


Home delivery among women who receive antenatal care in Ethiopia, design-based logistic regression analysis

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ABSTRACT

Background In Ethiopia, a significant proportion of women who receive antenatal care (ANC) deliver at home. This study aims to investigate home delivery among pregnant women who receive ANC during pregnancy in Ethiopia. Increased coverage of ANC is advised to improve institutional delivery, which in turn prevents maternal and neonatal morbidity and mortality.

Patients and methods We used data from the Performance Monitoring for Action Ethiopia panel study, which followed pregnant women 1 year through post partum. A total of 1749 women who received ANC during pregnancy were included in this study. To identify risk factors associated with home delivery, a design-based binary logistic regression analysis was used.

Results Of 1749 women who received ANC, 515 (29.4%) gave birth at home. Discussions on place of delivery with partner (adjusted OR (AOR)=0.56, 95% CI=0.35 to 0.90); desire to deliver at home (AOR=3.35, 95% CI=2.15 to 5.22); multiple birth readiness topics during ANC visits (AOR=0.39, 95% CI=0.21 to 0.63); and had ANC by a professional healthcare provider (AOR=0.40, 95% CI=0.23 to 0.70) were found to be significant predictors of home delivery.

Conclusion This study found that one-third of women who received ANC gave birth at home. Discussions on place of delivery with partner, birth readiness topics, women's desire for place of delivery and type of ANC provider were found to be independent predictors. Our results indicate for special attention to the evaluation and improvement of health extension workers' competency in ANC delivery, and counselling women on various aspects of birth readiness during ANC visits.

INTRODUCTION

Everyday, about 810 women die from causes related to pregnancy and childbirth. The vast majority (94%) of these deaths occur in low-resource settings.¹ Antenatal care (ANC) and skilled obstetric care during delivery are essential strategies that considerably decrease maternal morbidity and mortality. Delivering at health facilities enables women to receive skilled care during childbirth, which is recognised as being the most important strategy in

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Previous single-centre studies investigated the magnitude of home delivery and its associated factors focusing only on demographic, reproductive and obstetric characteristics of women. This study differs from other studies conducted in Ethiopia since it is based on nationally representative panel data and employs design-based analysis, which makes the findings more generalisable than smaller studies.

WHAT THIS STUDY ADDS

⇒ This study assessed the association between place of delivery and women's desire for place of delivery, type of antenatal care (ANC) provider and place of ANC, which had not been studied previously.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Our findings call for the evaluation and improvement of health extension workers' competency in ANC service provision, as well as counselling women on various aspects of birth readiness during ANC visits.

preventing maternal and neonatal deaths.^{2 3} Ethiopia has set targets to increase deliveries attended by skilled health personnel from 50% to 76% by the year 2024–2025.⁴ Despite measures to increase institutional delivery rates, a large proportion of women still deliver at home (72.6%, as estimated by the 2016 Demographic Health Survey). There has been a big focus for the ANC on identifying women at risk of home delivery and encouraging institutional delivery. A study conducted in 2015 on predictors of skilled attendance at delivery among antenatal clinic attendants in Ghana has shown that women who are at risk of delivering at home can be identified during ANC.^{5–8} However, a study done in southern Ethiopia shows that nearly two-thirds of women who received ANC, delivered at home, which highlights a major missed opportunity to retain women in the continuum of maternal healthcare.⁹



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Various studies have been conducted in Ethiopia to identify factors associated with home delivery after receiving ANC. Studies found that the number and place of ANC visits, poor counselling during ANC, cultural factors, pregnancy-related factors, socioeconomic factors, knowledge and attitudes towards institutional delivery and access to health facilities were significantly associated with home delivery among women who received ANC.^{5 7 10–15}

ANC provides an opportunity for healthcare providers, including health extension workers (HEWs), to counsel pregnant women to deliver at a health facility, particularly in developing countries like Ethiopia, where home delivery remains prevalent. Although increased coverage for ANC is recommended to improve institutional delivery,¹⁶ a significant proportion of women who receive ANC still deliver at home. A study conducted in the Southern Nations Nationalities and Peoples Region (SNNPR) aimed to determine why women opted to deliver at home after receiving ANC showed that non-institutional delivery was 62% among the participants, with previous experience of short and simple labour, uncomplicated home birth, night-time labour, the absence of pregnancy-related problems and perceived providers' poor reception of women being the main reasons.⁹ Despite all these studies, there is an evidence gap at the national level on why Ethiopian women who receive ANC do not deliver at a health facility.

Therefore, this study aimed to investigate the predictors of home delivery, related to the sociodemographic profile of women, reproductive and obstetric histories, place of ANC and other related factors among pregnant women in Ethiopia who receive ANC during pregnancy. Our study gave due consideration to overcome important limitations in previous studies, where the type of ANC provider was not adequately considered. Even studies considered that ANC providers collected the information either indirectly from an ANC register or directly from the pregnant women retrospectively. This study used data that were collected during pregnancy and follow-up points during the postpartum period. The findings will help policymakers and programme implementers to understand and respond to women's preferences for place of delivery when they receive ANC.

MATERIALS AND METHODS

Data source

This study used Performance Monitoring for Action (PMA) Ethiopia panel survey data. PMA-Ethiopia surveys use a multistage stratified cluster design to draw a probability sample of households and pregnant women. The PMA-Ethiopia panel survey is a large-scale, nationally representative survey that is conducted in six regional administrations of Ethiopia, which are divided into 10 strata (Tigray-1, Tigray-2, Addis Ababa, Afar, Amhara-1, Amhara-2, Oromiya-1, Oromiya-2, SNNP-1 and SNNP-2). The stratification is based on urban and rural areas of

regions, except Addis Ababa and Afar. We used data from the PMA-Ethiopia panel study, which enrolled currently pregnant and recently postpartum women into the study in 2019 and followed them through 1-year post partum. This study used data from interviews conducted when women were enrolled in the panel survey and from interviews that occurred when women were approximately 6-weeks post partum.

Study inclusion criteria

After screening, all eligible pregnant and postpartum women residing in the selected enumeration areas (EAs) gave oral consent to be enrolled in the panel study. We included women who completed baseline and 6-week postpartum surveys. Accordingly, 2868 females completed the baseline panel survey. Of those, 2392 females completed the 6-week postpartum follow-up survey. Our study included a subsample of 1749 women from the survey who reported that they received at least one ANC from HEWs and/or professional healthcare providers (PHCPs) during their pregnancy.

PMA-Ethiopia sampling procedure

A sample of 217 EAs from six regions was drawn to provide representative estimates of pregnant and postpartum women at the national level. A full census of the selected EAs was undertaken, listing the names, sex and ages of all household members. All women aged 15–49 years who are identified in the census were consented and screened for eligibility. Women were eligible to participate in the panel study if they were regular members of the household, including women staying at their parental home for the delivery and postpartum period, and self-identified as currently pregnant or less than 6-weeks post partum at the time of the interview. Women were enrolled in the PMA-Ethiopia study after giving their informed consent. They were informed of the time required to participate in the research and the risks and benefits of participating in the PMA study. At each follow-up interview, women are asked if they have any questions and if they still agree to participate in the study.

Data collection methods

Female resident enumerators (REs) collected baseline data at screening and follow-up data at 6-weeks post partum at the individual female level using smartphones to conduct the interviews.

At the study screening, the REs explained the purpose of the survey. If the respondent consented, the REs conducted an interview, using a baseline questionnaire. To conduct the 6-week postpartum interview for women who were pregnant at baseline, their approximate gestational age was used to estimate the date of delivery. A detailed description of the PMA data collection method is available.¹⁷

Variables of the study and operational definitions

Outcome variable

Home delivery (yes/no).

Independent variables

Sociodemographic background variables

Region, age of women, residence, educational status, current marital status, parity and wealth quintile.

Prenatal and postnatal delivery-related variables

Type of pregnancy (singleton or multiple), desire for place of delivery (home or health facility), having at least one danger sign during the recent pregnancy (severe headache with blurred vision, high blood pressure, oedema of the face, feet or body, convulsions or fits, vaginal bleeding before delivery, high fever, abnormal vaginal discharge, lower abdominal pain and/or worsening vision, particularly at night) and discussion about place of delivery with partner.

ANC-related variables

Gestational age at first ANC visit, number of ANC visits, type of ANC provider (HEW, PHCPs or both), discussion on birth readiness topics with a healthcare provider during ANC (ie, place of delivery, delivery by a skilled attendant, arrangement for transport for delivery), participation in 1–5 ANC group meetings (this is a meeting in which a group of one to five pregnant women come together to discuss their pregnancy and labour issues).

Data analysis

Data management and analysis were carried out using STATA, V.16. Descriptive analysis was performed using frequency and percentage for both dependent and independent variables. To identify risk factors and calculate adjusted ORs (AORs) for home delivery, design-based logistic regression analysis was used using 'svyset' command in STATA. Design-based analysis enabled us to account for dependence in the data collected among respondents who lived in the same clusters (EAs) and strata, since observations are not independent in complex surveys. Standard statistical analysis with an assumption of independence generally underestimates the variance estimation. As a result, we used one of the replication methods of variance estimation for complex survey designs: Jackknife replication. We considered sample weights in this analysis since a disproportionate sample selection was used, and we aimed to incorporate them to make the sample estimate representative of the population. Sample weights were constructed based on the selection probabilities of the EAs provided by the Ethiopia Central Statistics Agency and adjusted for non-response within the EA and for loss to follow-up. Application of the PMA-Ethiopia female survey weights for the panel survey resulted in a sample that is representative of all pregnant or recently postpartum women aged 15–49, residing in the six regions included in the PMA-Ethiopia Panel Study. To measure how the independent variables are consistently measuring the outcome variable (internally consistent), we computed 'Cronbach alpha' and found an overall test score of 0.73. Multicollinearity was checked using the variance inflation factor (VIF). The

mean VIF for the 13 items considered in the final model is 2.30 showing no multicollinearity. Furthermore, none of the variables has VIF value of >5. A p value less than or equal to 0.25 was taken as the candidate variable for the multivariable analysis as far as the rule of 'ten events per variable' for binary logistic regression is fulfilled. AORs with 95% CI and p value <0.05 were reported as a significant factor that affects home delivery.

Patient and public involvement statement

Women were not directly involved in formulating the research questions, choosing the study design or selecting study participants. However, a Project Advisory Board (PAB) was formed in January of 2019, chaired by the State Minister of Health, and composed of purposefully selected representatives from the community, the Ethiopian Ministry of Health (MoH), professional associations (eg, the Ethiopian Society of Obstetric and Gynaecologists), multilateral organisations (eg, UNICEF, UNFPA), non-governmental organisations (eg, Marie Stopes International, Pathfinder, Engender Health) and donors (eg, BMGF, DfID) that actively provide and/or support reproductive, maternal and neonatal health programmes in Ethiopia. The PAB provided critical input during the survey design and development stages to inform the content and scope of the survey and has been reviewing all preliminary results prior to dissemination to offer critical clinical and programmatic perspectives about the data. The PAB further advises PMA-Ethiopia about the development of outcome measures and indicators and encourages data utilisation within their organisations. All stakeholders participated in the PMA study knowledge dissemination workshops and provided feedback on further dissemination strategies.

Accordingly, key findings were distributed to the MoH and Regional Health Bureaus through published booklets, brochures and leaflets, both in English and local languages. Moreover, key results from PMA surveys were presented in briefs and in PowerPoint presentations and made available at <https://www.pmadata.org/countries/ethiopia>.

RESULTS

Sociodemographic characteristics

Table 1 shows the overall weighted sample characteristics by place of delivery. Higher number of home delivery, 165 (32%), was observed in Oromiya and 140 (27%) in Southern Nations Nationalities and People's (SNNP) Regions of Ethiopia, followed by 119 (23%) in Amhara region. The mean±SD age of women was 27.3±5.98 years. The majority of women lived in rural areas (58.4%), had attended primary education (36.6%), had 1–2 children (40.4%) and were married (93.4%). Among women who delivered at home, 31.5% were in the lowest wealth quintile, around half (50.8%) of women who delivered in a health facility were in the highest wealth quintile.

Table 1 Sociodemographic characteristics of women by place of delivery (weighted) in Ethiopia

		Home delivery	Facility delivery	All
		Count (%)	Count (%)	Count (%)
Region	Tigray	58 (11.3)	314 (25.4)	372 (21.3)
	Afar	31 (6.0)	9 (0.7)	40 (2.3)
	Amhara	119 (23.1)	237 (19.2)	356 (20.3)
	Oromiya	165 (32.0)	269 (21.8)	434 (24.8)
	SNNP	140 (27.2)	240 (19.5)	380 (21.7)
	Addis Ababa	2 (0.4)	165 (13.4)	167 (9.5)
Age category	15–19	40 (7.8)	100 (8.1)	140 (8.0)
	20–24	105 (20.4)	325 (26.3)	430 (24.6)
	25–29	161 (31.2)	425 (34.4)	586 (33.5)
	30–34	109 (21.2)	216 (17.5)	325 (18.6)
	35–39	73 (14.2)	139 (11.3)	212 (12.1)
	40–49	27 (5.2)	29 (2.4)	56 (3.2)
Residence	Urban	36 (7.0)	692 (56.1)	728 (41.6)
	Rural	479 (93.0)	542 (43.9)	1021 (58.4)
Educational status	Never attend	299 (58.0)	290 (23.5)	589 (33.7)
	Primary	178 (34.6)	462 (37.4)	640 (36.6)
	Secondary and above	38 (7.4)	482 (39)	520 (29.7)
Marital status	Married	491 (95.0)	1142 (92.5)	1633 (93.4)
	Living with a partner	10 (2.0)	56 (4.6)	66 (3.7)
	Never married/divorced/separated/widow/widowed	14 (2.7)	36 (2.9)	50 (2.8)
Wealth index	Lowest quintile	162 (31.5)	92 (7.6)	254 (14.5)
	Lower quintile	119 (23.1)	118 (9.6)	237 (13.5)
	Middle quintile	112 (21.7)	162 (13.0)	274 (15.6)
	Higher quintile	101 (19.6)	238 (19.0)	339 (19.4)
	Highest quintile	21 (4.1)	624 (50.8)	645 (36.9)
Parity	0 Children	47 (9.1)	356 (28.8)	403 (23.1)
	1–2 Children	178 (34.6)	529 (42.9)	707 (40.4)
	3+ Children	290 (56.3)	349 (28.3)	639 (36.5)

SNNP, Southern Nations Nationalities and People.

Of 1749 women who received ANC, 515 (29.4%, 95% CI: 27.3% to 31.6%) gave birth at home.

Reproductive and healthcare-related characteristics of women

Table 2 shows reproductive and healthcare-related characteristics of women overall and by place of delivery. The majority of women had a singleton pregnancy (98.0%), were in their second trimester at the time of their first ANC visit (64.6%), had four and above four ANC visits (62.3%), had discussion about place of delivery with partner (79.5%), were not members of 1–5 group meetings (77.8%), had ANC by a PHCP (62.4%), received ANC at a health facility (99.5%) and had a desire to deliver in a health facility (78.2%). Among women who delivered at home, 25.6% received ANC only from HEWs. Among

1183 women who had the desire to deliver at a health facility, 973 (82.2%) fulfilled their desire. On the other hand, among 282 women who desired to deliver at home, 199 (70.5%) gave birth at home.

Predictors of home delivery

Initially we considered 17 independent variables to identify factors associated with home delivery. Of those, we excluded region and place of ANC since they violated 10 events per variable rule of binary logistic regression analysis. In addition type of pregnancy, and presence of danger signs were excluded, because of having a p value of >0.25 in the bivariable analysis. Finally, 13 variables were simultaneously fitted to the design based multivariable binary logistic regression model, resulting in eight significantly associated variables with home delivery, at

Table 2 Reproductive characteristics of women who received ANC during pregnancy, by place of delivery (weighted)

		Home delivery count (%)	Facility delivery count (%)	All count (%)
Type of pregnancy	Single	507 (98.4)	1208 (97.9)	1715 (98.0)
	Twin	8 (1.6)	26 (2.1)	34 (2.0)
Gestational age at first ANC (N; HD=511, FD=1229, all=1740)	First trimester	95 (18.6)	449 (36.5)	544 (31.2)
	Second trimester	374 (73.2)	751 (61.1)	1125 (64.6)
	Third trimester	42 (8.2)	29 (2.4)	71 (4.1)
Number of ANC visits (N; HD=514, FD=1232, all=1746)	Less than four times	320 (62.3)	339 (27.5)	659 (37.7)
	Four and above four times	194 (37.7)	893 (72.5)	1087 (62.3)
Discussion on birth readiness topics	Discussed no birth readiness topic	169 (32.8)	207 (16.8)	376 (21.5)
	Discussed one birth readiness topic	39 (28.0)	112 (44.7)	151 (8.6)
	Discussed two birth readiness topics	163 (31.6)	363 (29.4)	526 (30.1)
	Discussed three birth readiness topics	144 (7.6)	552 (9.1)	696 (39.8)
Had danger sign during the recent pregnancy (N; HD=509, FD=1224, all=1733)	No	245 (48.1)	629 (51.4)	874 (50.4)
	Yes (at least one danger sign)	264 (51.9)	595 (48.6)	859 (49.6)
Discussion about place of delivery with partner	No/partner not involved	213 (41.3)	146 (11.8)	359 (20.5)
	Yes	302 (58.6)	1088 (88.1)	1390 (79.5)
Participation in 1–5 group meetings	Yes	34 (6.6)	112 (9.9)	156 (8.9)
	No, member but did not participate	74 (14.4)	159 (12.9)	233 (13.3)
	No, not member	407 (79.0)	953 (77.2)	1360 (77.8)
Women's desire for place of delivery (N; HD=440, FD=1072, all=1512)	Have not decided	31 (7.1)	16 (1.5)	47 (3.0)
	Home	199 (45.2)	83 (7.7)	282 (18.6)
	Health facility	210 (47.7)	973 (90.8)	1183 (78.2)
Type of ANC provider	HEW	132 (25.6)	106 (8.6)	238 (13.6)
	PHCP	254 (49.3)	838 (67.9)	1092 (62.4)
	HEW and PHCP	129 (25.1)	290 (23.5)	419 (23.9)
Place of ANC	Home	6 (1.2)	2 (0.2)	8 (0.5)
	Health facility	509 (98.8)	1232 (99.8)	1741 (99.5)

ANC, antenatal care; FD, facility delivery; HD, home delivery; HEWs, health extension workers; N, number of respondents; PHCPs, professional healthcare providers.

the 0.05 level of significance. [Table 3](#) shows the results of bivariable and multivariable binary logistic regression models on the odds of home delivery.

Among women who received ANC during their pregnancy, those living in rural areas had 2.7 times higher odds of home delivery, compared with women living in urban areas (AOR=2.70, 95% CI=1.17 to 6.21). Compared with married women, cohabiting women had 2.22 times higher odds of home delivery (AOR=2.22, 95% CI=1.03 to 4.80). Women in the middle, higher and highest wealth quintiles had 56%, 52% and 89% lesser odds of home delivery compared with women in the lowest quintile (AOR=0.44, 95% CI=0.26 to 0.76; AOR=0.48, 95% CI=0.26 to 0.8; and AOR=0.11, 95% CI=0.03 to 0.33), respectively. Women with 1–2 children and 3+ children were at 4.94 and 5.61 times higher odds of home delivery compared with women having zero children (AOR=4.91, 95% CI=2.37 to

13.24 and AOR=5.61, 95% CI=2.37 to 13.24, respectively). Women who had discussion on three birth readiness topics during ANC had 61% lesser odds of home delivery compared with women who had no discussion on birth readiness topics (AOR=0.39, 95% CI=0.21 to 0.63).

Compared with women who had no discussion about place of delivery with their partner, women who had a discussion about place of delivery with their partner had 44% lower odds of home delivery (AOR=0.56, 95% CI=0.35 to 0.90). Women who desired home delivery had a 3.35-fold increase in the odds of home delivery compared with women who desired facility delivery (AOR=3.35, 95% CI=2.15 to 5.22). On the other hand, women who have not decided where to deliver their babies had 4.91 times higher odds of home delivery compared with those who desired to give birth at a health facility (AOR=4.91, 95% CI=1.88 to 12.79).

Table 3 Bivariable and multivariable binary logistic regression models on the odds of home delivery using jackknife variance estimation techniques

		Home delivery			P value for the COR	AOR (95% CIs)	P value for the AOR
		Yes	No	COR (95% CIs)			
Age category	15–19	40	100	1		1	
	20–24	105	325	1.02 (0.67 to 1.57)	0.901	0.75 (0.39 to 1.44)	0.389
	25–29	161	425	1.30 (0.85 to 2.00)	0.216	0.92 (0.45 to 1.87)	0.819
	30–34	109	216	1.59 (1.08 to 2.33)	0.017	0.63 (0.26 to 1.50)	0.300
	35–39	73	139	1.65 (0.99 to 2.74)	0.052	0.66 (0.26 to 1.63)	0.370
	40–49	27	29	2.45 (1.17 to 5.12)	0.017	0.72 (0.64 to 2.75)	0.640
Residence	Urban	36	692	1		1	
	Rural	479	542	11.73 (6.29 to 21.85)	0.000	2.70 (1.17 to 6.21)	0.019*
Educational status	Never attend	299	290	1		1	
	Primary	178	462	0.53 (0.39 to 0.72)	0.000	0.98 (0.62 to 1.53)	0.937
	Secondary and above	38	482	0.14 (0.08 to 0.23)	0.000	1.28 (0.60 to 2.75)	0.515
Marital status	Married	491	1142	1		1	
	Living with a partner	10	56	0.52 (0.23 to 1.18)	0.121	2.22 (1.03 to 4.80)	0.042*
	Never married/divorced/separated/widow/widowed	14	36	1.20 (0.54 to 2.65)	0.644	1.78 (0.51 to 6.13)	0.358
Wealth index	Lowest quintile	162	92	1		1	
	Lower quintile	119	118	0.63 (0.42 to 0.94)	0.025	0.70 (0.41 to 1.28)	0.184
	Middle quintile	112	162	0.41 (0.27 to 0.62)	0.000	0.44 (0.26 to 0.76)	0.003*
	Higher quintile	101	238	0.28 (0.15 to 0.50)	0.000	0.48 (0.26 to 0.88)	0.019*
	Highest quintile	21	624	0.03 (0.01 to 0.06)	0.000	0.11 (0.03 to 0.33)	0.000*
Birth event (parity)	0 Children	47	356	1		1	
	1–2 Children	178	529	2.98 (1.94 to 4.58)	0.000	4.94 (2.63 to 9.26)	0.000*
	3+ Children	290	349	6.25 (4.03 to 9.68)	0.000	5.61 (2.37 to 13.24)	0.000*
Gestational age at first ANC	First trimester	95	449	1		1	
	Second trimester	374	751	2.28 (1.58 to 3.28)	0.000	1.15 (0.74 to 1.77)	0.517
	Third trimester	42	29	5.79 (2.90 to 11.53)	0.000	1.31 (0.53 to 3.20)	0.552
Number of ANC visits	Less than four times	320	339	1		1	
	Four and above four times	194	893	0.28 (0.21 to 0.39)	0.000	0.71 (0.45 to 1.11)	0.139
Discussion on birth readiness Topics	Discusses no birth readiness topic	169	207	1		1	
	Discusses on one birth readiness topic	39	112	0.46 (0.28 to 0.78)	0.004	0.54 (0.24 to 1.01)	0.075
	Discusses on two birth readiness topics	163	363	0.47 (0.33 to 0.67)	0.000	0.67 (0.37 to 1.04)	0.111
	Discusses on three birth readiness topics	144	552	0.23 (0.15 to 0.37)	0.000	0.39 (0.21 to 0.63)	0.001*
Discussion about place of delivery with partner	No/partner not involved	213	146	1		1	
	Yes	302	1088	0.19 (0.13 to 0.29)	0.000	0.56 (0.35 to 0.90)	0.017*
Participation in 1–5 group meetings	Yes	34	122	1		1	
	No, member but did not participate	74	159	1.97 (1.04 to 3.74)	0.036	1.64 (0.76 to 3.56)	0.205
	No, not member	407	953	2.03 (1.20 to 3.44)	0.008	1.61 (0.88 to 2.96)	0.121
Women’s desire on place of delivery	Have not decided	31	16	8.58 (4.07 to 18.08)	0.000	4.91 (1.88 to 12.79)	0.001*
	Home	199	83	7.58 (5.05 to 11.37)	0.000	3.35 (2.15 to 5.22)	0.000*
	Health facility	210	973	1		1	

Continued

Table 3 Continued

		Home delivery			P value for the COR	AOR (95% CIs)	P value for the AOR
		Yes	No	COR (95% CIs)			
Type of ANC provider	HEW	132	106	1		1	
	PHCP	254	838	0.20 (0.11 to 0.34)	0.000	0.40 (0.23 to 0.70)	0.002*
	HEW and PHCP	129	290	0.27 (0.16 to 0.46)	0.000	0.53 (0.27 to 1.03)	0.061

*Statistically significant at 0.05 level of significance.

†Reference group.

ANC, antenatal care; AOR, adjusted OR; COR, crude OR; HEWs, health extension workers; PHCPs, professional healthcare providers.

Women who received ANC from PHCPs had 60% reduced odds of home delivery compared with women who received ANC from HEWs (AOR=0.40, 95% CI=0.23 to 0.70).

DISCUSSION

Home delivery poses serious risks to the health of both the mother and the infant, especially in developing nations, where access to emergency care and transportation is limited. Various research studies indicate that some women give birth at home even after receiving ANC at health facilities. This study aimed to investigate why women in Ethiopia deliver at home after receiving ANC. The study found that the level of home delivery among women who receive ANC was slightly less than one-third (29.45%).

In this study, rural residence was significantly associated with an increased rate of home delivery compared with urban residence (AOR=2.70, 95% CI=1.17 to 6.21), which is consistent with multilevel modelling studies done in Ethiopia, where rural communities had a significant association with home delivery.^{8 18} The finding is also similar to a study conducted in northwest Ethiopia, where rural residence (AOR=3.8, 95% CI=1.3 to 10.9) was found to be a predictor of home delivery.¹⁹ Similarly, evidence from a systematic review and meta-analysis indicates that residence setting (AOR=3.84, 95% CI=1.31 to 11.25) was a significant predictor of place of delivery.¹³ In rural areas, women may prefer home delivery for social advantages, perceived and actual financial constraints, limited access to transportation and service delivery points which was also explored by qualitative studies conducted in Ghana and Zimbabwe.^{20 21}

This study also found that women who were currently living together with a man as if married were 2.22 times more likely to deliver at home compared with those who are married (OR=2.22, 95% CI=1.03 to 4.80). Women may have fears related to having a baby out of marriage, particularly in Ethiopia, where social norms highly value marriage, including wedding ceremonies. Unmarried women may prefer to deliver at home rather than be exposed to the public. However, no supporting evidence is found in Sub-Saharan Africa, and further study is

important on how marital status is related to the place of delivery.

In this study, wealth quintile was another predictor for home delivery, where women in higher wealth quintiles were less likely to deliver at home. The finding shows that women in the middle, higher and highest wealth quintiles were 56%, 52% and 89% less likely to deliver at home compared with women in the lowest quintile (AOR=0.44, 95% CI=0.26 to 0.76; AOR=0.48, 95% CI=0.26 to 0.88; AOR=0.11, 95% CI=0.03 to 0.33, respectively). This is consistent with the other studies conducted in Kenya²² and Ethiopia,^{8 16} in which the wealth index was an important predictor of home delivery. Delivery services are provided free of charge in Ethiopia. However, women may perceive it as if they are charged for maternal services or other actual costs for transportation and others. This may imply that programmes aimed at increasing institutional delivery should give due attention to economically disadvantaged women. However, it needs further investigation to determine why women in the lowest wealth quintiles are delivering at home compared with their counterparts.

This study's findings showed that women who had discussions on three birth readiness topics during ANC visits were 61% less likely to deliver at home compared with women who did not discuss any birth readiness topics (AOR=0.39, 95% CI=0.21 to 0.63). The result is consistent with a qualitative, phenomenological study finding on why some Ethiopian women give birth at home after receiving ANC, where lack of planning in advance for childbirth was explored as one of the main reasons for home delivery after ANC follow-ups.¹⁴ It is also similar to other quantitative studies where poor knowledge of obstetric complications¹¹ and no information about birth preparedness¹⁵ were associated with home delivery. Of note, the odds of home delivery had no difference between women who discussed one or two birth readiness topics and women who discussed no birth readiness topics during ANC visits. This finding suggests that only comprehensive discussions about birth readiness during ANC are associated with decreased odds of home delivery.

This study has found that women who had a discussion about place of delivery with their partner were 44% less

likely to deliver at home compared with women who had no discussion about place of delivery with their partner (AOR=0.56, 95% CI=0.35 to 0.90). This is consistent with a study conducted in Eritrea, where joint decision-making with husbands has a negative influence on home delivery.²³ This suggests that the more authority women have in their relationships, the more dialogues they will initiate with their husbands concerning the place of delivery and advocate for themselves to give birth in a facility.

Furthermore, the study's findings found that women who wanted to give birth at home had 3.35 times the odds of doing so compared with women who wanted to deliver at a health institution (AOR=3.35, 95% CI=2.15 to 5.22). This could imply that, in the absence of a convincing message, women tend to gravitate towards their own desires, even if such desires or beliefs are potentially damaging to their health. On the other hand, women who have not decided where to deliver their babies had higher odds of home delivery compared with those who desired to give birth at a health facility (AOR=4.91, 95% CI=1.88 to 12.79). This underlies the fact that the more mothers are in a dilemma about place delivery, the more they will deliver at home. This may imply that no matter whether women are attending ANC, we should ensure that their potential place of delivery is a health facility.

In this study, type of ANC provider was found to be a significant predictor of place of delivery, with women who received ANC from PHCPs being 60% less likely to deliver at home compared with women who received ANC from HEWs only (AOR=0.40, 95% CI=0.23 to 0.70). This might result from either the skills of providers, the quality of service they provide, or the perception of women towards the acceptance of messages they obtain from different types of providers. Therefore, further study is needed to clearly indicate why the type of provider matters in Ethiopia.

Strength and limitation of the study

This study differs from other studies conducted in Ethiopia in that it is based on nationally representative panel data and employs design-based analysis, which makes the findings more generalisable. Furthermore, this study assessed the association between place of delivery and women's desire for place of delivery, type of ANC provider and place of ANC, which had not been studied previously. Although the study has its own strengths, it is not without limitations in that the effect of factors like distance to maternity clinics, family beliefs and the attitude of healthcare providers towards the place of delivery was not controlled. Furthermore, we cannot draw any conclusions about the causality of associations.

CONCLUSION AND RECOMMENDATIONS

The study found that almost one-third of women who received ANC missed a golden opportunity by giving

birth at home. Economic background, place of residence, discussion on place of delivery with partner, discussion on birth readiness topics, desire for place of delivery and type of ANC provider were found to be associated with home delivery. This demands special attention to partner involvement and counselling on birth readiness topics during ANC visits. Any programmes aimed at decreasing home delivery should emphasise on rural and economically disadvantaged women beyond free maternal health services at the facilities. Furthermore, more emphasis should be given to the health extension programme in order to improve the competency of HEWs on ANC provision, with close follow-up on the implementation of counselling on danger signs and place of delivery for all ANC attendants. All ANC providers, especially HEWs, should be trained in birth preparedness topics and partner involvement during ANC. Further study focusing on how types of providers and marital status affect the actual place of delivery is suggested in order to better understand why women deliver at home after receiving ANC.

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