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

Mohammed Oumer 1,2, Hailu Aragie 1, Amanuel Girma Worede 1

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.

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: 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=0.17; 95% CI: 0.04 to 0.72) 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.

INTRODUCTION

Globally, more than 20 million women conceive every year, with 15% of them experiencing pregnancy-related complications. 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. 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. 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.

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. Annual maternal mortality rates from pregnancy and delivery-related complications are highest in Asia and Africa.
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. 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%. In developed countries, 98% of women receive antenatal care services. However, about half of all women are unable to get adequate antenatal care services in developing countries. 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.

In Ethiopia, the maternal mortality rate is estimated at 401 per 100,000 live births by the year 2017. From 2000 to 2017, the country’s average yearly rate of reduction was 5.5%. It is crucial to increase institutional delivery in order to minimise maternal and neonatal mortality. According to a 2016 study from Ethiopia’s demographic health survey, 26% of live births were delivered in health facilities. Despite Ethiopia’s strong promotion of institutional delivery, home delivery (73%) is still common, especially in hard-to-reach areas. 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%). Recently, the traditional and untrained birth attendants attended about 72% of births, while skilled health providers attended just 28%. 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.

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.

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.

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. However, some other studies reported a non-significant association of the above variables with the use of institutional delivery services.

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 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. 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, Ethiopia), 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 21–25 29–31 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 405 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 ± (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

Oumer M, et al. BMJ Open 2022;12:e060141. doi:10.1136/bmjopen-2021-060141
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 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           |
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).

| 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 |
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](http://bmjopen.bmj.com/) Distribution of institutional delivery service utilisation by health facility among mothers of childbearing age in Delgi District, Northwest Ethiopia.
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%).

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

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 intensive 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. Our study finding is slightly lower than the findings from Debere-Brahan. As we know, Debere-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 Dupti 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. 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 delivery utilisation. 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 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%).

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

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 intensive 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. Our study finding is slightly lower than the findings from Debere-Brahan. As we know, Debere-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 Dupti 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. 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 delivery utilisation.

| 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.
| 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   |
| 32–37                                | 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, lower-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,15 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-Braham,30 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-Braham,30 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, lower-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.

Acknowledgements The authors are grateful to thank the study participants for their valuable contributions. The author’s appreciation goes to data collectors and supervisors for their proper data collection.

Contributors MO, HA and AGW participated in the conceptualisation, investigation, formal analysis, methodology or study design, supervision, visualisation, writing—original draft, interpretation, writing and editing and approving of the final draft. All authors read and approved the manuscript. MO acts as the guarantor of the study.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, 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.

Provenance and peer review Not commissioned; externally peer reviewed.

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.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially.
and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/.

ORCID IDs
Mohammed Oumer http://orcid.org/0000-0003-4289-8712
Hailu Aragie http://orcid.org/0000-0002-0790-2922

REFERENCES

1. Kidanu S, Degu G, Tiruye TY. Factors influencing institutional delivery service utilization among mothers in Kombolcha district, Northwest Ethiopia: a community based cross sectional study. *Reprod Health* 2017;14:2–8.

2. Tesso M, Larnaro T, Henok A. Prevalence of institutional delivery among mothers in Kombolcha Sub-Locality, Mizan–Aman town, south-west Ethiopia. *Health Science Journal* 2015;10:1–6.

3. Trends in maternal mortality, 1990 to 2015: estimates by who, UNICEF, UNFPA, world bank group and the United nation population division. Geneva, Switzerland: World Health Organization, 2015: 1–92.

4. Tigabu K, Getu D, Zelalem B. Assessment of modern contraceptive practice and associated factors among currently married women age 15-49 years in Farta district, South Gondar zone, north-west Ethiopia. *Journal of Public Health* 2014;2:507–12.

5. Zanconato G, Msolomba R, Guarerra L, et al. Antenatal care in developing countries: the need for a tailored model. *Semin Fetal Neonatal Med* 2006;11:15–20.

6. Finlayson K, Downe S. Why do women not use antenatal services in low- and middle-income countries? A meta-synthesis of qualitative studies. *PLoS Med* 2013;10:e1001373.

7. Ruiz JJ, Nuhu K, McDaniel JT, et al. Inequality as a powerful predictor of infant and maternal mortality around the world. *PLoS One* 2015;10:e0140796.

8. Koblinksky M, Matthews Z, Hussein J, et al. Going to scale with professional skilled care. *Lancet* 2006;368:1377–86.

9. Trends in maternal mortality 2000 to 2017, Estimates by who, UNICEF, UNFPA, world bank group and the United nation population division. Geneva: Licenced; CC BY-NC-SA 3.0 IGO: World Health Organization, 2019.

10. Ethiopian demographic and health survey 2016. Central statistical agency, Addis-Ababa, Ethiopia and the demographic and health survey program. Maryland, USA. Federal Democratic Republic of Ethiopia: ICF Rockville, 2017: 1–155.

11. Kidanu S, Degu G, Tiruye TY. Factors influencing institutional delivery service utilization in Ethiopia. *International Journal of Women's Health* 2016;8:463–75.

12. Abera M, Gebru A, Zewdie S, et al. Determinants of institutional delivery service utilization in Ethiopia: a cross-sectional study. *Int J Equity Health* 2013;12:30.

13. Kebede H. Use of previous maternal health services has a limited role in re-attendance for skilled institutional delivery in Northwest Ethiopia: a cross-sectional survey. *International Journal of Women's Health* 2013;5:79–85.

14. Teferra AS, Alamu FM, Waldeyohannes SM. Institutional delivery service utilization and associated factors among mothers who gave birth in the last 12 months in Sekela district, North West of Ethiopia: a community-based cross sectional study. *BMC Pregnancy Childbirth* 2012;12:74.

15. Birmeta K, Diabaha Y, Waldeyohannes D. Determinants of maternal health care utilization in Holeta town, central Ethiopia. *BMC Health Serv Res* 2013;13:256.

16. Hailemichael F, Woldie M, Tafese F. Predictors of institutional delivery in Sodo town, southern Ethiopia. *Afr J Prim Health Care Farm Med* 2013;5:544.

17. Dida N, Birhanu Z, Gerhaha M, et al. Modeling the probability of giving birth at health institutions among pregnant women attending antenatal care in West Shewa zone, Oromia, Ethiopia: a cross sectional study. *Afr Health Sci* 2014;14:288–98.

18. Abejew W, Muhammed J, Abeje G. Institutional delivery service utilization in Wolodia, Ethiopia. *Science Journal of Public Health* 2013;1:18–23.

19. Fikre AA, Demissie M. Prevalence of institutional delivery and associated factors in Dodota Woreda (district), Oromia regional state, Ethiopia. *Reprod Health* 2012;9:33.

20. Hagos S, Shavenco D, Assieb G, et al. Utilization of institutional delivery service at Wukro and Butajira districts in the Northern and South central Ethiopia. *BMC Pregnancy Childbirth* 2014;14:1–11.

21. Abeje G, Azage M, Setegn T. Factors associated with institutional delivery service utilization among mothers in Bahir Dar City administration, Amhara region: a community based cross sectional study. *Reprod Health* 2014;11:379–82.

22. Federal Democratic Republic of Ethiopia Central Statistical Agency. Population projection of Ethiopia for all regions at woreda level from 2014–2017. Available: http://populationprojection/Ethiopian/ 2017.php [Accessed 12 Sep 2017

23. Shigute T, Tejineh S, Tadesse L. Institutional delivery service utilization and associated factors among women of child bearing age at Boset woreda, Oromia region, central Ethiopia. *Journal of Women's Health Care* 2017;6:2–9.

24. Esaway A, Kanté AM, Njoo M, et al. Access to institutional delivery care and reasons for home delivery in three districts of Tanzania. *Int J Equity Health* 2014;13:11.

25. Puthuchira Ravi R, Atihiumul Kulasekaran R, Ravi RP. Does Socio-demographic Factors Influence Women’s Choice of Place of Delivery in Rural Areas of Tamilnadu State in India. *Am J Public Health Research* 2014:75–80.

26. Roy MP, Mohan U, Singh SK, et al. Factors associated with the preference for delivery at the government hospitals in rural areas of Lucknow district in Uttar Pradesh. *Indian J Public Health* 2013;57:288–95.

27. Esawa K, Sappor M. Factors associated with the utilization of skilled delivery services in the East Municipality of Ghana Part 2: barriers to skilled delivery. *International Journal Science Technology Research* 2013;2:195–207.

28. Fanta M. Assessment of factors affecting utilization of maternal health care services in Aysaata and Dubiti towns, Afar Region, North-East Ethiopia [Master Thesis]. Addis Ababa University: Department of Community Health, Faculty of Medicine, 2005.

29. Asmamaw L, Negussie D, Adugnaw B. Assessing the magnitude of institutional delivery service utilization and associated factors among mothers in Debre-Berhan, Ethiopia. *Journal of Pregnancy and Child Health* 2013;2:3–7.

30. Mengistu BA, Yismaw AE, Azene NZ, et al. Incidence and predictors of neonatal mortality among neonates admitted in Amhara regional state referral hospitals, Ethiopia: prospective follow up study. *BMJ Pediatr 2020*;20:142.

31. Yosef T. Magnitude and associated factors of institutional delivery among reproductive age women in Southwest Ethiopia. *Int J Womens Health* 2020;12:1005–11.

32. Asmamaw L, Negussie D, Adugnaw B. Assessing the magnitude of institutional delivery service utilization and associated factors among mothers in Debre-berhan, Ethiopia. *Journal of Reproductive Med* 2015;60:226–30.

33. Anteneh KT, Gebreselassie KZ, Negusie TS, et al. Utilization pattern of institutional delivery among mothers in North-western Ethiopia and the factors associated; A community - based study. *Clin Epidemiol Glob Health* 2021;10:10675.

34. Bersele Y, Yeshiwas D, Yismaw L, et al. Determinants of institutional delivery service utilization in Ethiopia: a population based cross sectional study. *BMC Public Health* 2020;20:1077 https://doi.org/10. 186/s12889-020-09125-2

35. Mittie KA, Wasse GT, Beyene MB. Institutional delivery services utilization and associated factors among mothers who gave birth in the last year in Mandura district, Northwest Ethiopia. *PLoS One* 2020;15:e0243466.