

BMJ Open Institutional delivery service utilisation and associated factors among mothers of childbearing age in Delgi District, Northwest Ethiopia: a community-based cross-sectional study design

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ABSTRACT

Objective This study aimed to assess the use of institutional delivery services and associated factors among Delgi District mothers of childbearing age.

Design A community-based cross-sectional study design.

Setting At five Kebeles in Delgi District, Northwest Ethiopia.

Participants The study was performed on 403 childbearing age mothers using a structured questionnaire and a face-to-face interview. We used a systematic random sampling method to select the study participants.

Methods The data were analysed using descriptive analysis, binary logistic regression analysis, and multivariable logistic regression analysis.

Outcome Institutional delivery service utilisation.

Results In the present study, 75.9% (95% CI: 71.7% to 80.1%) of respondents used health facilities for their last delivery. After adjusting for covariates, diploma holders (adjusted odds ratio (AOR)=5.63; 95% CI: 3.77 to 8.39), maternal age at 23–27 years (AOR=6.47; 95% CI: 2.74 to 15.32), divorced women (AOR=0.30; 95% CI: 0.12 to 0.75), husband's primary education (AOR=0.38; 95% CI: 0.18 to 0.82), the distance required above 10 km to reach the health facility (AOR=0.17; 95% CI: 0.04 to 0.72) and the time required above 4 hours to reach the health facility (AOR=0.30; 95% CI: 0.12 to 0.73) were significantly associated with institutional delivery service utilisation.

Conclusions The majority of respondents utilised institutional delivery services in this study. High-level maternal education, younger maternal age, divorce marital status, low-level husband education, long distances to reach a health facility and prolonged time to reach a health facility were all independently linked to the use of institutional delivery services. One of the foundations for increasing institutional delivery service use is improving mother-waiting centres for delivery services, infrastructure and transportation services and awareness about institutional delivery services. Providing counselling services for mothers during antenatal care visits or house-to-house health education on institutional delivery services for rural residents will improve institutional delivery service use even more.

STRENGTH AND LIMITATIONS OF THIS STUDY

- ⇒ This study is a community-based study based on a random sampling approach.
- ⇒ Recall bias may happen because some exposures were asked retrospectively.
- ⇒ Selection bias may present due to an error in a random chance of selecting the Kebeles.
- ⇒ Confounding bias may occur due to any other unknown confounding factors that were not controlled.

INTRODUCTION

Globally, more than 20 million women conceive every year, with 15% of them experiencing pregnancy-related complications.¹ Every day, at least 1600 mothers die from pregnancy and childbirth complications around the world, with 90% of these deaths occurring in Asia and Sub-Saharan Africa.² A transformative new maternal health strategy was recently formed as part of the Sustainable Development Goals to minimise global maternal mortality to less than 70 per 100 000 live births by 2030.³ The WHO publication, on the other hand, sets a supplementary national aim of no country having a maternal mortality rate greater than 140 per 100 000 live births by 2030, as well as sets a strategic structure for achieving these lofty goals.³ Even if the majority of maternal deaths could be prevented, huge disparities were found between the high-income and low-income countries. The lifetime risk of maternal mortality due to pregnancy and childbirth complications in developing countries is higher than in developed countries, at 1 in 41 and 1 in 3300, respectively.³ Annual maternal mortality rates from pregnancy and delivery-related complications are highest in Asia and Africa.^{1,3}

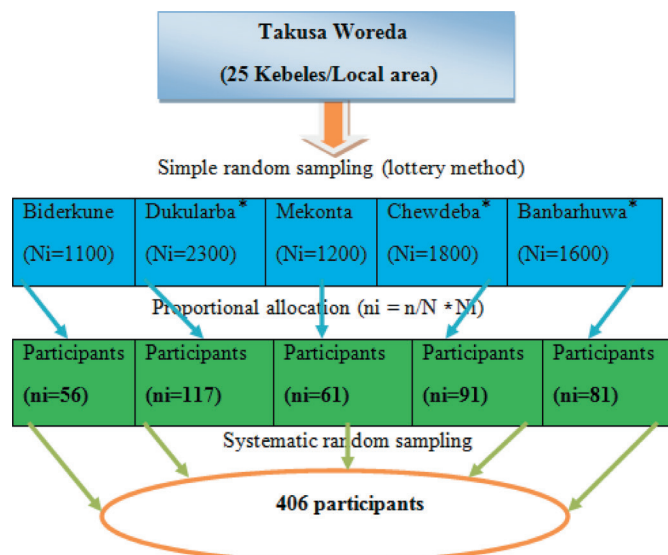


Figure 1 Schematic representation of the sampling technique of the mothers in Delgi District, Northwest Ethiopia. Urban Kebele (*), ni is sample size ith stratum, n is a total sample size, N is a total participants size and Ni is participants size of ith stratum.

In Sub-Saharan African countries, every hour, at least 30 mothers die from complications during pregnancy and childbirth, for a total of 270 000 deaths per year.⁴ Therefore, these countries are on the way to missing their maternal mortality targets, with recent reports indicating that the overall yearly rate of reduction in maternal mortality is less than 1%.¹⁴ In developed countries, 98% of women receive antenatal care services.⁵ However, about half of all women are unable to get adequate antenatal care services in developing countries.⁶ Maternal healthcare services utilisation such as family planning, antenatal care, postpartum care and institutional delivery have been proven to be associated with reductions in maternal mortality.^{7,8}

In Ethiopia, the maternal mortality rate is estimated at 401 per 100 000 live births by the year 2017.⁹ From 2000 to 2017, the country's average yearly rate of reduction was 5.5%.⁹ It is crucial to increase institutional delivery in order to minimise maternal and neonatal mortality.¹⁰ According to a 2016 study from Ethiopia's demographic health survey, 26% of live births were delivered in health facilities.¹⁰ Despite Ethiopia's strong promotion of institutional delivery, home delivery (73%) is still common, especially in hard-to-reach areas.^{10,11} Besides, due to inaccessibility, lack of adequate services, and unavailability of antenatal care services, a rural part of Ethiopia has a higher rate of maternal mortality but a lower rate of skilled health providers (21%).^{10,11} Recently, the traditional and untrained birth attendants attended about 72% of births, while skilled health providers attended just 28%.¹⁰ In our country, the women whose deliveries are assisted by skilled health providers have less risk of delivery complications leading to death than those assisted by traditional birth attendants.^{10,11} Institutional delivery and delivery assisted by skilled health providers are higher in women attending more than four antenatal care visits, 46% and 48% of births were

delivered in the health facility and by skilled health providers, respectively.¹⁰

Regionally, skilled health providers' proportion differences were seen in the Ethiopian demographic health survey report that ranges from 97% in Addis Ababa to only 16% in the Afar region.¹⁰

Previous studies have shown that the place of residence, age of the women, educational level of the women and their husbands, the number of antenatal care visits, distance to reach the health institutions, overall knowledge and overall attitude all influence the use of institutional delivery services.¹¹⁻¹⁷ However, some other studies reported a non-significant association of the above variables with the use of institutional delivery services.¹⁸⁻²³

There was a paucity of data on institutional delivery service utilisation in the study area. Therefore, this study aimed to assess the use of institutional delivery services and associated factors among mothers of childbearing age in Delgi District.

METHODS AND MATERIALS

Study design, period, setting and population

From 26 February 2020 to 30 May 2020, a community-based cross-sectional study was carried out in Delgi District (Takusa Woreda), Central Gondar Zone, Amhara Regional State, Northwest Ethiopia. Delgi Town is the administrative centre of Takusa Woreda. Delgi Town is located 91 km far from Gondar City. Delgi District has a total population of 153 253, with 77 631 men and 75 622 women, according to Ethiopian population projections. Delgi District has 25 kebeles (lowest administrative units) and 6 health centres. There are two private clinics, one primary hospital and one health centre in Delgi Town.²⁴ All women of the childbearing age (from 15 to 49 years) who gave birth within the past 1 year prior to commencing the study were the study population.

Sample size determination and sampling technique

A single population proportion formula was considered to calculate the sample size, with a proportion value of 0.60 (taken from a similar study conducted in the Boset Woreda, Ethiopia²⁵), a 95% CI, a 5% margin of error and a 10% non-response rate (n=37). As a result, a total of 406 participants were included.

This study utilised a lottery method, simple random sampling, to select 5 from 25 kebeles (namely, Biderkune, Dukularba, Mekonta, Chewdeba and Banbarhuwa) in the District and we considered a systematic random sampling method to select the study participants (figure 1). The sample size was appropriately allocated to the number of childbearing age mothers in each of the selected kebeles (figure 1). Besides, the kth interval (k=5) was determined by dividing the estimated number of mothers of childbearing age by the sample size. The study included all randomly selected childbearing mothers who gave birth within the past 1 year and who had been living at least for 6 months in the study area.

Study variables

The primary outcome of interest of the study is institutional delivery service utilisation. Sociodemographic variables such as residence, maternal age, religion, educational level, marital status, husbands' education, occupation, husbands' occupation and household monthly income are independent variables. Moreover, obstetric and maternal variables such as age at first marriage, age at first pregnancy, number of pregnancies, number of live births, antenatal care visit during last pregnancy, the number of antenatal care visits, previous intrapartum health problems, previous postpartum health problems (complications), family size, history of institutional delivery, the decision-maker of the delivery place, the distance to reach a health facility and the time it took to reach a health facility are independent variables.

Data collection tools, techniques, procedures and quality control

Data on institutional delivery service use and associated factors were acquired through a direct face-to-face interview utilising a structured questionnaire.

A data collection questionnaire was adopted from the tools that focus on institutional delivery utilisation in different related literature that could satisfy the objectives of this study.^{1 11 13 16 18 21-23 25-31} A pretest study (on 5% of the sample size before the actual data collection) and expert discussion with public health experts, midwives and obstetricians ensured the questionnaire's validity. Expert recommendations and pretest findings were used to make changes/modifications to the questionnaire. Moreover, after the data were gathered in the pretest study, the questionnaire was evaluated for clarity, content and flow. To maintain continuity of meaning, the questionnaire was first written in English and then translated into Amharic (the local language) and then, back to English. The data have been gathered by trained midwives (five BSc midwives under the supervision of five supervisors).

The data collection questionnaire was reviewed for uniformity and completeness regularly to ensure data quality. Data collectors and supervisors received training for 1 day related to study objectives, data collection procedures and related issues. Every day, in addition to the research investigators, qualified supervisors provided close supervision and appropriate input to the data collectors when it was necessary.

Operational definitions

1. **Institutional delivery service utilisation:** defined as a mother who gave birth to her last baby by skilled health professionals in a hospital, health centre, health post or clinic.
2. **Home delivery:** refers to a mother who gave birth to her last baby outside the health institution; the delivery takes place at home or on the way to the health institution.

3. **The distance to reach a health facility:** the distance between the women's house and the nearest healthcare facility providing delivery services in kilometres.
4. **The time to reach a healthcare facility:** the time it took by walking from the women's house to the nearest healthcare facility.

Data management and analyses

The investigators used STATA V.16 statistical software to analyse the collected data after it is entered and cleaned in the Epi-Info V.7.2.2.2 software.³² The completeness, accuracy and clarity of the collected data were checked. Before analyses, the coding and missing values were taken into account. As a result, findings were presented using frequencies and summary statistics in the form of text and graphs. If a mother gave birth at home, the outcome variable (institutional delivery service utilisation) was set to 'No=0' and if a mother gave birth in a hospital, health centre, health post or clinic for her recent delivery, the outcome variable, institutional delivery service utilisation, was set to 'Yes=1'. The frequency and percentage of dependent and independent variables were defined using descriptive analysis. Binary logistic regression and multivariable logistic regression analyses were performed to explain the link between predictor and outcome variables, as well as independent predictors of the outcome variable. The model's fitness was assessed using the Hosmer-Lemeshow goodness of fit test. The strength of association between predictor and outcome variables was tested using crude odds ratio (COR) and adjusted odds ratio (AOR). To control all potential confounding variables simultaneously, covariates that have a p value <0.05 in the bivariate analyses were entered into the multivariable logistic regression analysis. In general, a p value <0.05 (or AOR with 95% CI) was deemed statistically significant. In this study, all the above logistic regression analyses were adjusted for the design effect (cluster effect) of the primary sampling/clustering unit, Kebeles.

Patient and public involvement

The mothers/participants were interviewed after receiving their permission. Besides, we received the permission and cooperation of the district and local administrators of the study area following the detailed explanations of the study.

RESULTS

Sociodemographic characteristics

A total of 403 mothers were involved in the study (with a 99.3% response rate), of whom 158 (39.2%) were from 28 to 32 years of age. The mean age of respondents was $31.4 \pm (SD=5.51)$ years ranging from 18 to 46 years. The majority of them were urban residents, 290 (72%), orthodox followers, 308 (76.4%), married, 353 (87.6%) and without formal education, 157 (39%). More than half of the respondents were homemakers in their occupation, 241 (59.8%), and approximately 42.4% (171) of

Table 1 Sociodemographic characteristics of respondents in Delgi District, Northwest Ethiopia

Characteristics	Home delivery	Institutional delivery	Total frequency	Total per cent
Place of residence				
Rural	48	65	113	28.04
Urban	49	241	290	71.96
Religion				
Muslim	18	48	66	16.38
Protestant	6	23	29	7.20
Orthodox	73	235	308	76.43
Age of the respondent in years				
18–22	10	13	23	5.71
23–27	12	56	68	16.87
28–32	33	125	158	39.21
33–37	23	78	101	25.06
38 and above	19	34	53	13.15
Marital status				
Married	80	273	353	87.59
Widowed	3	11	14	3.47
Divorced	14	22	36	8.93
Educational level				
No formal education	37	120	157	38.96
Primary and junior education	31	56	87	21.59
Secondary and preparatory education	15	30	45	11.17
Certificate holder	10	22	32	7.94
Diploma holder	2	47	49	12.16
Degree and above holder	2	31	33	8.19
Occupation of the respondent				
Housewife	59	182	241	59.80
Government employee	19	61	80	19.85
Farmer	9	43	52	12.90
Others	10	20	30	7.44
Household monthly income				
≤600	35	136	171	42.43
601–1650	39	92	131	32.51
1651–3200	16	42	58	14.39
3201 and above birr	7	36	43	10.67
The educational level of the husband				
No formal education	37	115	152	37.72
Primary and junior education	20	40	60	14.89
Secondary and preparatory education	12	20	32	7.94
Certificate holder	8	20	28	6.95
Diploma holder	12	54	66	16.38
Degree holder and above	8	57	65	16.13
Occupation of the husband				
Merchant	9	18	27	6.70
Government employee	24	89	113	28.04
Farmer	55	173	228	56.58
Others	9	26	35	8.68

participants had a household income of fewer than 600 birrs. Most of the respondent's husbands were farmers, 228 (56.6%), and without formal education, 152 (37.7%) (table 1).

Obstetric and maternal characteristics

The majority of the respondent's first marriage age and first pregnancy age were from 14 to 18 (45.7%) and 19 to 23 (59.6%) years, respectively. Of the total study

Table 2 Obstetric and maternal characteristics of respondents in Delgi District, Northwest Ethiopia

Obstetric characteristics	Home delivery	Institutional delivery	Total frequency	Total per cent
Age at first marriage				
14–18	48	136	184	45.66
19–23	39	141	180	44.67
24 and above years	10	29	39	9.68
Age at first pregnancy				
14–18	29	69	98	24.32
19–23	54	186	240	59.55
24 and above years	14	51	65	16.13
Number of pregnancies				
Below 2	31	118	149	36.97
2 and above	66	188	254	63.03
Number of live births				
Below 2	26	107	133	33.00
2 and above	71	199	270	67.00
Antenatal care visit during last pregnancy				
No	67	3	70	17.37
Yes	30	303	333	82.63
Number of antenatal care visits				
No visits	32	38	70	17.37
1–2	48	164	212	52.61
≥3 visits	17	104	121	30.02
Previous intrapartum health problems				
No	81	265	346	85.86
Yes	16	41	57	14.14
Previous postpartum health problems				
No	73	231	304	75.43
Yes	24	75	99	24.57
Family size				
1–3	34	101	135	33.50
4 and above	63	205	268	66.50

respondents, 63% had at least two pregnancies, 82.6% had antenatal care visits, 52.6% had one to two antenatal care visits, 14.1% had previous intrapartum health problems and 24.6% had previous postpartum health problems (table 2).

Accessibility characteristics

Of 403 respondents, 381 (94.5%) had accessibility for transportation. Most of the respondents reach a health facility within 1 hour in time, 127 (31.5%), and 1–3 km in distance, 123 (30.5%) (table 3).

Institutional delivery service utilisation and related information

Of 403 respondents, three hundred six (75.9%; 95% CI: 71.7% to 80.1%) women utilised health facilities during the last delivery and 322 (79.9%) had a previous history of institutional delivery. Health centres, 192 (47.6%), were

the most frequently visited site of delivery among mothers who used health facilities (figure 2). The majority of the respondents decided on their delivery place jointly with their husbands, 175 (43.4%). The major reason for home delivery was the suddenness of labour, 57 (58.8%). Among respondents who delivered at home, the traditional birth attendants, 49 (50.5%), were the most frequent (table 4).

Factors associated with institutional delivery service utilisation

Place of residence, respondent's age, educational level, marital status, husbands' education, number of antenatal care visits, the distance to reach a health facility and time to reach a health facility were all significant factors in binary logistic regression analyses. Nevertheless, religion, occupation, occupation of the husband, household monthly income, age at first marriage, age at first pregnancy,

Table 3 Accessibility characteristics of respondents in Delgi District, Northwest Ethiopia

Characteristics	Home delivery	Institutional delivery	Total frequency	Total per cent
Accessibility of transport service				
No	7	15	22	5.46
Yes	90	291	381	94.54
Distance to reach a health facility (km)				
1–3	17	106	123	30.52
4–6	7	104	111	27.54
7–9	30	40	70	17.37
10 and above	37	34	71	17.62
I do not know	6	22	28	6.95
Time to reach a health facility (hours)				
Below 1:00	26	101	127	31.51
1–2:00	14	107	121	30.02
2:01–3:00	15	40	55	13.65
3:01–4:00	24	35	59	14.64
Above 4:00	15	13	28	6.95
I do not know	3	10	13	3.23

number of pregnancies, number of a live birth, previous intrapartum health problems, previous postpartum health problems, family size, history of institutional delivery, accessibility of transport and the decision-maker of the place of delivery were non-significant factors in binary logistic regression analyses. To rule out confounders, variables that showed statistically significant association in binary logistic regression analyses were entered into a multivariable logistic regression analysis. As a result, 23–27 years age-group (AOR=6.47 (95% CI: 2.74 to 15.32)), 28–32 years age-group (AOR=3.64 (95% CI: 1.35 to 9.84)), primary education (AOR=0.40 (95% CI: 0.16 to 0.99)), diploma holders in education (AOR=5.63 (95% CI: 3.77 to 8.39)), divorced women (AOR=0.30 (95% CI: 0.12 to 0.75)), husband's primary education (AOR=0.38

(95% CI: 0.18 to 0.82)), husband's secondary education (AOR=0.44 (95% CI: 0.21 to 0.91)), 7–9 km distance (AOR=0.20 (95% CI: 0.05 to 0.76)), 10 and above km distance (AOR=0.17 (95% CI: 0.04 to 0.72)), the time 1–2 hours (AOR=2.04 (95% CI: 1.08 to 3.86)), the time 3–4 hours (AOR=0.47 (95% CI: 0.23 to 0.96)) and the time to reach a health facility above 4 hours (AOR=0.30 (95% CI: 0.12 to 0.73)) were significantly associated with institutional delivery service utilisation.

Being in the age group between 23 and 27 years was about seven times more likely to use institutional delivery services as compared with the age group of 18–22 years. Similarly, the age group 28–32 years was about four times more likely to use institutional delivery services as compared with the age group 18–22 years. Diploma holders were six times more likely to use institutional delivery services than those who did not follow their formal education. Mothers with primary education were 60% less likely to use institutional delivery services than those who did not follow their formal education. Compared with married women, divorced women were 70% less likely to use institutional delivery services. Husbands with primary education were 62% less likely to use institutional delivery services than those without formal education. Similarly, husbands with secondary education were 56% less likely to use institutional delivery services than those without formal education. Respondents with distances requiring 7–9 km to reach the health facility were 80% less likely to use institutional delivery services than those who required below 3 km. Similarly, respondents with distances requiring above 10 km to arrive at the health facility were 83% less likely to use institutional delivery services than those who required below 3 km.

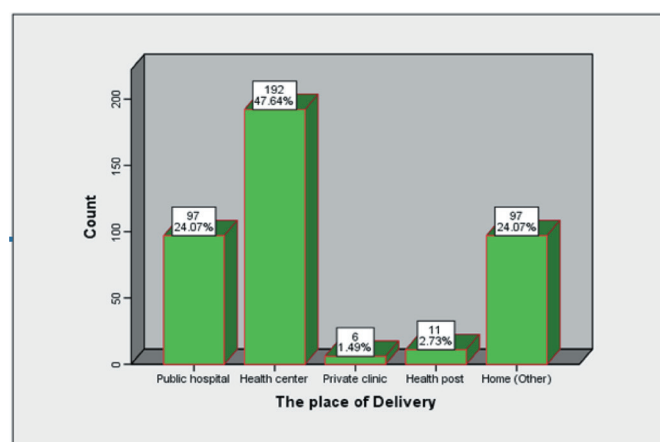
**Figure 2** Distribution of institutional delivery service utilisation by health facility among mothers of childbearing age in Delgi District, Northwest Ethiopia.

Table 4 Institutional delivery service utilisation among respondents in Delgi District, Northwest Ethiopia

Institutional delivery utilisation	Response	Home delivery	Institutional delivery	Total frequency	Total per cent
Ever used institutional delivery services	No	27	54	81	20.10
	Yes	70	252	322	79.90
Have you delivered your last child to a health institution	No	–	–	97	24.07
	Yes	–	–	306	75.93
The decision-maker of the place of the last delivery	Self only	48	105	153	37.97
	Jointly with husband	29	146	175	43.42
	Others	20	55	75	18.61
The reason for home delivery (n=97)*	Like to deliver at home	–	–	32	32.99
	Suddenness of labour	–	–	57	58.76
	Afraid male attendant	–	–	29	29.90
Attendant of your last child delivered at home (n=97)	Family members only	–	–	19	19.59
	Neighbour and family members	–	–	24	24.74
	Traditional birth attendant	–	–	49	50.52
	Trained traditional birth attendant	–	–	5	5.15

*Multiple answers are possible.

Respondents who require 1–2 hours to reach the health facility were two times more likely to use institutional delivery services compared with those who require below 1 hour. When compared with those who require below 1 hour, those who require 3–4 hours to reach the health facility were 53% less likely to use institutional delivery services. Respondents who require above 4 hours to reach the health facility were 70% less likely to use institutional delivery services compared with those who require below 1 hour (table 5). Using the Hosmer-Lemeshow goodness of fit test, the final logistic model was well fitted (Pearson $\chi^2=331.3$; p value=0.7911).

DISCUSSION

This community-based study was carried out in the Delgi District to determine the prevalence of institutional delivery service use and the factors that influence it. Accordingly, the prevalence of the institutional delivery service utilisation was 75.9% (95% CI: 71.7% to 80.1%). Notably, educational status, maternal age, marital status, husband educational status, distance to reach a health facility and time to reach a health facility were all significantly and independently correlated with the utilisation of institutional delivery services.

The percentage of people who used institutional delivery services was 75.9% in this study. This result is nearly identical to those from Southwest Ethiopia (76.0%) and Bahir-Dar City, Ethiopia (78.8%).^{23 33}

However, the utilisation of institutional delivery services is slightly lower than the finding of Debre-Brahan, Ethiopia (80.2%).³¹ And, the utilisation of institutional delivery services is higher than the findings from Mizan-Aman Town, Southwest Ethiopia 66.5%,² Northwestern Ethiopia 61.5%,³⁴ Boset Woreda, Ethiopia 60%,²⁵ Population-based Study of Ethiopia 38.9%,³⁵ Woldia, Ethiopia 48.3%²⁰ and Asayta and Dupiti Towns 54.2%.³⁰

Differences in the research location, sample size, year of study and study design may be the cause of the observed differences. The disparity in findings may be due to differences in some additional healthcare services. For instance, community education, community mobilisation through intense developmental army programmes, the establishment of a mother-waiting centre and free ambulance services aided by phone calls enable mothers to deliver at a health facility.¹ Our study finding is slightly lower than the findings from Debre-Brahan. As we know, Debre-Brahan Town is one of the biggest towns in Ethiopia. Living in an urban area provides the opportunity to use institutional delivery services due to factors such as accessibility and availability of transportation and healthcare services. The finding on utilisation of institutional delivery services in our study is also higher than the findings from Mizan-Aman Town, Boset Woreda, Woldia, and Asayta and Dupiti Towns. The year of the study period has an effect on the delivery of services. Over time, our community has become improved in accessing information as well as in communication about delivery services.²³ There are differences in the time gap between the present study and the other previous studies. In addition, community mobilisation using intensive developmental army activities, mother-waiting centres and free ambulance services are creating an opportunity for mothers to deliver at the institution in our district. Furthermore, in our study, about 72% of the study population was urban residents; this may affect the prevalence estimates because living in the urban area may be associated with institutional delivery services utilisation. Besides, Delgi District was found near Gondar City, the centre area for different services for more than 13 districts.

In the present study, sociodemographic variables, obstetric and maternal variables and accessibility variables were assessed for association with institutional

Table 5 Bivariate and multivariable logistic regression analyses on factors associated with institutional delivery utilisation in Delgi District, Northwest Ethiopia

Characteristics	Institutional delivery utilisation		COR (95% CI)	AOR (95% CI)	P value
	No	Yes			
Place of residence					
Rural	48	65	1.0	1.0	
Urban	49	241	3.63 (1.05 to 12.53)*	3.47 (0.58 to 20.56)	0.171
Age of the respondent					
18–22	10	13	1.0	1.0	
23–27	12	56	3.59 (2.07 to 6.23)*	6.47 (2.74 to 15.32)*	<0.0001
28–32	33	125	2.91 (0.95 to 8.98)	3.64 (1.35 to 9.84)*	0.011
33–37	23	78	2.61 (0.89 to 7.66)	3.32 (0.81 to 13.58)	0.095
38 and above	19	34	1.38 (0.77 to 2.46)	1.91 (0.50 to 7.25)	0.345
Marital status					
Married	80	273	1.0	1.0	
Widowed	3	11	1.07 (0.25 to 4.58)	0.75 (0.06 to 9.60)	0.822
Divorced	14	22	0.46 (0.23 to 0.94)*	0.30 (0.12 to 0.75)*	0.010
Educational level					
No formal education	37	120	1.0	1.0	
Primary and junior education	31	56	0.56 (0.36 to 0.85)*	0.40 (0.16 to 0.99)*	0.048
Secondary and preparatory education	15	30	0.62 (0.27 to 1.40)	0.85 (0.25 to 2.90)	0.789
Certificate holder	10	22	0.68 (0.24 to 1.95)	0.34 (0.15 to 0.74)*	0.006
Diploma holder	2	47	7.25 (2.66 to 19.74)*	5.63 (3.77 to 8.39)*	<0.0001
Degree and above holder	2	31	4.78 (0.74 to 30.80)	3.85 (0.45 to 33.35)	0.220
The educational level of the husband					
No formal education	37	115	1.0	1.0	
Primary and junior education	20	40	0.64 (0.38 to 1.09)	0.38 (0.18 to 0.82)*	0.013
Secondary and preparatory education	12	20	0.54 (0.24 to 1.19)	0.44 (0.21 to 0.91)*	0.026
Certificate holder	8	20	0.80 (0.27 to 2.43)	0.37 (0.09 to 1.54)	0.171
Diploma holder	12	54	1.45 (0.62 to 3.40)	0.94 (0.35 to 2.51)	0.899
Degree holder and above	8	57	2.29 (1.10 to 4.78)*	0.81 (0.43 to 1.53)	0.521
Number of antenatal care visits					
No visits	32	38	1.0	1.0	
1–2	48	164	2.88 (1.13 to 7.33)*	1.30 (0.50 to 3.37)	0.584
≥ 3 visits	17	104	5.15 (1.57 to 16.89)*	2.58 (0.79 to 8.38)	0.116
Distance to reach a health facility (km)					
1–3	17	106	1.0	1.0	
4–6	7	104	2.38 (1.30 to 4.38)*	2.01 (0.88 to 4.57)	0.098
7–9	30	40	0.21 (0.07 to 0.61)*	0.20 (0.05 to 0.76)*	0.018
10 and above	37	34	0.15 (0.05 to 0.47)*	0.17 (0.04 to 0.72)*	0.017
I do not know	6	22	0.59 (0.30 to 1.14)	0.36 (0.15 to 0.86)*	0.021
Time to reach a health facility (hours)					
Below 1:00	26	101	1.0	1.0	
1–2:00	14	107	1.97 (1.22 to 3.18) *	2.04 (1.08 to 3.86)*	0.028
2:01–3:00	15	40	0.69 (0.30 to 1.59)	1.01 (0.59 to, 1.72)	0.981
3:01–4:00	24	35	0.37 (0.13 to 1.10)	0.47 (0.23 to 0.96)*	0.038
Above 4:00	15	13	0.22 (0.06 to 0.84)*	0.30 (0.12 to 0.73)*	0.008
I do not know	3	10	0.86 (0.16 to 4.49)	0.49 (0.13 to 1.80)	0.280

Analyses were adjusted for the design effect.

*Statistically significant at p value <0.05 in binary and multivariable logistic regression analyses.

AOR, adjusted odds ratio; COR, crude odds ratio.

delivery service utilisation and high-level maternal education, younger maternal age, divorce marital status, low-level husband education, long distances to reach a health facility and prolonged time to reach a health facility were factors associated with the utilisation of institutional delivery services. The mother's age was found to be a factor in the institution delivery services use. Younger mothers are more likely to be prepared/educated and have better access to knowledge than older mothers, which may be the cause. A study conducted among Arsi,¹² Southwest Ethiopia,³³ Bahir-Dar,¹³ Tigray,¹⁴ Northwest Ethiopia,¹⁵ Sekela District¹⁶ and Holeta Town¹⁷ supports this finding. Besides, institution delivery service use was significantly linked to the mother's education level and husbands' education level. This study also showed that mothers with diploma degrees were more likely to use institution delivery than their counterparts were. This could be due to the improvement in women's access to information about pregnancy and delivery complications, and the knowledge they got from previous formal education. Education has a positive influence on institutional delivery service utilisation. This finding is supported by the study conducted among Boset Woreda,²⁵ Debre-Brahan,³¹ Arsi,¹² a population-based study of Ethiopia,³⁵ and Sekela District.¹⁶ Moreover, institution delivery service use was negatively linked to mothers' divorce marital status as compared with married women. This may be due to a lack of interest to go to the health institution because husband support is minimised. It may be due to the problems related to transportation and finance deficiency. The distance and time it took to get to nearby health institutions were found strongly related to the institutional delivery service utilisation. This may be due to mothers who lived near health facilities having easy access to health education, antenatal care and transportation. This result is supported by the study conducted among Holeta Town,¹⁷ Northwest Ethiopia,³⁶ Debre-Brahan,³¹ Boset Woreda,²⁵ Northwestern Ethiopia,³⁴ Arsi,¹² Bahir-Dar,¹³ Tigray¹⁴ and Sekela District.¹⁶

In this study, factors that reduce the institutional delivery service utilisation are low-level maternal and husband education, older maternal age, divorce marital status, long distances to reach a health facility and prolonged time to reach a health facility. To minimise these issues, this study indicates to educate the women of reproductive age group on institutional delivery services; investigate the reason behind older and divorce mothers for their low utilisation and support/motivate them to use health institution services; and improve infrastructure and transportation services and/or mother-waiting centres.

Strength and limitations of this study

This study is the first study in the study setting to address institutional delivery service use, and it is a community-based study based on a random sampling approach. Besides, assessing institutional delivery service utilisation and its associated factors could be explained as the strength of the study. There may be selection bias

in this study, due to error in random chance, and bias from selecting the five Kebeles for the study. Besides, information bias may happen due to potential differential reporting bias by mothers who gave birth at different times. Recall bias may happen because some exposures were asked retrospectively (last 1 year); there may be difficult to recall prior exposures. Moreover, confounding bias may occur due to any other unknown or unmeasured confounding factors that were not controlled.

CONCLUSIONS

The following is a summary of the study's findings:

The majority of respondents utilised institutional delivery services in this study. Younger maternal age, high-level maternal education, divorce marital status, low-level husband education, long distances to reach a health facility and prolonged time to reach a health facility were all independently linked to the institutional delivery service utilisation.

In general, one of the foundations for increasing institutional delivery service use is improving mother-waiting centres for delivery services, infrastructure and transportation services and awareness through education about institutional delivery. Besides, providing counselling services for mothers during antenatal care visits or house-to-house health education on institutional delivery services for rural residents will improve institutional delivery service utilisation even more.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Consent obtained directly from patient(s).

Ethics approval Ethical clearance was obtained from the University of Gondar Ethical Review Board (Ref. No. V/P/RCS/04/2571/2020). The mothers were told of the study's intent and benefits, as well as its protocol and right to refuse. Furthermore, the respondents were informed that confidentiality (and privacy) will be maintained, and each mother's written informed consent was obtained during the data collection. Following the data collection, each participant received health education about safe delivery. Participants gave informed consent to participate in the study before taking part.

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Data availability statement Data are available upon reasonable request. All data relevant to the study are included in the article or uploaded as supplementary information. All relevant data are available within the manuscript. The datasets used and/or analysed during the current review are available from the corresponding author on reasonable request.

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