower administrative levels by sorting the sampling frame within each sampling stratum. Data collection took place over a 3-month period, from March 21<sup>st</sup>, 2019, to June 28<sup>th</sup>, 2019. The detailed sampling method has been explained in the EMDHS [6].

### Data source and study population

We have used Birth Record (BR) data set of EMDHS 2019 for this study. The data was accessed from the measure DHS website (<http://www.measuredhs.com>). From a total of 3,979 interviewed mothers, 2,907 women had ANC follow up for their most recent pregnancy. After weighting, a total of 2,888 women were included in the final analysis. All the frequencies and percentages in the result section were weighted.

### Variables and measurement

The outcome variable was skilled birth attendance. It was dichotomized as (yes/no). A woman was considered as having skilled birth attendance, if the delivery was followed by any of the following health care professionals (doctor, public health officer, nurse, mid wife and trained health extension workers). Mothers were asked whether they had obtained antenatal care during the pregnancy for their most recent live birth in the 5 years preceding the survey. For each live birth over the same period, mothers were also asked what type of assistance they received at the time of delivery [6]. The independent variables were grouped under individual-level variables and community level variables. Individual level variables include age, marital status, educational status, and religion, and wealth index, age at first birth, frequency of ANC visit, parity, contraceptive use, and sex of household head. Whereas community level variables include residence, community wealth, community education, community level contraceptive use, community percentage of marriage,

community and community working status.

## Operational Definitions

### Individual level variables

**Educational status of women:** This variable was divided into four categories: No education primary, secondary and higher education.

**Wealth index:** In the dataset, the wealth index was categorized as Poorest, Poorer, Middle, Richer, and Richest. In this study, a new variable was generated with three categories as "Poor", "Middle" and "Rich" by merging poorest with poorer and richest with richer.

**Religion:** In the data set, religion was categorized as Orthodox, Muslim, Protestant, Catholic, traditional followers and others. In this study, the former three were encoded independently and Catholic and traditional religion followers were merged into the "others" category.

### Community level variables

Community-level variables were computed by aggregating the individual level women's characteristics into clusters. Then the proportion was calculated by dividing subcategories by the total. Distributions of the proportion of aggregate variables were checked using the Shapiro-Wilk normality test and were normally distributed. Therefore, these aggregate variables were categorized using the mean value. Seven community variables were generated. A residence was taken as a community-level variable. Therefore, a total of eight community variables were tested (Residence, Community wealth, Community education, Community level marriage, Community ANC visits frequency, Community contraceptive use, Community level parity and Community level age at first birth).

### Data processing and analysis

Descriptive statistics such as frequencies and percentages were computed once the data had been cleaned. We used Stata software to analyze the data. Sampling weights were used to account for the sample's non-proportional strata allocation and non-responses. Individuals were nested inside communities in the EDHS data, and the Intra-Class Correlation Coefficient (ICC) was 36.90%. To evaluate the independent (fixed) effects of the explanatory variables as well as the community-level random effects on the outcome variable, a two-level mixed-effects logistic regression model was fitted. Multi-co linearity was checked and no variables with a variance inflation factor greater than 10 found. We fitted four models (Null Model (no factors), Model 1 (only individual level factors), Model 2 (only community-level factors), and Model 3 (both individual and community-level factors)). Variables with a p-value of  $\leq 0.25$  from the bi-variable multilevel logistic regression analysis were included in the multivariable multilevel logistic regression analysis. The Adjusted Odds Ratio (AOR) with a 95% Confidence Interval (95% CI) was computed. Variables with a P-value of less than 0.05 in the multivariable multilevel logistic regression analysis in the final model were declared as statistically significant determinants of skilled birth attendance.

## Result

In this study, a total of 2,888 weighted mothers were involved. The mean ( $\pm$  SD) age of respondents was 28.40 ( $\pm$  6.42). Two thousand seven hundred twenty-one (94.2 %) were currently married women. The majority of study participants, 1250 (43.30%) had no formal education. About 21% of respondents gave birth for the first time before their 16<sup>th</sup> birthday. Nearly half, 1339 (46.40%) of the study

participants were in the rich economic class. Almost half (49.94%) of the respondents are contraceptive non users. More than half (58.33%) of the respondents had at least four antenatal care visits (Table 1).

More than two third, 69.95% of the study participants were rural dwellers. About 38% of the participants were from communities with a high proportion of poor economic status. Nearly half, 48.99% of respondents were from communities with a high proportion of single parity. About 46.30% of respondents were from communities with a high proportion of birth at age less than 18-year-old (Table 2).

### Skilled birth attendance

From the total respondents, 65.03% (CI: 63.3, 66.75) had skilled birth attendance. This result greatly varied across different characteristics of respondents. About 41 % rural women had skilled birth attendance while about 24% of urban had skilled birth attendance. 37.73% of rich women had SBA compared to 16.02% of poor women. When we saw their ANC frequency, 43.08% of women who had four and above visit had SBA while only 1.34% of women who had only one ANC visit had SBA. About 45% of women from community with low proportion of poorness had skilled birth attendance compared to nearly 20% of women from community with high proportion of poorness (Table 1, 2).

### Model selection

Multilevel mixed effect logistic regression model was fitted. The measures of variations or random effects were reported using Intra-Class Correlation (ICC), a Proportional Change in Variance (PCV), and Median Odds Ratio (MOR). The ICC was used to show how much the observation within one cluster resembled each other and it was generated directly from each model using "estat ICC" command following regression. PCV was computed as [22] and MOR was used as measure of unexplained cluster heterogeneity and it was calculated using the formula [22] where "VA" represents the area or cluster level variance for each model. The model comparison was done using Akaike's Information Criterion (AIC). The model with smallest AIC was selected. Therefore, model III was the best fit model with AIC 2677.165 (Table 3).

### Determinants of skilled birth attendance

In this study residency, education, religion, wealth, age at first birth, parity, number of ANC visits, and community level contraceptive use were statistically significant predictors of Skilled Birth Attendance (SBA).

The odds of SBA among non-educated mothers were reduced by 67% (No education; AOR: 0.33; 95% CI: 0.16, 0.72) compared to mothers who had higher education. The odds of SBA among Muslim mothers were 2.17 (Muslim; AOR: 2.17; 95% CI: 1.30, 3.59) times higher compared to orthodox mothers. The odds of SBA among Protestant mothers were reduced by 43% (Muslim; AOR: 0.57; 95% CI: 0.36, 0.90) compared to orthodox mothers. The odds of SBA among Mothers in the other category was reduced by 79% (Other; AOR: 0.21; 95% CI: 0.07, 0.65) compared to orthodox mothers.

The odds of SBA among poor mothers were reduced by 56% (poor; AOR: 0.44; 95% CI: 0.32, 0.60) and the odds of SBA among mothers in the middle wealth index was reduced by 40% (middle; AOR: 0.60; 95% CI: 0.44, 0.82) compared to rich mothers. The odds of SBA among mothers who gave birth on and before their 15<sup>th</sup> birthday was increased by 38 % ( $\leq 15$ ; AOR: 1.38; 95% CI: 1.01, 1.89) compared to mother who gave birth after their 18<sup>th</sup> birthday.

**Table 1:** Individual level characteristics and skilled birth attendance distribution (n=2888), Ethiopia 2019.

Variables	Categories	Frequency (%)	Skilled birth attendance (%)	
			No (%)	Yes (%)
Age	15-19	151 (5.22)	48 (1.66)	103 (3.56)
	20-24	601(20.8)	156 (5.40)	445 (15.40)
	25-29	934 (32.35)	331 (11.46)	603 (20.89)
	30-34	592 (20.50)	230 (7.96)	362 (12.54)
	35-39	406 (14)	156 (5.40)	250 (8.60)
	40-44	157 (5.44)	73 (2.54)	84 (2.90)
	45-49	47 (1.64)	16 (0.56)	31 (1.08)
Current marital status	Currently married	2721 (94.2)	955 (33.06)	1766 (61.14)
	Currently not married	167 (5.8)	55 (1.91)	112 (3.88)
Educational status	No education	1250 (43.30)	587(20.33)	663 (22.94)
	Primary	1151 (39.86)	368 (12.76)	783 (27.10)
	Secondary	335 (11.60)	42 (1.44)	293 (10.15))
	Higher	152 (5.20)	13 (0.44)	139 (4.84)
Wealth index	Poor	974 (33.72)	511 (17.7)	463 (16.02)
	Middle	575 (19.94)	250 (8.66)	325 (11.28)
	Rich	1339 (46.40)	249 (8.61)	1090 (37.73)
Religion	Orthodox	1,203 (41.64)	381 (13.17)	822 (28.47)
	Muslim	872 (30.18)	259 (8.96)	613 (21.23)
	Protestant	784 (27.16)	351 (12.16)	433 (15)
	Others <sup>a</sup>	29 (1.03)	20 (0.70)	9 (0.33)
Age at first birth	≤ 15	610 (21.13)	252 (8.73)	358 (12.40)
	16-18	833 (28.85)	335 (11.62)	498 (17.23)
	>18	1,445 (50.02)	423 (14.62)	1022 (35.40)
Contraceptive use	No	1,442 (49.94)	584 (20.21)	858 (29.73)
	Yes	1,446 (50.06)	426 (14.76)	1020 (35.30)
Sex of HHH	Male	2,506 (86.76)	905 (31.33)	1601 (55.43)
	Female	382 (13.25)	105 (3.65)	277 (9.6)
Parity	1	686 (23.73)	115 (3.97)	571 (19.76)
	45018	1,348 (46.68)	485 (16.78)	864 (29.90)
	≥ 5	854 (29.58)	410 (14.22)	444 (15.36)
Number of ANC visits	1	126 (4.36)	87 (3.01)	39 (1.34)
	44987	1,078 (37.32)	483 (16.71)	595 (20.61)
	≥ 4	1,684 (58.33)	440 (15.25)	1244 (43.08)

ANC: Ante Natal Care; HHH: Household Head; Others <sup>a</sup>: Catholic, traditional and others

The odds of SBA among Para one mothers were 3.11 (Para 1; AOR: 3.11; 95% CI: 1.85, 5.25) times higher compared to Para 5 and above mothers. The odds of SBA among mothers who had only one ANC visit was reduced by 81% (One ANC visit; AOR: 0.19; 95% CI: 0.11, 0.33) and the odds of SBA among mothers who had 2 up to 3 ANC visits reduced by 43% (2 to 3 ANC visits; AOR: 0.57; 95% CI: 0.45, 0.70) compared to mothers who had four and above ANC visits.

The odds of SBA among mothers in rural residency was reduced 68% (Rural; AOR: 0.32; 95% CI: 0.16, 0.65) compared to urban mothers. The odds of SBA among mothers in a community with high proportion of contraceptive non-use was reduced by 50% (High proportion of contraceptive non-use; AOR: 0.50; 95% CI: 0.29, 0.88) compared to their counter parts.

## Discussion

The overall objective of this study was to determine the magnitude and to identify the determinant of SBA among delivered mothers after who had ANC follow up for their most recent pregnancy in Ethiopia. From the total respondents, 65.03% (CI: 63.3, 66.75) of mothers had SBA. This finding was lower than studies conducted in East Africa (67.18%) [5], and in Northern Ethiopia (95.85%) [20]. The possible explanation for this discrepancy could be the difference in the methodology and population. The finding from east Africa was the pooled prevalence of 12 east African countries in which there are outliers [5]. The finding from Northern Ethiopia was from longitudinal study in which many interventions such as health service promotion and the strong referral linkage of pregnant women from community to health facilities were implemented at different times

**Table 2:** Community level characteristics and skilled birth attendance distribution (n=2888), Ethiopia 2019.

Variables	Categories	Frequency (%)	Skilled birth attendance (%)	
			No (%)	Yes (%)
Residence	Urban	868 (30.04)	163 (5.63)	705 (24.41)
	Rural	2,020 (69.95)	847 (29.34)	1173 (40.61)
Community wealth	Low proportion of poor	1,792 (62.03)	492 (17.05)	1299 (44.98)
	High proportion of poor	1,096 (37.96)	517 (17.92)	579 (20.04)
Community education	Low proportion No education	1,611 (55.77)	448 (15.52)	1163 (40.25)
	High proportion of No education	1,277 (44.23)	562 (19.46)	715 (24.77)
Community level marriage	Low proportion of marriage	1,051 (36.40)	334 (11.57)	717 (24.83)
	High proportion of marriage	1,837 (63.60)	676 (23.4)	1161 (40.19)
Community ANC visits frequency	Low proportion of single ANC visit	1,800 (62.31)	569 (19.68)	1231 (42.63)
	High proportion of single ANC visit	1,088 (37.69)	441 (15.29)	647 (22.39)
Community contraceptive use	Low proportion of contraceptive non use	1,788 (61.91)	522 (18.07)	1266 (43.84)
	High proportion of contraceptive non use	1,100 (38.09)	488 (16.90)	612 (21.19)
Community level parity	Low proportion of single parity	1,473 (51.01)	664 (22.98)	809 (28.03)
	High proportion of single parity	1,415 (48.99)	346 (11.99)	1069 (37.00)
Community level age at first birth	Low proportion of birth at age less than 18.	1,551 (53.70)	441 (15.26)	1110 (38.44)
	High proportion of birth at age less than 18.	1,337 (46.30)	569 (19.71)	768 (26.59)

ANC: Ante Natal Care

**Table 3:** Random effect and model of two-level mixed effect logistic regression models predicting skilled birth attendance, Ethiopia 2019.

Parameters	Null model	Model III (final model)
Community Variance (SE)	3.11 (0.47)	1.93 (0.32)
AIC	3006.315	2677.165
BIC	3018.265	2874.336
ICC	48.60%	36.90%
PCV	Reference	0.938
MOR	4.56	3.59
Log likelihood	-1501.16	-1305.58

ICC: Intra Class Correlation; PCV: Proportional Change in Variance; MOR: Median Odds Ratio

[20]. This finding was comparable with studies conducted in Cameroon (66.2%) [8] and Togo 66.67% [23]. The finding was much higher than studies conducted in Ghana (45.3%) [24], in Niger (32.6%) [25], in Mali (39.9%) [25], in Sierra Leone (45.2%) [25], in southeast Ethiopia (29.2%) [7], Bangladesh (35.9%) [12], in sub-Saharan African countries (53%) [26], and Nepal (48%) [27]. This discrepancy could be due to the difference in the study population. Most of the above listed studies included all delivered women irrespective their ANC follow up status. But our study included all delivered women who had at least one ANC visit for the recent pregnancy. It is obvious that ANC follow up gave opportunities to get adequate counselling and information, and health education about the advantage of skilled birth attendance. As a result, women will get behavioral change towards skilled birth attendance at birth and increased service uptake [5,12].

This study identified residency, education, religion, wealth, age at first birth, parity, number of ANC visits, and community level contraceptive use as statistically significant predictors of SBA.

Non-educated mothers had reduced odds of SBA compared to mothers who had higher education. This evidence was supported by findings from East Africa [5], southeast Ethiopia [7], Cameroon

[8], and Bangladesh [12]. This association could be explained by, the higher the education level, the higher the chance of getting plenty of information through reading newspapers and following mass media and the higher the knowledge of educated mothers about the benefit of skilled birth attendance at birth and the risk of giving birth without the help of skilled health professionals. Therefore, educated women had good health-seeking behavior [28]. This is because educated women are more likely than uneducated women to develop confidence, be able to make informed decisions about their own health, be aware of complications associated with pregnancy, and seek out appropriate medical care. In addition, educated women easily understand health professionals' advice and may have easier access to written material [7].

The wealth index of mothers also had statistically significant association with skilled birth attendance. This study evidenced that women of poor and middle wealth status had reduced likelihood of obtaining skilled birth attendance at birth as compared to rich women. This evidence was supported by findings from East Africa [5], southeast Ethiopia [7], Cameroon [29], and Bangladesh [12]. The possible justification might be, women with poor and middle wealth index had financial challenges to pay for transportation to the health facilities and to pay for additional supplies that are needed during the delivery process. Even though skilled birth delivery services being given free of charge in public health facilities, mothers may be asked to buy supplies that are not available at the health facilities during the time of delivery [4].

This study revealed that, there was inverse relationship between parity and SBA at birth. This means as number of children in the family increased the odds of having SBA at birth decreased. This evidence was in agreement with studies conducted in East Africa [5], Nigeria [30], Ethiopia [21], and Uganda [31]. The possible justification might be due to higher parity women commonly had increased self-confidence from previous experience to pregnancy and childbirth and might prefer to give birth at home and they might

**Table 4:** Individual and community-level factors associated skilled birth attendance distribution (n=2,888), Ethiopia 2019.

Individual and Community Level Characteristics		COR (95% CI)	Final Model AOR (95% CI)
Age	15-19	Ref	Ref
	20-24	0.98 (0.61, 1.59)	1.15 (0.65, 2.02)
	25-29	0.54 (0.34, 0.85)	1.10 (0.59, 2.03)
	30-34	0.45 (0.28, 0.72)	1.16 (0.60, 2.24)
	35-39	0.51 (0.31, 0.83)	1.72 (0.83, 3.57)
	40-44	0.31 (0.17, 0.56)	.91(0.40, 2.07)
	45-49	0.84 (0.36, 1.96)	2.50 (0.87, 7.16)
Educational status	No education	0.13(0.06, 0.26)	0.33 (0.16, 0.72)
	Primary	0.27 (0.13, 0.53)	0.53 (0.25, 1.11)
	Secondary	0.87 (0.40,1.88)	1.14(0.51, 2.57)
	Higher	Ref	Ref
Religion	Orthodox	Ref	Ref
	Muslim	1.16 (0.73, 1.86)	2.17 (1.30, 3.59) *
	Protestant	0.61 (0.39, 0.94)	0.57 (0.36, 0.90) *
	Others	0.10 (0.03, 0.30)	0.21(0.07, 0.65) *
Wealth	Poor	0.23 (0.17, 0.31)	0.44 (0.32, 0.60) **
	Middle	0.37 (0.27, 0.50)	0.60 (0.44, 0.82) *
	Rich	Ref	Ref
Current Marital status	Currently married	Ref	Ref
	Currently not married	0.76 (0.49, 1.19)	0.90 (0.52, 1.56)
Contraceptive use	No	0.65 (0.52, 0.80)	0.88 (0.69, 1.12)
	Yes	Ref	Ref
Sex of HHH	Male	Ref	Ref
	Female	0.90 (0.65,1.24)	0.83 (0.56, 1.24)
Age at first birth	≤15	0.87 (0.67,1.12)	1.38 (1.01, 1.89) *
	16-18	0.68 (0.54, 0.86)	0.83 (0.63, 1.09)
	>18	Ref	Ref
Parity	1	3.79 (2.81, 5.11)	3.11 (1.85, 5.25) **
	45018	1.20 (0.96, 1.50)	1.05 (0.76, 1.44)
	≥5	Ref	Ref
Number of ANC visits	1	0.13 (0.08, 0.22)	0.19 (0.11, 0.33) **
	44987	0.47 (0.38, 0.59)	0.57 (0.45, 0.70) **
	≥4	Ref	Ref
Residence	Urban	Ref	Ref
	Rural	0.07 (0.03, 0.14)	0.32 (0.16, 0.65) *
Community wealth	Low proportion of poor	Ref	Ref
	High proportion of poor	0.14 (0.08, 0.24)	0.62 (0.35, 1.09)
Community education	Low proportion no education	Ref	Ref
	High proportion of no education	0.19 (0.11, 0.33)	1.02 (0.56, 1.88)
Community marriage	Low proportion of marriage	Ref	Ref
	High proportion of marriage	0.56 (0.32, 0.97)	0.91 (0.54, 1.54)
Community ANC visits frequency	Low proportion of single ANC visit	Ref	Ref
	High proportion of single ANC visit	0.36 (0.21, 0.64)	1.36 (0.81, 2.30)
Community contraceptive use	Low proportion of contraceptive non use	Ref	Ref
	High proportion of contraceptive non use	0.25 (0.14, 0.42)	0.50 (0.29, 0.88) *
Community level parity	Low proportion of single parity	Ref	Ref
	High proportion of single parity	5.26 (3.11, 8.90)	1.58 (0.90, 2.77)
Community level age at first birth	Low proportion of birth at age less than 18	Ref	Ref
	High proportion of birth at age less than 18	0.27 (0.15, 0.46)	0.72 (0.43, 1.21)

ANC: Ante Natal Care; HHH: Household Head; Ref: Reference group

not have ANC and SBA as recommended They might also have time and resource constrains due to larger family [5,32]. But this finding had contradiction with the findings from Sub-Saharan Africa, [33] in which women who had two or three births had higher odds having SBA as compared to women with one birth. This was justified as, due to bad past experience obtained during the first and subsequent births. For example, a woman who experienced complications or had obstetric difficulty during first childbirth may choose to always have SBA during subsequent deliveries [33]. This contradictory finding warrants further investigation using more advanced source of evidences such as systematic review and Meta analysis.

We found an association between religion and SBA. In our study Muslims had higher odds of SBA while protestants and other categories had reduced odds of SBA. Previous studies witnessed that, women who are traditionalists were less likely to utilize skilled birth services due to their high inclination to their traditional beliefs, norms and practices [34,35]. It is also evidenced that, Spiritual practices such as blessed water, blessed white handkerchief, blessed sand, Bible and Rosary are applied before and during delivery by women or religious leaders for a safe delivery [36,37]. These religious differences in SBA showed that religious norms and practices play significant role in the use of maternal healthcare services. Therefore, governmental as well as non-governmental organizations should strengthened education on maternal healthcare services utilization, taking into account the norms, values and beliefs that women share. Qualitative researches should be conducted to explore reasons for the religious disparities in the use of SBA [8].

Other important determinant of SBA at birth was residence. The current study evidenced that the odds of having SBA at birth among women who reside in the rural area was lower than urban women. This finding was in agreement with studies in Bangladesh [12], Cameroon [8], East Africa [5], and Southeast Ethiopia [7]. The reason for this is because urban residents have easier access to healthcare facilities that offer skilled delivery services and might not need transportation because as they are close the facilities. Even, when transportation is required, urban residents can obtain a vehicle than rural residents. The majority of rural communities lack road and telephone infrastructure and lack access to transportation services, making it impossible for laboring mothers to use free ambulances [7].

Another important factor affecting SBA of mothers in Ethiopia was the age of the mothers during their first birth. Women who gave birth less than 15 years older had higher odds of SBA. This finding was contrary to the findings from Ethiopia [17] and Sub-Saharan Africa [33]. which revealed that as age at first birth increased, the odds of having SBA increased. Those findings justify this evidence as; there are deep rooted cultural values such as negative social stigma and attitudes towards adolescent pregnancy in many sub-Saharan African countries. Fear of stigmatization, devaluation, and shame made it difficult for young pregnant adolescents to receive maternal health services at health facilities [33]. Since our study was on pregnant mothers who had at least one ANC follow up, those challenges had been broken. Because, during ANC follow up, women got health education and will have behavioral change towards SBA at birth [5].

## Strengths and Limitations

We believe our study had several strengths as we used the most recent nationwide data which increased the representativeness of the finding and we also used advanced statistical model which solved

the effect hierarchal nature of the data set. Despite those strengths, using secondary data limit the researcher to measure all possible factors such as culture and tradition-related factors. Since the source of the data was self-report, the accuracy of the data could be affected by recall bias. The data for this conclusion was from cross-sectional survey and it does not show causality.

## Conclusion

All pregnant women are encouraged and supported to deliver in health facilities with skilled attendants. Even though Ethiopia had dramatic progress over the last two decades (2000 to 2019), utilization of skilled birth attendant service is very low. SBA should be improved to achieve the sustainable development goals targeted on maternal and neonatal death by 2030. Moreover, we found that a higher level of women's, education, higher household wealth index, younger age at first birth, and primipara, were factors that increase the odds of SBA. Whereas, being a rural resident, living in a community with high proportion of contraceptive non-use and having few numbers of ANC visit were factors that decrease the odds of SBA. Therefore, improving women's education and household wealth, giving special attention for teenagers and primipara women as well as encouraging pregnant mothers to have frequent ANC visits are vital for the health policies aiming to increase SBA services utilizations in Ethiopia. Therefore, governmental as well as non-governmental organizations should strengthened education on maternal healthcare services utilization, taking into account the norms, values and beliefs that women share. Qualitative researches should also be conducted to explore reasons for the religious disparities in the use of SBA.

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