

Are Ethiopian women getting the recommended maternal health services? The analysis of Ethiopian mini Demographic and Health Survey 2019

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Abstract

Background and Aims: Health services during pregnancy, childbirth, and the postnatal period play a pivotal role in the survival of both the mother and the baby. We, therefore, analyzed maternal health service utilization and the related drivers among women of childbearing age in Ethiopia.

Methods: We used secondary data from the 2019 Ethiopian mini Demographic and Health Survey. The survey was conducted in 11 regions, and 2 city administrations, in Ethiopia from March 21 to June 28, 2019. Maternal health service utilization was measured in terms of three dimensions including antenatal care (ANC), skilled delivery service, and postnatal care (PNC). Bi-variable and multivariable logistic regression was used. We then fitted three separate models. Data were analyzed using SPSS version 25; all analysis was adjusted for cluster and sample weight.

Results: A total of 2923, 3924, and 1899 women were included for ANC, delivery, and PNC utilization, respectively. The majority of 1802 (61.7%) women had a “good” antenatal care utilization, and it was explained by the level of maternal education, marital status, and wealth index. Nearly half, of 1899 (48.1%) of the women gave birth in a health facility, and it was associated with age, educational status, wealth index, the timing of first antenatal care, and the number of antenatal care contact. Finally, one third (33.7%) of them had adequate PNC utilization and it was associated with households having a television, the timing of first antenatal care, and the number of antenatal care contacts.

Conclusion: Despite the due emphasis on maternal health services by the Ethiopian government, the uptake of services is not optimal. Women empowerment and timely and adequate ANC contacts will prepare women for better uptake of services.

KEYWORDS

ANC, EDHS, maternal health services, PNC, skilled delivery

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1 | INTRODUCTION

Health service during pregnancy, delivery, and postnatal period holds a pivotal role in the survival and future well-being of both the mother and the baby. The World Health Organization and health authorities of most countries in the world have made maternal health services part of essential health service packages.¹ Those packages are mostly outlined in terms of antenatal care (ANC), delivery care, and postnatal care (PNC).²

ANC is a form of preventive health care during pregnancy that focuses on advice on healthy behaviors, health-care check-ups, and the provision of emotional and psychological support to pregnant women.³ While skilled birth attendance is a birth assisted by either a doctor, nurse, midwife, or other accredited health-care professionals,⁴ PNC is health checkups by a skilled health professional within 6 weeks of childbirth.⁵ Holding other things constant, a health system that performs well in these three health packages ends up with lesser maternal morbidity and mortality.⁶

Though the global trend showed maternal mortality is declining over time, it remains a major public health problem in some parts of the world.⁷⁻⁹ Estimates of 2017 show that around 295,000 deaths per year occurred during and following pregnancy and childbirth and almost all (95%) of these deaths occurred in sub-Saharan African (SSA) and Southern Asian countries, with the greatest (65%) share by the WHO African Region.^{10,11}

Globally, maternal mortality is expected to decline by 6.1% each year between 2016 and 2030.¹² However, in countries like Ethiopia, the trend of maternal mortality ratio (MMR) reduction seems quite far from this estimate.¹³ To meet this target on average each year Ethiopia should reduce the MMR by 10% afterward 2021.¹⁴

According to the 2016th Ethiopian Demographic, and Health Survey (EDHS) report, the level of at least one ANC contact; skilled birth attendance; and having at least two signal functions 2 days after delivery were 62%, 28%, and 39.6%, respectively, which is lower than most African countries.¹⁵ The Fragile States Index also stated Ethiopia as one of the 15 countries classified as a “very high alert” or “high alert” for maternal mortality.⁷

Other previous studies in Ethiopia used either of the indicators like; at least one ANC visit at least four ANC visits the timing of first ANC visits services received during ANC visits type of health-care provider visited, and quantity of contacts¹⁶⁻¹⁹ with possible individual, and household (HH)-related determinants of use.²⁰⁻²³ In this study, to provide a good summary of information all of the available mixes of indicators were exhaustively used. Additionally, it is the first study using the 2019th Ethiopian Mini Demographic, and Health Survey. The findings will then help policymakers and stakeholders to reduce maternal mortality by designing each MCH component-specific intervention based on the identification of hotspot areas and factors that affect service utilization in Ethiopia.

2 | METHODS

2.1 | Study design and setting

Ethiopia is a land-locked country located in East Africa, sharing borders with Sudan and South Sudan from the west, Somalia and Djibouti from the east, Eritrea from the north, and Kenya from the southern direction. The population of Ethiopia is approximated to be 120 million, with around 25 million reproductive-age women.²⁴

Administratively, Ethiopia is divided into 11 regions and 2 city administrations (Figure 1). Human resource for health is one of the major challenges in the country including shortages, and urban/rural disparities.²⁵ In the year 2019, the health professional (Medical Doctors, Midwives, and Nurse) to population ratio was below the minimum requirement for SSA, 1.81 per 1000 population, as stated by the WHO. In addition to this, access to essential maternal health services is another challenge for service utilization as more than three-fourths of women in Ethiopia live in rural areas, and most of the infrastructure and roads there do not exist or are in poor condition.²⁶ The study was conducted from March 21 to June 28, 2019.

2.2 | Population and sampling

The sampling frame was a complete list of 149,093 enumeration areas (EAs) created for the 2019 Ethiopia Population and Housing Census (PHC). An EA is a geographic area covering an average of 131 HHs.

The stratification was made into urban and rural areas for each region and administrative city, yielding 21 sampling strata. Samples of EAs were selected independently in each stratum in two stages. In the first stage, 305 EAs (93 in urban areas and 212 in rural areas) were selected with probability proportional to EA size and with independent selection in each sampling stratum. An HH listing operation was carried out in all selected EAs, and the resulting list of HHs then served as a sampling frame for the second stage.

In the second stage of selection, a fixed number of 30 HHs per cluster were selected with an equal probability of systematic selection from the newly created HH listing. Women of the reproductive age group who gave birth within 5 years preceding the survey, were the source population for this study, and women of childbearing age, who were either permanent residents of the selected HHs or visitors who slept in the HH the night before the survey, were eligible to be interviewed. To assure the randomness of selection in HHs with more than one eligible woman, only one woman per HH was selected using the lottery method.

2.3 | Data collection

The survey team used DHS Program's standard tools that were adapted to reflect the population and health issues relevant to Ethiopia. Maternal

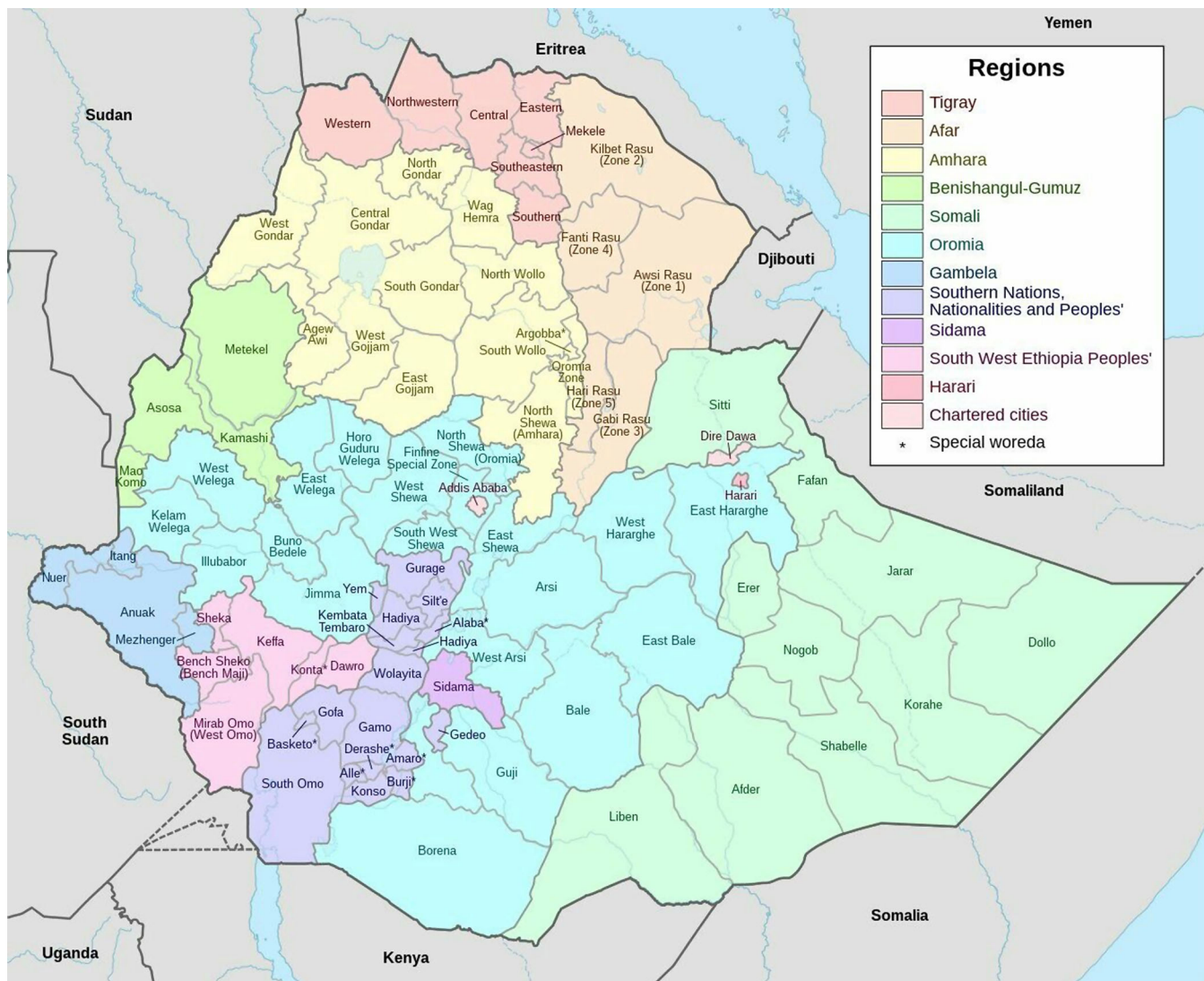


FIGURE 1 The status of maternal health service utilization across the regions of Ethiopia, 2019 mini DHS, Ethiopia. DHS, Demographic and Health Survey.

health service-related information was collected using the women's questionnaire among the five questionnaires in the DHS program surveys. The questionnaire includes items related to respondents' background characteristics, reproduction, contraception, pregnancy and PNC, child nutrition, childhood immunizations, and health facility information. The Survey was implemented by the Ethiopian Public Health Institute (EPHI), in partnership with the Central Statistical Agency (CSA) and the Ethiopian Ministry of Health (MOH). Around 17 data collectors who had some experience in previous Ethiopian DHS surveys received training from February 11 to 20, 2019, and proceeded to data collection after field practice, and a debriefing session.

2.4 | Study variables and measurement

In this study, MCH components were measured using three dimensions; ANC services, delivery services, and PNC care services.

ANC utilization was assessed using six interview questions. In the measurement, health-care providers indicate; doctors, nurses, midwives, and health officers. Others include; traditional birth attendants, community/village health volunteers, neighbors/friends/relatives, and others. After summarizing their response, women were said to get recommended ANC services if a woman scored "one" for at least four of them (80%). Delivery service use was measured by two questions, after summarizing their answers women were declared to have skilled birth attendance if responded: "one" for all (100%). Postnatal utilization was derived from four questions. Then after summarizing their response, women were said to get PNC service, if a woman responded: "one" for all (100%) (Table 1). Independent variables were: age of mother, region, place of residence, level of education, marital status, sex of HH head, whether the HH has a radio, whether the HH has television, and wealth index.

The wealth index in this study was used as DHS measured using easy-to-collect data on a HH's ownership of selected assets; such as

TABLE 1 Measurement of maternal health-care utilization in terms of antenatal care, delivery service, and postnatal care utilization among women aged 15–49 years, 2019 mini DHS, Ethiopia

R. no	ANC		Delivery		PNC	
	Question	Response	Question	Response	Question	Response
1	Did you seek ANC for this pregnancy?	1. Yes 0. No	Where did you give birth?	1. Health facility 0. Home	Before your discharge after (name of child) was born, did any health-care provider check on your health?	1. Yes 0. No
2	If yes, "whom did you see?"	1. HCP 0. Others	Who assisted you with the delivery?	1. HCP 0. Others	How many hours, days, or weeks after the birth of (name) did the first check take place?	1. Within 24 h 0. Within days and weeks
3	How many months pregnant were you when you first received the care?	1. Before 12 weeks 0. After 12 weeks			Who checked on your health at that time?	1. HCP 0. Others
4	How many times did you receive ANC during this pregnancy?"	1. Four and above 0. Below 4			Was your body temperature measured after 2 days of discharge?	1. Yes 0. No
5	Were you given or did you buy any iron tablets or iron syrup	1. Yes 0. No				
6	For how many days do you take the iron tablets?	1. Ninety and above days. ²⁷ 0. Below 90 days				

Abbreviations: ANC, antenatal care; DHS, Demographic and Health Survey; HCP, health-care provider; PNC, postnatal care.

televisions and bicycles, materials used for housing construction, and types of water access and sanitation facilities.

2.5 | Data analysis

We analyzed the data using the SPSS version 25 software. The analysis involved both descriptive and inferential analysis. Frequency and percentage measures were generated. We used a binary logistic regression model in two steps to assess the predictors of maternal health service utilization. Primarily we did simple binary logistic regression for each of the independent variables. Variable with p -value ≤ 0.25 were a candidate for inclusion in the multiple logistic models. Finally, a p -value ≤ 0.05 was used.

We did a weighted analysis to account for disproportionate stratification for different regions, for the use of multistage sampling to recruit participants, and to be able to generalize the findings to the national reference population.

2.6 | Ethics consideration

The authors analyzed secondary publicly available data obtained from the DHS program database. There was no additional ethical approval, and informed consent was obtained by the authors.

2.7 | Statistical methods

Quantitative data from the demographic and health survey of Ethiopia was used for analysis. For the three components of maternal health service utilization, data are expressed as $n(\%)$. For the inferential analysis; the age of the mother, region, place of residence, level of education, marital status, sex of HH head, whether the HH's possession of radio, or television, and wealth index were considered. The a priori levels of significance were two-sided and $p < 0.05$ were considered statistically significant. SPSS version 25 was used for all analyses.

3 | RESULTS

3.1 | Description of the study participants

A total of 3924 women were selected for this study. Of these, the highest proportion; 1192 (30.4%) of women were in the age range of 25–29 years. Three-fourths; 2900 (73.9%), of the participants were residents of rural areas, and almost all; 3657 (93.1%), were married. Being a HH head was dominated by the male sex; 3401 (86.6%), and around half; of 2014 (51.3%), of the study participants, had no formal education. The wealth status was almost equally distributed among the five quantiles with a slightly higher proportion of the poorest quantile 825 (21.0%) (Table 2).

TABLE 2 Sociodemographic and economic characteristics of study participants, 2019 EDHS, Ethiopia

Variable	Category	ANC (%) (N = 2923)	Delivery (%) (N = 3924)	PNC (%) (N = 1899)
Age group	15–19	73 (4.05)	130 (3.32)	17 (0.36)
	20–24	398 (22.07)	468 (25.96)	140 (7.76)
	25–29	606 (33.61)	616 (34.17)	177 (9.82)
	30–34	383 (21.24)	386 (21.41)	158 (8.76)
	35–39	230 (12.76)	280 (15.53)	107 (5.93)
	40–44	88 (4.88)	100 (5.55)	32 (1.77)
	45–49	25 (1.39)	33 (1.83)	10 (0.55)
Place of residence	Urban	658 (36.49)	744 (37.01)	264 (42.93)
	Rural	1145 (63.51)	1266 (62.99)	351 (57.07)
Educational attainment	No education	675 (37.46)	728 (36.22)	243 (37.97)
	Primary	736 (40.84)	845 (42.04)	235 (36.72)
	Secondary	255 (14.15)	297 (14.78)	109 (17.03)
	Higher	136 (7.55)	140 (6.97)	53 (8.28)
Current marital status	Never in union	4 (0.22)	14 (0.70)	7 (0.46)
	Married	1708 (94.84)	1871 (92.90)	1455 (96.04)
	Living together	9 (0.50)	15 (0.74)	4 (0.26)
	Widowed	11 (0.61)	16 (0.79)	2 (0.13)
	Divorced	54 (3.00)	68 (3.38)	36 (2.38)
	separated	15 (0.83)	30 (1.49)	11 (0.73)
Sex of HH head	Male	1573 (87.24)	1708 (84.85)	532 (83.00)
	Female	230 (12.76)	305 (15.15)	109 (17.00)
Wealth index combined	Poorest	191 (10.59)	184 (9.14)	47 (7.33)
	Poorer	310 (17.19)	339 (16.84)	87 (13.57)
	Middle	340 (18.86)	351 (17.44)	105 (16.38)
	Rich	347 (19.25)	436 (21.66)	119 (18.56)
	Richest	615 (34.11)	703 (34.92)	283 (44.15)

Abbreviations: ANC, antenatal care; EDHS, Ethiopian Demographic and Health Survey; HH, household; PNC, postnatal care.

3.2 | Use of maternal health services

3.2.1 | Antenatal care utilization

Out of the total 3924 eligible women, almost three-quarters (74.4%) of the women had at least one contact with someone during their pregnancy. Of those who attended ANC at least once, almost all 2888 (98.8%), had contact with one or more health-care providers. However, only 1092 (37.4%) of the women started ANC before 12 weeks of gestation. Although three-quarters of the women (77%) received Iron tablets at least for a day, only 14.0% took iron for at least 90 days throughout their pregnancy. Generally, 1802 (61.7%) of pregnant women had a “good” ANC utilization (Table 3).

3.2.2 | Delivery care utilization

Of the total births within 5 years preceding the survey 3426 (87.3%), women have got some assistance either from a skilled health-care provider or others during childbirth. Of the assisted deliveries, the highest proportion of 2120 (61.8%) was assisted either by one or more health-care providers. One out of eight deliveries 498 (12.7%) remains unassisted by anyone in the country. Regarding the place of delivery, less than half of 1899(48.4%) deliveries were managed at health facilities. As a result, nearly half, 1888 (48.1%) of women gave birth in the health facility and their delivery was assisted by one or more health-care providers (Table 4).

TABLE 3 The status of antenatal care utilization among women aged 15–49 years, 2019 mini DHS, Ethiopia

Variable	Category	N (2923)
At least one contact for ANC	Yes	2923 (74.4%)
Seen HCP for ANC	Yes, seen by one or more HCP	2888 (98%)
Timing of first ANC	Before 12 weeks	1092 (37%)
Number of ANC visit	Four and above ANC contacts	1688 (57.8%)
Took iron during pregnancy	Yes	2249 (77%)
Days of iron intake	Ninety and above days	410 (14%)
WHO recommended ANC	Good ANC utilization	1802 (61.7%)
	Poor ANC utilization	1121 (38.2%)

Abbreviations: ANC, antenatal care; DHS, Demographic and Health Survey; HCP, health-care provider; PNC, postnatal care.

TABLE 4 The status of delivery care utilization among women aged 15–49 years, 2019 mini DHS, Ethiopia

Variable	Category	N (3924)
Place of delivery	Health facility	1899 (48.4%)
Assistance during delivery	Assisted by at least one HCP	2120 (54%)
WHO recommended delivery	Good delivery care utilization	1888 (48.1%)
	Poor delivery care use	2039 (51.9%)

Abbreviations: DHS, Demographic and Health Survey; HCP, health-care provider.

3.2.3 | Postnatal care utilization

Out of the total population who gave their recent birth at the health facility (1899), the majority 1243 (65.4%) were checked for their health status before they leave the health facility. The check-ups for 1174 (94.4%) of the mother were done within 24 h from delivery. Almost all of the mothers 1237 (99.5%), got these services from a skilled health-care provider. However, from women who gave their recent birth at the health facility, body temperature measurement after 2 days of discharge was done for less than half 942 (43%) of the women. Overall, one third of 641 (33.7%), mothers had an adequate PNC (Table 5).

3.3 | Maternal health service utilization by region

The utilization of maternal health services was observed to have variation by region across the country; the proportion of ANC

TABLE 5 The status of postnatal care utilization among women aged 15–49 years, 2019 mini DHS, Ethiopia

Variable	Category	N (%)
Health checkup before discharge (n = 1899)	Yes	1243 (65.4%)
How long before discharge (n = 1243)	Within 24 h	1174 (94.4%)
Personnel performed check-up (n = 1243)	Health-care provider	1237 (99.5%)
Check-up after discharge (n = 1899)	Yes	942 (43%)
WHO recommended PNC	Good PNC use	641 (33.7%)
	Poor PNC use	1383 (66.2%)

Abbreviations: DHS, Demographic and Health Survey; PNC, postnatal care.

utilization is higher in Addis Ababa (87%), and Dire Dawa (83%), whereas it was the lowest in the Somalia region (37%). Similarly, delivery service utilization had the highest proportion in Addis Ababa (96%), and Dire Dawa (76%), while it was lowest in the Somalia region (25%). Lastly, the proportion of PNC service use was higher in the Gambela region (57%), and Addis Ababa (56%), whereas Women residing in SNNPR were the lowest of all (18%) (Figure 2).

3.4 | Factors associated with maternal health service utilization

3.4.1 | Antenatal care utilization

The simple logistic regression analysis suggested variables like age, place of residence, educational level, marital status, wealth index, HH having a radio, sex of HH head, and HH having a Television as candidates for multiple regression (Table A1). Then in the multivariate analysis; educational level, marital status, and wealth index were found to have an association with adequate ANC utilization.

As compared to women having no education, women having a primary education were 30% more likely (adjusted odds ratio [AOR]: 1.3; 95% CI: 1.1–1.6); those who had secondary education were twice more likely (AOR: 1.9; 95% CI: 1.4–2.6; and women who had higher education were around fourfold more likely (AOR: 4.3; 95% CI: 2.4–7.5); to have a good ANC utilization. Married women were around eightfold more likely (AOR: 8.5; 95% CI: 2.3–30.4) on the other hand, women who have separated were around sixfold more likely (AOR: 6.8; 95% CI: 1.7–26.0) to have a good ANC utilization than women never in a union. Compared to the poorest women, poorer were 10% more likely (AOR: 1.1; 95% CI: 1.1–1.7), whereas, both middle and richer women were 30% more likely (AOR: 1.3; 95% CI: 1.1–1.7), and those who were richest were threefold more likely (AOR: 3.2; 95% CI: 2.4–4.3) to have a good ANC utilization (Table 6).

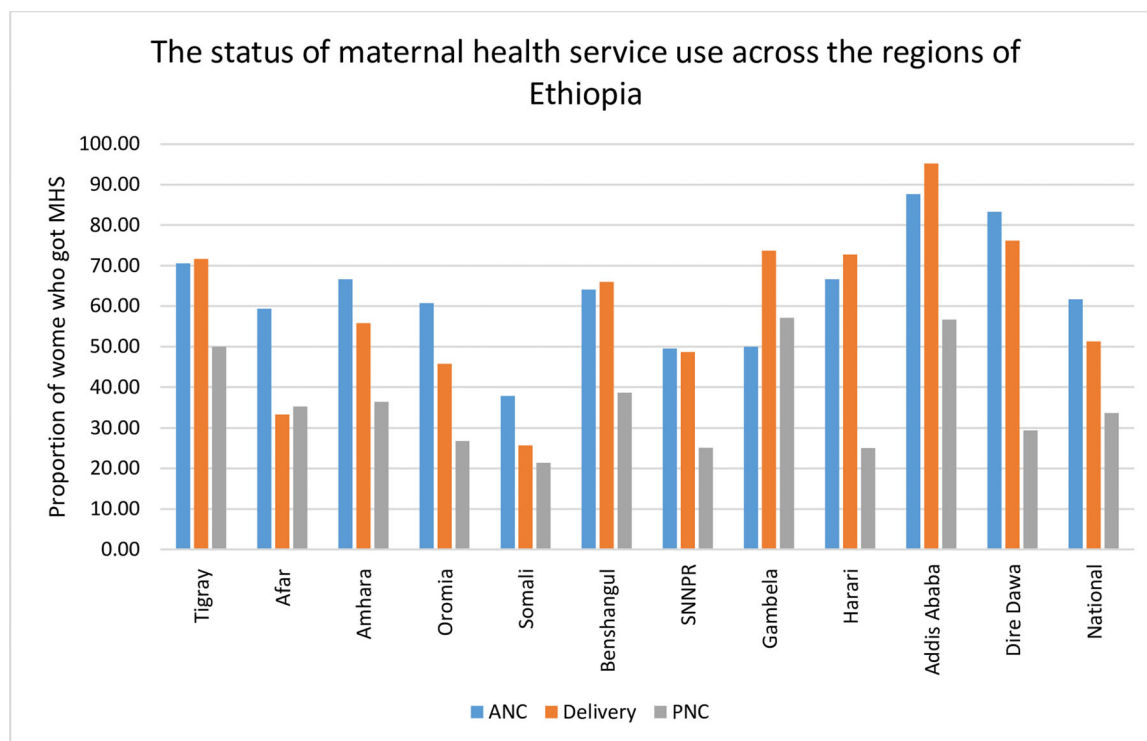


FIGURE 2 The status of maternal health-care utilization across the regions of Ethiopia. ANC, antenatal care; PNC, postnatal care.

3.4.2 | Delivery care utilization

The simple logistic regression analysis suggested variables including: age, place of residence, educational level, marital status, sex of HH head, HHs having a television, HH having a radio, wealth index, timing of first ANC contact, and the number of ANC contacts having a crude association with delivery care utilization (Table A1). Then in the multivariable logistic regression age, educational status, wealth status, the timing of first ANC contact, and the number of ANC were found to have a statistically significant association with delivery care utilization.

Women aged 40–44 were 60% less likely (AOR: 0.4; 95% CI: 0.2–0.7), those aged 25–29 were 50% less likely (AOR: 0.5; 95% CI: 0.3–0.8), and women on the age range of 30–34 were 40% less likely (AOR: 0.6; 95% CI: 0.4–0.9) to have a skilled delivery utilization than that of women aged 15–19. Compared to women who have no education, women having a primary education were 40% more likely (AOR: 1.4; 95% CI: 1.1–1.7), and those who have secondary education were twice more likely (AOR: 2.3; 95% CI: 1.6–3.3), and women having higher education were 2.6 times more likely (AOR: 2.6; 95% CI: 1.4–4.9) to have a skilled delivery utilization. Compared to the poorest women, both poorer, and middle-class women were two times more likely, (AOR: 2.1; 95% CI: 1.6–2.8), and (AOR: 2.0; 95% CI: 1.5–2.7) to have a skilled delivery respectively. Whereas, richer women were three times more likely (AOR: 3.3; 95% CI: 2.5–4.4), and those who were richest were around 6 folds more likely (AOR: 6.1; 95% CI: 4.1–9.2) to have a skilled delivery use. Those who have adequate ANC follow-up

during pregnancy were 60% more likely to (AOR: 1.6; 95% CI: 1.4–1.9), and those who started the ANC early, were 20% more likely (AOR: 1.2; 95% CI: 1.1–1.5) to have skilled delivery care (Table 6).

3.4.3 | Postnatal care utilization

Variables including age, region, type of place of residence, educational level, sex of HH head, HHs having a television, HHs having a radio, wealth index, timing of first ANC contact, and the number of ANC contacts had a crude association with PNC service utilization (Table A1). Moreover, in the final model variables including HHs having a television, the timing of first ANC contact, and the number of ANC contacts were found to have a statistically significant association with PNC utilization.

Those women possessing a television, and those who started their ANC contact earlier were 50% (AOR: 1.5; 95% CI: 1.2–1.9) more likely to have a recommended PNC respectively. Women having an adequate ANC were 40% better at PNC utilization (AOR: 1.4; 95% CI: 1.1–1.7) (Table 6).

4 | DISCUSSION

Depending on the all-around benefits of integrated maternal health services, the practice has been promoted both globally and locally to further strengthen the uptake of ANC service during pregnancy, SBA

TABLE 6 Factors associated with maternal health services, among women aged 15–49 years, 2019 mini DHS, Ethiopia

Variable	Category	Antenatal care		Institutional delivery		Postnatal care	
		COR (95% CI)	AOR (95% CI)	COR (95% CI)	AOR (95% CI)	COR (95% CI)	AOR (95% CI)
Age	15–19	1	1	1	1	1	1
	20–24	2.1 (1.4, 3.0)	1.4 (1.0, 2.1)	1.2 (0.9, 1.6)	0.8 (0.5, 1.2)	2.8 (1.6, 4.9)	0.3 (0.4, 1.9)
	25–29	1.9 (1.3, 2.7)	1.4 (1.0, 2.1)	0.8 (0.6, 1.1)	0.5 (0.3, 0.8)**	2.6 (1.5, 4.5)	1.2 (1.0, 2.3)
	30–34	1.9 (1.3, 2.7)	1.6 (1.0, 2.4)	0.7 (0.5, 1.0)	0.6 (0.4, 0.9)*	4.6 (2.4, 8.0)	0.9 (0.8, 1.6)
	35–39	1.3 (0.9, 2.0)	1.3 (0.9, 2.0)	0.7 (0.5, 1.0)	0.8 (0.5, 1.2)	4.0 (2.2, 7.1)	1.3 (0.8, 1.6)
	40–44	1.3 (0.8, 2.1)	1.4 (0.8, 2.2)	0.4 (0.3, 0.6)	0.4 (0.2, 0.7)**	3.1 (1.6, 6.1)	3.5 (0.1, 3.8)
	45–49	1.2 (0.6, 2.4)	1.1 (0.5, 2.3)	0.4 (0.2, 0.7)	0.8 (0.4, 1.8)	3.1 (1.2, 7.6)	0.9 (0.2, 1.7)
Place of residence	Urban	1	1	1	1	1	1
	Rural	0.4 (0.3, 0.4)	0.82 (0.6, 1.0)	0.2 (0.2, 0.3)	1.0 (0.8, 1.4)	0.6 (0.4, 0.7)	0.8 (0.6, 1.0)
Educational level	No education	1	1	1	1	1	1
	Primary	1.5 (1.3, 1.8)	1.3 (1.1, 1.6)**	2.7 (2.3, 3.1)	1.4 (1.1, 1.7)**	0.7 (0.6, 0.9)	0.7 (0.5, 1.0)
	Secondary	2.8 (2.1, 3.7)	1.9 (1.4, 2.6)**	9.4 (7.0, 12.5)	2.3 (1.6, 3.3)**	1.1 (0.8, 1.5)	1.0 (0.7, 1.3)
	Higher	7.4 (4.4, 12.5)	4.3 (2.4, 7.5)**	20.2 (11.5, 35.2)	2.6 (1.4, 4.9)**	1.2 (0.8, 1.8)	0.7 (0.4, 1.1)
Current marital status	Never in union	1	1	1	1	1	1
	Married	3.7 (1.1, 12.0)	8.5 (2.3, 30.4)**	0.4 (0.1, 1.5)	0.1 (0.0, 1.5)	0.4 (0.1, 1.2)	0.8 (0.1, 1.9)
	Living with partner	2.0 (0.4, 9.1)	3.2 (0.6, 16.0)	0.5 (0.1, 1.8)	0.1 (0.0, 1.7)	0.3 (0.0, 1.6)	1.4 (0.9, 1.8)
	Widowed	1.7 (0.4, 6.9)	4.1 (0.9, 18.8)	0.1 (0.0, 0.5)	0.2 (0.0, 0.8)	0.1 (0.0, 1.0)	0.9 (0.8, 4.4)
	Divorced	3.3 (0.9, 11.5)	6.8 (1.7, 26.0)*	0.5 (0.2, 1.4)	0.4 (0.0, 1.4)	1.1 (0.3, 3.7)	1.2 (0.9, 1.6)
	No longer living together	1.4 (0.3, 5.5)	2.4 (0.5, 10.1)	0.5 (0.2, 1.4)	0.6 (0.0, 1.0)	0.5 (0.1, 2.0)	2.4 (1.0, 2.5)
Sex of household (HH) head	Male	1	1	1	1	1	1
	Female	0.9 (0.7, 1.1)	0.8 (0.6, 1.0)	1.4 (1.1, 1.7)	1.4 (1.0, 1.9)	1.3 (0.6, 0.9)	2.6 (0.1, 3.4)
HH has radio	No	1	1	1	1	1	1
	Yes	1.4 (1.2, 1.6)	1.0 (0.8, 1.2)	0.4 (0.2, 0.7)	0.9 (0.7, 1.1)	1.2 (0.6, 1.2)	2.3 (0.9, 3.6)
	Not a de jure resident	1.2 (0.6, 2.3)	1.2 (0.6, 2.6)	0.8 (0.4, 1.6)	0.7 (0.3, 1.6)	0.6 (0.3, 0.9)	0.7 (0.1, 1.0)
HH has television	No	1	1	1	1	1	1
	Yes	3.2 (2.6, 4.0)	1.2 (0.8, 1.8)	12.0 (9.4, 15.8)	2.1 (0.4, 3.2)	1.9 (1.6, 2.4)	1.5 (1.2, 1.9)*
	Not a de jure resident	1.4 (0.7, 2.6)	1.4 (0.9, 1.2)	2.7 (1.4, 5.0)	1.1 (0.3, 1.4)	2.1 (1.0, 4.4)	1.8 (0.8, 3.7)
Wealth index combined	Poorest	1	1	1	1	1	1
	Poorer	1.2 (0.9, 1.5)	1.1 (1.1, 1.7)*	2.7 (2.1, 3.4)	2.1 (1.6, 2.8)**	1.0 (1.0, 1.5)	1.2 (0.9, 2.1)
	Middle	1.4 (1.1, 1.9)	1.3 (1.1, 1.7)*	3.1 (2.5, 3.9)	2.0 (1.5, 2.7)**	2.1 (0.8, 1.8)	0.6 (0.5, 1.0)
	Richer	1.6 (1.2, 2.1)	1.3 (1.1, 1.8)*	6.1 (4.8, 7.7)	3.3 (2.5, 4.4)**	1.0 (0.7, 1.6)	2.4 (1.0, 4.5)
	Richest	4.3 (3.3, 5.6)	3.2 (2.4, 4.3)**	25.6 (19.7, 33.7)	6.1 (4.1, 9.2)**	1.9 (1.3, 2.8)	1.2 (0.8, 1.5)
Timing of first ANC	Inappropriate timing			1	1	1	1
	Appropriate timing			2.0 (1.7, 2.3)	1.2 (1.1, 1.5)*	1.9 (1.5, 2.3)	1.5 (1.2, 1.9)**
Number of ANC contact	Inadequate ANC			1	1	1	1
	Adequate ANC			4.7 (4.1, 5.3)	1.6 (1.4, 1.9)**	1.7 (1.4, 2.1)	1.4 (1.1, 1.7)**

Abbreviations: ANC, antenatal care; AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; DHS, Demographic and Health Survey.

p*-value < 0.05; *p*-value < 0.001.

service during delivery, and PNC services during the postpartum period.²⁷ This study, therefore, attempted to assess the level of maternal health service utilization with their possible predictors.

4.1 | ANC utilization

Even though maternal health services are provided free of charge in Ethiopia,²⁸ the full ANC attendance is about 62%. Attendance is much better in urban settings than the rural, where there is relatively better access, and infrastructure to care. For instance, the ANC service in the capital Addis Ababa and the other town administration Dire Dawa is 26% and 21% higher than the overall national proportion. The United Nations Children's Fund (UNICEF's) recent report indicates the proportion of women who attend complete four ANC in the world reaches up to 65%. However, it is lower in the African region with high variability in the urban and rural settings. Women in the rural area either attend late ANC, had fewer visits, or receive much fewer services than their counterparts.^{29–32}

The ANC utilization in our finding is lower than the average contact made by women in the world (65%) but, slightly higher than women in regions with higher maternal mortality (49%–53%).^{5,33–35} Ethiopian story in primary health care which deployed numerous community health workers also called health extension workers has shown a massive change through promoting a positive attitude toward healthy behavior using model families and providing basic promotive and preventive care, even if there is a lot needed for improvement, is exemplary.³⁶ This endeavor might have contributed to the resulting ANC utilization.¹⁴ Despite this, evidence shows that focused ANC is still in practice in many African countries including Ethiopia as geographical, socioeconomic, and demographic factors might have constrained the implementation of the initiative.^{37–39} This impedes the efforts at reducing maternal mortality in the region.

Coming to the specific set of ANC services, three in five women utilized four out of the expected five services during their pregnancy. This finding has a three percentage point increase from a study conducted in 36 SSA countries with a pooled ANC utilization of 58.3%. This difference might be due to the value of the cutoff point used for this study. This finding, in summation with women of their counterparts, indicates that essential promotive, and preventive health services were potentially missed because even a woman who was classified as a “good” service user might lose some of the essential services.⁴⁰ Despite ANC being the first linkage of a woman and her family with the formal health system, it presents a unique and lifesaving opportunity.^{5,41,42} The utilization is still far from the expected achievement. As a result, to salvage those women out of the service use, immense attention shall be there to access each pregnant woman nearby their village through a HEP.

According to our findings, an increase in the level of education raised ANC utilization. The ANC use among those who attended higher education is almost double compared to those with no education. This finding is supported by other similar studies.^{35,43,44}

As education is an imperative instrument that provides a better cognitive capacity for pregnancy-related health issues, women with higher education might have a better utilization over their uneducated counterparts,^{45,46} to increasing the utilization working to raise females' level of education can have a spillover effect in that it leads to a healthier, and more informed population.⁴⁷

Compared to women who were never in a union, ANC utilization is about eightfold for married ones. Staying in a secured partnership is suggested to provide adherence to the services, financial support, and accompaniment to ANC clinics which enhances a positive service utilization either by married women or for those women who were in a partnership for some time as compared to women who were never in a relationship.^{48,49} This finding is also supported by other studies.^{50–52} To address those pregnant women out of the union by reducing the associated stigma, and discrimination; societal advocacy to raise awareness shall be an important issue of concern. Additionally, an approach to getting those pregnant women in the school through youth club, and using health extension workers in the community might mitigate the minimal service use by those unmarried pregnant women.

As an economic capacity measure, the wealth of the HH where the women came from has a direct relationship with ANC use. For instance, the ANC use for the richest HH women is more than four times higher than the poorest HHs. This is evident that poverty at the HH level may create a greater impediment to access services due to a lack of financial resources either to get registered or pay for the services leading to a situation where such women would partially attend or not attend at all.⁴² Higher inequalities between different socioeconomic characteristics of women are there, and studies have shown that those inequalities are much greater than the inequalities for immunization coverage or treatment of childhood illnesses.^{14,53}

4.2 | Delivery care utilization

Almost half of the Ethiopian women have given birth at health facilities. This finding is the lowest among countries in the SSA region ranging from 55% to 66%.^{54,55} Even though Ethiopia has made the greatest strides in increasing facility delivery from the lowest base with the help of the HEP,⁵⁶ a lot of women are still left in the dark confronted with around 16%–33% of preventable maternal death and long-term complications.^{57,58}

The wealth of the family where the women belong affects institutional delivery use. As compared to the poorest HHs, women from the richest HHs are six times more likely to use the recommended delivery service. The analysis of trends in 74 LMICs also stated that, despite the progress made, wealth-related inequality in delivery services is common in SSA countries, classifying Ethiopia as one with the highest disparity.⁴⁴ This hinders their utilization through a lack of either infrastructure or unaffordability to pay for those services.

We found that an adequate number of ANC and early initiation of ANC visits give rise to better facility delivery. These findings are

supported by other studies.^{59–61} This is because adequate ANC provides a full package that boosts a women's understanding of potentially life-threatening events that emerge during childbirth. This leads to a better understanding of the context and better utilization.

4.3 | PNC utilization

Only one third of women who gave birth in Ethiopia had adequate PNC utilization. This finding is lower than a pooled analysis of PNC utilization status in 29, and 36 SSA countries,^{62,63} which showed 41%, and 52.4% PNC utilization respectively. Even though progress has been made from the previous periods in Ethiopia, it is one of the lowest in the world.⁶⁴ Impliedly much more effort is needed to increase women's utilization of PNC within the first 24–48 h of delivery by then; around half of maternal mortality can be averted as per the WHO report.⁶⁵

Timely initiation of ANC, adequate ANC contact, and HH having television, were found to have a significant association with women's PNC utilization. This might be because; ANC provides the first entrance, which increases women's adherence to the healthcare, services, through advice and health education packages, to the end of their pregnancy.⁶⁶ Exposure to mass media is found to increase PNC utilization by 50%. This finding is in line with the finding of a study from four South-Asian countries.⁶⁷ The utilization of all three components of maternal health services can avert up to 71% of MMR.⁶⁸

4.4 | Limitations of the study

In this study, we used data from the Ethiopian mini demographic and health survey with a limited number of variables. As a result, we could not recruit as many variables of interest as we intended. Besides this, according to our analysis, we have obtained a relatively uniform wealth distribution between the five wealth quintiles, even if the Ethiopian population's wealth distribution is reported to be uneven.

5 | CONCLUSIONS

The findings of this study show that beyond half of the pregnant women had good ANC utilization. The higher educational status of the women, being married and higher wealth quintile had a positive association with ANC service utilization. Almost half of the women in the study gave their recent birth at a health facility. Higher educational status, higher wealth, and ANC service use raised delivery service use. One third of the women had adequate PNC utilization and it was associated with HHs' exposure to mass media, the timing of first ANC contact, and the number of ANC contacts.

Despite the due emphasis on maternal health services by the Ethiopian government, surprisingly, considerable amounts of women are lagging behind the WHO recommendations. To increase the utilization of maternal health services, approaches should aim to empower women

through improved educational access and economic standing through inter-sectoral collaboration. In addition, since uplifting the wealth and educational status of the people seems strenuous in a resource-limited setting like Ethiopia, urgent attention and action shall be strengthened to access each woman nearby their village through the Health Extension Program.

AUTHOR CONTRIBUTIONS

Frehiwot Birhanu: Conceptualization; data curation; formal analysis; methodology; software; writing – original draft; writing – review & editing. **Gachana Mideksa:** Conceptualization; data curation; formal analysis; investigation; methodology; software; supervision; writing – review & editing. **Kiddus Yitbarek:** Conceptualization; formal analysis; methodology; project administration; resources; software; supervision; visualization; writing – original draft; writing – review & editing.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data sets generated and analyzed during the study will be available to organizations and individuals based on reasonable requests from the corresponding author.

TRANSPARENCY STATEMENT

The lead author Frehiwot Birhanu affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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APPENDIX A

See Table A1.

TABLE A1 Factors affecting antenatal care, delivery, and postnatal care utilization among women aged 15–49 years, 2019 mini DHS, Ethiopia (n = 2923, 3924, and 1899, respectively)

Variable	Category	Antenatal care, n = 2923				Delivery care, n = 3924				Postnatal care, n = 1899			
		Good	Poor	COR (95%)	AOR (95%)	Good	Poor	COR (95%)	AOR (95%)	Good	Poor	COR (95%)	AOR (95%)
Age	15–19	73	80	1	1	130	98	1	1	17	113	1	1
	20–24	398	207	2.1 (1.4, 3.0)	1.4 (1.0, 2.1)	468	301	1.2 (0.9, 1.6)	0.8 (0.5, 1.2)	140	328	2.8 (1.6, 4.9)	0.3 (0.4, 1.9)
	25–29	606	342	1.9 (1.3, 2.7)	1.4 (1.0, 2.1)	616	576	0.8 (0.6, 1.1)	0.5 (0.3, 0.8)**	177	447	2.6 (1.5, 4.5)	1.2 (1.0, 2.3)
	30–34	383	202	1.9 (1.3, 2.7)	1.6 (1.0, 2.4)	386	413	0.7 (0.5, 1.0)	0.6 (0.4, 0.9)*	158	129	4.6 (2.4, 8.0)	0.9 (0.8, 1.6)
	35–39	230	180	1.3 (0.9, 2.0)	1.3 (0.9, 2.0)	280	311	0.7 (0.5, 1.0)	0.8 (0.5, 1.2)	107	151	4.0 (2.2, 7.1)	1.3 (0.8, 1.6)
	40–44	88	69	1.3 (0.8, 2.1)	1.4 (0.8, 2.2)	100	156	0.4 (0.3, 0.6)	0.4 (0.2, 0.7)**	32	68	3.1 (1.6, 6.1)	3.5 (0.1, 3.8)
Place of residence	45–49	25	22	1.2 (0.6, 2.4)	1.1 (0.5, 2.3)	33	56	0.4 (0.2, 0.7)	0.8 (0.4, 1.8)	10	2	3.1 (1.2, 7.6)	0.9 (0.2, 1.7)
	Urban	658	214	1	1	744	283	1	1	205	459	1	1
Educational level	Rural	1144	907	0.4 (0.3, 0.4)	0.82 (0.6, 1.0)	1266	1631	0.2 (0.2, 0.3)	1.0 (0.8, 1.4)	351	824	0.6 (0.4, 0.7)	0.8 (0.6, 1.0)
	No education	675	607	1	1	728	1287	1	1	243	490	1	1
	Primary	736	417	1.5 (1.3, 1.8)	1.3 (1.1, 1.6)**	845	567	2.7 (2.3, 3.1)	1.4 (1.1, 1.7)**	235	518	0.7 (0.6, 0.9)	0.7 (0.5, 1.0)
	Secondary	255	80	2.8 (2.1, 3.7)	1.9 (1.4, 2.6)**	297	47	9.4 (7.0, 12.5)	2.3 (1.6, 3.3)**	109	164	1.1 (0.8, 1.5)	1.0 (0.7, 1.3)
	Higher	136	17	7.4 (4.4, 12.5)	4.3 (2.4, 7.5)**	140	13	20.2 (11.5, 35.2)	2.6 (1.4, 4.9)**	53	86	1.2 (0.8, 1.8)	0.7 (0.4, 1.1)
	Never in union	4	9	1	1	14	7	1	1	7	7	1	1
Current marital status	Married	1708	1027	3.7 (1.1, 12.0)	8.5 (2.3, 30.4)**	1871	1786	0.4 (0.1, 1.5)	0.1 (0.0, 1.5)	1456	302	0.4 (0.1, 1.2)	0.8 (0.1, 1.9)
	Living with partner	9	10	2.0 (0.4, 9.1)	3.2 (0.6, 16.0)	15	13	0.5 (0.1, 1.8)	0.1 (0.0, 1.7)	4	11	0.3 (0.0, 1.6)	1.4 (0.9, 1.8)
	Widowed	11	15	1.7 (0.4, 6.9)	4.1 (0.9, 18.8)	16	28	0.1 (0.0, 0.5)	0.2 (0.0, 0.8)	2	14	0.1 (0.0, 1.0)	0.9 (0.8, 4.4)
	Divorced	54	36	3.3 (0.9, 11.5)	6.8 (1.7, 26.0)*	67	56	0.5 (0.2, 1.4)	0.4 (0.0, 1.4)	36	31	1.1 (0.3, 3.7)	1.2 (0.9, 1.6)
	No longer living together	15	25	1.4 (0.3, 5.5)	2.4 (0.5, 10.1)	30	25	0.5 (0.2, 1.4)	0.6 (0.0, 1.0)	11	18	0.5 (0.1, 2.0)	2.4 (1.0, 2.5)
	Male	1573	965	1	1	1708	1693	1	1	507	1087	1	1
Sex of household (HH) head	Female	230	156	0.9 (0.7, 1.1)	0.8 (0.6, 1.0)	305	221	1.4 (1.1, 1.7)	1.4 (1.0, 1.9)	109	198	1.3 (0.6, 0.9)	2.6 (0.1, 3.4)

(Continues)

TABLE A1 (Continued)

Variable	Category	Antenatal care, n = 2923			Delivery care, n = 3924			Postnatal care, n = 1899		
		Good	Poor	AOR (95%)	Good	Poor	AOR (95%)	Good	Poor	AOR (95%)
HH has radio	No	591	288	1	662	1373	1	209	354	1
	Yes	1185	818	1.4 (1.2, 1.6)	1319	153	0.4 (0.2, 0.7)	393	912	1.2 (0.6, 1.2)
	Not a de jure resident	27	15	1.2 (0.6, 2.3)	32	11	0.8 (0.4, 1.6)	14	18	0.6 (0.3, 0.9)
HH has television	No	504	119	1	572	70	1	242	305	1
	Yes	1272	987	3.2 (2.6, 4.0)	1410	1833	12.0 (9.4, 15.8)	385	936	1.9 (1.6, 2.4)
	Not a de jure resident	27	15	1.4 (0.7, 2.6)	32	11	2.7 (1.4, 5.0)	14	18	2.1 (1.0, 4.4)
Wealth index combined	Poorest	191	208	1	184	641	1	47	139	1
	Poorer	310	277	1.2 (0.9, 1.5)	339	483	2.7 (2.1, 3.4)	87	254	1.0 (1.0, 1.5)
	Middle	340	249	1.4 (1.1, 1.9)	351	410	3.1 (2.5, 3.9)	105	223	2.1 (0.8, 1.8)
	Richer	347	231	1.6 (1.2, 2.1)	436	269	6.1 (4.8, 7.7)	119	322	1.0 (0.7, 1.6)
	Richest	615	155	4.3 (3.3, 5.6)	703	110	25.6 (19.7, 33.7)	283	319	1.9 (1.3, 2.8)
Timing of first ANC	Inappropriate timing				991	840	1	479	904	1
	Appropriate timing				771	321	2.0 (1.7, 2.3)	322	319	1.9 (1.5, 2.3)
Number of ANC contact	Inadequate ANC				522	1517	1	479	904	1
	Adequate ANC				1167	721	4.7 (4.1, 5.3)	322	312	1.7 (1.4, 2.1)

Abbreviations: ANC, antenatal care; DHS, Demographic and Health Survey.

*p-value < 0.05; **p-value < 0.001.