

RESEARCH ARTICLE

Home birth and its determinants among antenatal care-booked women in public hospitals in Wolayta Zone, southern Ethiopia

Melese Siyoum^{1*}, Ayalew Astatkie², Shewangizaw Mekonnen¹, Gezahegn Bekele¹, Kefyalew Taye³, Zelalem Tenaw¹, Zemenu Yohannes¹, Zerai Kassaye³

1 School of Nursing and Midwifery, College of Medicine and Health Sciences, Hawassa University, Hawassa, Ethiopia, **2** School of Public and Environmental Health, College of Medicine and Health Sciences, Hawassa University, Hawassa, Ethiopia, **3** School of Medicine, College of Medicine and Health Sciences, Hawassa University, Hawassa, Ethiopia

* melesesiyoum755@gmail.com



Abstract

Introduction

Antenatal care (ANC), health facility birth and postnatal care services are proved to reduce maternal and newborn morbidity and mortality. In Ethiopia, even though antenatal care coverage is good, still home birth is high. This study aimed to assess the prevalence and determinants of home birth among women who were booked for ANC in public hospitals in Wolaita zone, southern Ethiopia.

Methods

A cohort study was conducted from February to May 2017 among 554 third trimester pregnant mothers who visited public hospitals of Wolaita Zone, southern Ethiopia for ANC service. All women were interviewed twice: the first interview was done face-to-face in the health facility in which they were having ANC follow up to gather information about basic socio-demographic and obstetric characteristics; the second interview was done via telephone after they gave birth to get information about the place of birth. Epi-Data version 3.1 was used for data entry and the Statistical Package for the Social Sciences (SPSS) version 22 was used for data analysis.

Results

A total of 68 (13.5%; 95% Confidence Interval (CI): 10.5%-16.6%) women who were booked for ANC gave birth at home. Being uneducated (AOR = 2.46, 95% CI: [1.10–5.10]), starting ANC visit late (>16weeks) (AOR = 2.27, 95% CI: [1.14–4.50]), time taken to reach at health facility for ANC service (>30minutes) (AOR = 8.94, 95% CI: [4.50–17.72]), waiting time of greater than 30 minutes for ANC in health facilities (AOR = 1.18, 95% CI: [1.06–2.30]) and lack of knowledge about danger signs of pregnancy (AOR = 4.18, 95%CI: [1.80–9.70]) were significantly associated with home birth.

OPEN ACCESS

Citation: Siyoum M, Astatkie A, Mekonnen S, Bekele G, Taye K, Tenaw Z, et al. (2018) Home birth and its determinants among antenatal care-booked women in public hospitals in Wolayta Zone, southern Ethiopia. *PLoS ONE* 13(9): e0203609. <https://doi.org/10.1371/journal.pone.0203609>

Editor: Getiye Dejen Kibret, Debre Markos University, ETHIOPIA

Received: December 28, 2017

Accepted: August 23, 2018

Published: September 7, 2018

Copyright: © 2018 Siyoum et al. This is an open access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Funding: Save the Children Ethiopia supported us for data collector's per diem, questionnaire duplication and supervisors per diem.

Competing interests: The authors have declared that no competing interests exist.

Conclusions

Home birth among ANC booked women is low compared to other studies. Yet, giving attention to women with no education and those coming from far areas while providing advice on birth preparedness and pregnancy danger signs may be useful to further reduce the rate of home birth. Advising mothers to start ANC early and trying to reduce ANC waiting time could also be of importance.

Introduction

Antenatal care (ANC) from a skilled provider is important to monitor pregnancy and reduce morbidity and mortality risks for the mother and the child during pregnancy, delivery, and the postnatal period (PNC)[1]. ANC comprises a set of interventions that a pregnant woman receives from organized health care services in order to prevent, identify and treat complications and help a woman approach pregnancy and birth as positive experiences[2]. It is proved that ANC, skilled attendance during delivery and PNC services have crucial role in reduction of perinatal mortality [3, 4]. However the prevalence of health facility birth in Ethiopia is still low, even though there is improvement over the last years. According to the Ethiopian Demographic Health Survey (EDHS) reports, the prevalence of health facility birth was 10% in 2011, 15.4% in 2014 and 26% in 2016. Despite this low coverage of health facility birth, the ANC coverage is increasing over time, especially ANC-1 visit is high[1, 5–7].

Studies have shown mothers who have ANC visit to be more likely to give birth at health institutions. However, even among women who have ANC follow up, many of them give birth at home, usually without skilled birth attendants. For instance, among women booked for ANC in Ghana, only 38% gave birth at health institutions [8]. Other studies conducted in Nigeria, Senegal and Nepal have shown that institutional delivery rates among women who had at least one ANC visit were 68.5%, 76% and 50%, respectively [9–12]. Studies conducted in northern Ethiopia among women who were booked for ANC have reported the magnitude of home birth to range from 25.3% to 75.3% [13, 14]. The burden of home birth mainly that of unattended delivery is not only limited to maternal health problem, but it also ends up with perinatal and neonatal morbidity and mortality[15].

Various studies conducted in different developing countries and in different part of Ethiopia revealed different determinants of place of birth. Some of these factors are similar for different study areas while some of them are specific for specific study areas. Among the identified factors are lack of access to health facility, educational status of the expectant women, place of residence, increased parity, counseling service obtained during ANC visit, maternal age, age at first pregnancy, age at first marriage, absence of previous obstetric complications, women's knowledge of pregnancy complications, number of ANC visits, health care providers' behavior, quality of ANC service and decision maker on place of delivery [13–22].

However, there is very limited evidence regarding the magnitude of home birth and its determinants among ANC-booked women in Ethiopia. Therefore, this Study was designed to assess the magnitude of home birth and its determinants among ANC-booked women in Wolayta Zone of southern Ethiopia.

Materials and methods

This study was conducted after obtaining ethical clearance from the Institutional Review Board of the College of Medicine and Health Sciences, Hawassa University. All study

participants gave a written informed consent to participate in the study. The data obtained from the study participants were handled with strict confidentiality and all responses were de-identified after the second interview was accomplished.

Study design and setting

A cohort study was conducted among third trimester pregnant mothers who were booked for ANC in public hospitals in Wolayta Zone, southern Ethiopia from February 1 to May 30, 2017. Wolayta Zone is found in the Southern Nations, Nationalities and Peoples Region of Ethiopia. The zone has one referral hospital, four district hospitals and 70 health centers (5 urban and 65 rural). The report from the Wolayta Zone Health Department indicated that the total number of deliveries reported from the five public hospitals in the year 2015/16 was 7445. Of these, 3511 were from Otona Referral Hospital (100% of the hospital's annual plan), 1228 from Bonbe Hospital (72.74% of its annual plan), 1142 from Halale Hospital (85.60% of its annual plan), 956 from Bitana Hospital (71.44% of its annual plan), and 608 from Bale Hospital (77.25% of its annual plan).

Sample size and sampling procedures

The sample size was determined using the sample size calculator of OpenEpi version 2.3 for the two objectives (i.e., for proportion of home birth among ANC-booked women and for determinants of home birth). The sample size for the proportion of home birth among ANC-booked women was determined considering the following assumptions: expected proportion of home birth among ANC-booked women (68%) based on a previous study[18], 95% confidence level, and a margin of error of 4%. Accordingly, the required sample size was 526. Adjusted for an anticipated nonresponse rate of 5%, the required sample size became 554. This is larger than the total sample size calculated for determinants of home birth (level of education, number of ANC visits, respect during ANC and privacy). Hence, 554 was considered to be a sufficient sample size for this study.

Stratified sampling was used to select the required number of study participants. Each public hospital was considered as a stratum. The sample size was then proportionally allocated based on the client flow for ANC, labor and delivery services at each of the five public hospitals in the year preceding the study period. Accordingly, the number of third trimester pregnant mothers recruited in to the study from each hospital was: 261 from Otona Hospital, 92 from Bonbe Hospital, 85 from Halale Hospital, 71 from Bitana Hospital, and 45 from Bale Hospital. Consecutive third trimester pregnant mothers were included into the study until the required number of study participants was fulfilled in each hospital.

Data collection tools and technique

The data were collected using structured interviewer-administered questionnaire by trained midwives. The questionnaire was initially developed in English by reviewing pertinent literature and translated in to the local Wolaita language and translated back to English to check its consistency.

Data were collected two times. The first data collection was done through a face-to-face interview in the health facility in which the women were having ANC follow up to gather information about basic socio-demographic and obstetric characteristics. Then, their address, name and phone number or the phone number of the Health Extension Worker (HEW) working in their locality were registered. After two weeks of their expected date of delivery, the clients or the HEW working in the respective localities were interviewed through telephone to

get information about the place of birth. If the women did not still give birth during the first call, the telephone call was repeated after another two weeks.

The data were collected by five midwives who had basic emergency obstetric training certificate and who were fluent in the local Wolaita language. The data collectors were recruited on a competitive basis from Hawassa University Referral Hospital and from health facilities in Wolaita Zone. The data collectors were assigned for the data collection in a hospital different from the one they are affiliated with.

Study variables

In this study home birth is the dependant variable while socio-demographic characteristics, obstetric characteristics and mothers' knowledge were considered as explanatory variables. Women who scored more than the mean score of the knowledge questions on danger signs of pregnancy, and complications during pregnancy and child birth were considered as knowledgeable.

Data management and analysis

All filled questionnaires were checked for completeness and the data were coded, entered and cleaned using EpiData version 3.1 and exported to SPSS version 22 for analysis. Descriptive analysis was used to describe the study participants by basic background characteristics and to estimate home birth rate among ANC-booked women. Bivariable logistic regression was used to select independent variables for entry into multivariable logistic regression. Variables having p-values less than or equal to 0.25 in the bivariable analysis as well as those considered important based on literature were entered into the multivariable logistic regression model. Then multivariable logistic regression was used to identify the determinants of home birth among ANC-booked women adjusting for possible confounders. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) obtained from the multivariable logistic regression were used to judge the presence and strength of association between home birth and possible determinants.

Results

Socio demographic characters

Initially 554 mothers on ANC were recruited for the study and data on all basic characteristics were collected including their expected date of delivery (EDD). Two weeks after their EDD, clients were re-interviewed for their place of birth through telephone. A total of 505 participants responded to the second interview yielding a response rate of 91.2% for place of birth. Forty one (8.8%) women were lost to follow up for their place of birth after being booked for ANC. The age of the participants ranged from 15 to 38 years with a mean (\pm standard deviation [SD]) 25.3 (\pm 4.06) years. Almost all (98.6%) of the participants were married, 409 (73.8%) were protestant, 498 (89.9%) were Wolayta by ethnicity, and 400 (72.2%) had a parity of two or less. The time taken to reach at health facility for ANC service ranged from five minutes to eight hours (see [Table 1](#)).

Perceived characteristics of ANC and labour-delivery service, and client's knowledge about danger signs during pregnancy, labor and delivery

The minimum and maximum gestational ages at first ANC visit ranged from three weeks to 39 weeks with a mean (\pm SD) gestational age of 19 (\pm 6.94) weeks. The duration of time they waited for service at ANC clinics ranged from five minutes to eight hours with a mean

Table 1. Socio-demographic characteristics of the study participants, Wolayta Zone public hospitals, May 2017.

| Variables | Category | Frequency (N = 554) | Percentage |
|-------------------------------------|------------------------|---------------------|------------|
| Age | 15–24 | 202 | 36.5 |
| | 25–29 | 250 | 45.1 |
| | 30 and above | 102 | 18.4 |
| Marital status | Single | 6 | 1.1 |
| | Married | 546 | 98.6 |
| | Divorced/widowed | 2 | 0.36 |
| Religion | Protestant | 409 | 73.8 |
| | Orthodox | 109 | 19.7 |
| | Adventist | 26 | 4.7 |
| | Muslim | 9 | 1.6 |
| | Catholic | 1 | 0.18 |
| Ethnicity | Wolayta | 498 | 89.9 |
| | Dawuro | 22 | 4 |
| | Others ^a | 34 | 6.1 |
| Residence | Urban | 306 | 55.2 |
| | Rural | 248 | 44.8 |
| Level of education | no formal education | 146 | 26.4 |
| | Primary | 183 | 33 |
| | Secondary and above | 225 | 40.6 |
| Time taken to reach health facility | ≤30 minutes | 438 | 79.1 |
| | >30 minutes | 116 | 20.9 |
| Occupation | House wife | 332 | 59.9 |
| | Employed (government) | 101 | 18.2 |
| | Private business) | 67 | 12.1 |
| | Other ^b | 54 | 9.7 |
| Access to mass media | No | 175 | 31.6 |
| | Yes | 379 | 68.4 |
| Husband's education | No formal education | 111 | 20 |
| | Primary school | 155 | 28 |
| | Secondary school | 128 | 23.1 |
| | Above secondary school | 160 | 28.9 |
| Husband's occupation | Farmer | 167 | 30.1 |
| | Employed | 150 | 27.1 |
| | Private business | 181 | 32.7 |
| | Other ^b | 56 | 10.1 |

Other ^a = Oromo, Amhara, Gamo or Hadiya

Other ^b = Students, daily laborer, jobless

<https://doi.org/10.1371/journal.pone.0203609.t001>

duration of 43 minutes. More than 95% of the participants reported that they were cared for with respect, got advice on complication of pregnancy, preparedness for birth and explanation about their health condition during ANC visit. Four hundred and sixty two (83.4%) of the participants knew at least half of the eight danger signs of pregnancy and 423 (76.4%) of participants knew at least half of the ten possible complications during labor and delivery (see [Table 2](#)).

Table 2. Obstetric characteristics and knowledge about obstetric danger signs among ANC-booked women in Wolayta Zone public hospitals, May 2017.

| Variables | Category | Frequency (n = 554) | Percentage |
|---|------------------------------|---------------------|------------|
| Parity | ≤2 | 400 | 72.2 |
| | >2 | 154 | 27.8 |
| Gravidity | ≤2 | 295 | 53.2 |
| | >2 | 259 | 46.8 |
| Number of ANC visit by the time of data collection | One | 55 | 9.9 |
| | Two | 101 | 18.2 |
| | Three | 174 | 31.4 |
| | Four and above | 224 | 40.4 |
| Waiting time for ANC | ≤30 minutes | 432 | 77.98 |
| | >30 minutes | 122 | 22.03 |
| Fear to expose genitalia | No | 344 | 62.1 |
| | Yes | 210 | 37.9 |
| Age at first pregnancy | ≤18 years | 146 | 26.4 |
| | >18 years | 348 | 62.8 |
| Pregnancy was planned | No | 92 | 16.6 |
| | Yes | 462 | 83.4 |
| Advised on place of birth | No | 15 | 2.7 |
| | Yes | 539 | 97.3 |
| Privacy respected | No | 4 | 0.7 |
| | Yes | 550 | 99.3 |
| Counseled what to expect | No | 110 | 19.9 |
| | Yes | 444 | 80.1 |
| Explained about her health | No | 20 | 3.6 |
| | Yes | 534 | 96.4 |
| Know danger sign of pregnancy | No | 92 | 16.6 |
| | Yes | 462 | 83.4 |
| Know complications of labor and delivery | No | 131 | 23.6 |
| | Yes | 423 | 76.4 |
| Mothers' perception of who is eligible to give birth in a health institution? | Mothers who have indications | 149 | 26.9 |
| | All mothers | 405 | 73.1 |
| Discussion with husband on place of delivery | No | 27 | 4.9 |
| | Yes | 527 | 95.1 |
| Decision maker on birth place | Me | 68 | 12.3 |
| | Husband | 69 | 12.5 |
| | Together | 417 | 75.2 |

<https://doi.org/10.1371/journal.pone.0203609.t002>

Place of birth

Among the 505 participants who responded to the question on place of birth, 437 (86.5%) gave birth at health facilities (either hospital or health center) while 68 (13.5%, 95%CI: 10.5%-16.6%) gave birth at home.

Determinants of home birth among ANC-booked women

On bivariable logistic regression, maternal age, maternal level of education, parity, residence, gestational age at first ANC visit, time taken to reach at health facility for ANC service, waiting time for ANC service, mother's knowledge about danger sign of pregnancy and possible

Table 3. Determinants of home birth among women who were booked for ANC at public hospitals of Wolayta Zone, southern Ethiopia, May 2017.

| Variables | | Home birth | | COR (95%CI) | AOR (95%CI) | p-value |
|--|----------------------------|------------|-----|-------------------|-------------------------|-------------------|
| | | Yes | No | | | |
| Mothers Age | (15–24) | 20 | 170 | 1 | 1 | |
| | 25–29 | 29 | 191 | 1.3(0.74–2.53) | 1.26(0.56–2.82) | |
| | 30 and above | 20 | 75 | 2.4(1.21–4.76) | 1.57(0.57–4.30) | |
| Mothers level of education | Not educated | 24 | 92 | 2.52(1.95–8.19) | 2.46(1.10–5.10) | 0.024 |
| | Primary school | 31 | 146 | 3.25(1.64–6.43) | 1.29(0.45–3.66) | |
| | Secondary school and above | 20 | 193 | 1 | 1 | |
| Parity | ≤2 | 42 | 328 | 1 | 1 | |
| | >2 | 26 | 109 | 1.86(1.09–3.18) | 1.03(0.36–2.90) | |
| Residence | Urban | 22 | 263 | 1 | 1 | |
| | Rural | 46 | 174 | 3.16(1.84–5.44) | 1.18(0.57–2.43) | |
| Gestational Age at ANC-1 | ≤16weeks | 20 | 225 | 1 | 1 | |
| | >16weeks | 48 | 212 | 2.55(1.46–4.40) | 2.27(1.14–4.50) | 0.022 |
| Time taken to reach at health facility | ≤30 minutes | 24 | 375 | 1 | 1 | |
| | >30 minutes | 44 | 62 | 11.09(6.30–19.52) | 8.94(4.50–17.72) | < 0.001 |
| Waiting time for ANC | ≤30 minutes | 41 | 342 | 1 | 1 | |
| | >30minutes | 27 | 95 | 2.37(1.39–4.10) | 1.18(1.06–2.30) | 0.045 |
| Know danger sign of pregnancy | No | 28 | 61 | 4.32(2.48–7.51) | 4.18(1.80–9.70) | 0.001 |
| | Yes | 40 | 376 | 1 | 1 | |
| Know complications of labor and delivery | No | 30 | 99 | 2.7(1.6–4.57) | 1.2(0.54–2.68) | |
| | Yes | 38 | 338 | 1 | 1 | |
| Indications for institutional delivery | All laboring mothers | 42 | 324 | 1 | 1 | |
| | Mothers having problems | 26 | 113 | 1.78(1.04–3.02) | 1.25(0.65–2.40) | |

Note: COR, crude odds ratio; AOR, adjusted odds ratio; Model: Enter; Hosmer and Lemeshow model fitness: p = 0.60

<https://doi.org/10.1371/journal.pone.0203609.t003>

complications during labor and delivery, and perception about health facility birth indications were associated with place of delivery. However, on multivariable logistic regression, being an uneducated mother (AOR = 2.46, 95% CI: [1.10–5.10]), late presentation for ANC (>16weeks) (AOR = 2.27, 95%CI: [1.14–4.50]), time taken to reach at health facility for ANC service of greater than 30 minutes (AOR = 8.94, 95% CI: [4.50–17.72]), waiting time of greater than 30 minutes for ANC in health facilities (AOR = 1.18, 95% CI: [1.06–2.30]) and lack of knowledge about danger signs of pregnancy (AOR = 4.18, 95%CI: [1.80–9.70]) significantly increased the odds of home birth after being booked for ANC (see Table 3).

Discussion

In this study, the proportion of ANC-booked women who gave birth at home was 13.5% (95% CI: 10.5%–16.6%). This result is consistent with a similar study conducted in Nepal where the rate of home delivery was found to be 15%[19].

On the other hand, this result is lower than the results of other studies conducted in Ghana (68%) [8], Nigeria (31.5%) [9], Senegal (24%) [10, 11], Nepal (50%) [12], Gozzamin district of Gojjam, Ethiopia (75.3%) [14], and Debremakos and Fogera districts, Ethiopia (25.3% and 68.4%, respectively) [13, 18]. This is also lower than the proportion of home births stated in the Ethiopian Demographic and Health Survey[1, 5]. The difference of the result of the present study from those of the previous studies can be explained as follows. First, it might be due to the effort made by the Ethiopian government to make all kebeles free of home delivery.

Second, it might be due to the difference in study design; in the current study, pregnant women who visited ANC clinics were followed for their place of delivery while the previous studies were retrospective type. The third reason could be due to the gap in time period as some of the above studies were conducted before five years. The difference of the result of the present study from that of EDHS also can be explained as follows. The EDHS covers a wide geographical area with considerable variation in access to health care and health seeking behaviours. It also relies on cross-sectional data which is collected for the five years time preceding the survey date. Besides, it assesses both for ANC follow-up status and place of birth retrospectively. But in the present study, a cohort of pregnant women on ANC were identified from a specific geographical area and followed till birth to ascertain place of birth. Hence, results are for a very recent time period (May 2017) and a specific geographical area and population and outcome ascertainment is prospective. Therefore, in the EDHS the magnitude of home birth is expected to be higher even among those booked for ANC.

The odds of home birth among women who were not educated were 2.46 times higher than the odds of women who attended secondary school and above. This is supported by studies conducted in Nigeria and different parts of Ethiopia [11, 13, 14, 17, 18, 23–27]. This could be due to the fact that educated women have more awareness about the advantage of health facility birth and hence may prefer giving birth in health institutions[1].

Women who waited more than 30 minutes at health facility for ANC had about 1.2 times higher odds of giving birth at home than women who wait less than 30 minutes. If mothers wait long for ANC, then they may feel that they will wait long to get delivery service too. This may discourage them from seeking health facility birth. In line with this, in a study conducted in Nigeria[28], about 29% of mothers who did not give birth in government health facilities had reported long waiting time as a cause. Hence, provision of ANC to mothers without much waiting time may serve as a reinforcer for health facility birth.

The odds of home birth among women who started ANC follow up after 16 weeks of gestation were 2.3 times higher than the odds of women who started ANC follow up before 16 weeks of gestation. This is similar with a study conducted in Bahir-Dar, northern Ethiopia [16]. In other studies, this was explained in terms of number of ANC visits. The previous studies have shown that women who have completed four visits were more likely to give birth at health institution [8, 10, 13, 18, 19, 29]. This can be true if the woman starts ANC follow up early in pregnancy as the visit is conducted by time intervals based on focused ANC[2]. Hence, there is high probability for late bookers not to get four visits. In this study, it is difficult to check the effect of number of ANC visit as the data on ANC was collected before delivery; they may or may not have additional ANC visit after the data were collected.

The odds of home birth among women who need more than 30 minutes to reach at health facilities were almost nine times higher than odds of women who need less than 30 minutes to reach at health facilities. This finding is consistent with other studies conducted in northern and southern parts of Ethiopia [18, 25, 30]. In the present study, there were women who reported that they travel eight hours to get to health facility. This can be related to inaccessibility of transportation and inaccessibility of services including delivery service which may discourage giving birth in health facilities.

Furthermore, the odds of home birth among women who lacked knowledge about the danger signs of pregnancy were four times higher than odds of women who were knowledgeable about pregnancy danger signs. This is consistent with studies conducted in northern part of Ethiopia in Alamata, Bahir-Dar and Abergale areas [16, 31, 32]. Women who know about danger signs of pregnancy, possible complications, and prevention methods may prefer health facility birth, while those who have no knowledge of such problem prefer home birth.

This study is not free from limitations. Information about place of birth was obtained from health extension workers for clients who did not have telephone service. This may affect the magnitude of home birth as the health extension workers may under-report the number of home births since they are responsible for mothers' place of birth in their respective kebeles (small administrative units). Even when the mothers were reached, there may still exist a social desirability bias whereby the mothers are inclined to report giving birth in health facilities rather than at home. Consequently, the magnitude of home birth might have been underestimated.

Conclusions

In this study, the prevalence of home birth among ANC-booked women is low compared to other studies. Being uneducated, long distance or time taken to reach at a health facility, long waiting time during ANC, lack knowledge about danger sign of pregnancy and late ANC visits were significantly associated with home birth among ANC booked women. It is better if ANC service providers give special attention to women who come from far areas and those who have no formal educations while advising on birth preparedness and pregnancy danger signs. Health programme planners should focus on geographical accessibility of health facility. HEWs, health professionals and all stakeholders working on communication and health education about ANC should give emphasis to frequency and time of ANC. Shortening waiting time during ANC may encourage mothers to visit health facilities for birth.

Supporting information

S1 File. English version questionnaire.

(DOCX)

S2 File. Wolaytigna version.

(DOCX)

Acknowledgments

We extend our heartfelt gratitude to the Save Newborn Life Phase-III Project of Save the Children Ethiopia, SNNPR branch for financial support. The College of Medicine and Health Sciences of Hawassa University, Hawassa, Ethiopia also deserves thanks for initiating the collaboration with Save the Children Ethiopia. We are indebted to Professor Yemane Berhane for his comments and guidance in designing this study. We also remain thankful to Dr. Fitsum Woldegebriel (from Hawassa University), data collectors, study participants, and officials of Wolayta Zone Health Department and public hospitals in Wolayta zone who helped us one way or another in accomplishing this study.

Author Contributions

Conceptualization: Melese Siyoum, Ayalew Astatkie, Shewangizaw Mekonnen.

Data curation: Melese Siyoum, Ayalew Astatkie, Shewangizaw Mekonnen, Gezahegn Bekele, Kefyalew Taye, Zelalem Tenaw, Zerai Kassaye.

Formal analysis: Melese Siyoum, Ayalew Astatkie, Shewangizaw Mekonnen, Gezahegn Bekele, Kefyalew Taye, Zelalem Tenaw, Zemenu Yohannes.

Funding acquisition: Melese Siyoum, Ayalew Astatkie, Gezahegn Bekele, Zelalem Tenaw, Zemenu Yohannes, Zerai Kassaye.

Investigation: Melese Siyoum, Shewangizaw Mekonnen, Gezahegn Bekele, Kefyalew Taye, Zemenu Yohannes.

Methodology: Melese Siyoum, Ayalew Astatkie, Shewangizaw Mekonnen, Gezahegn Bekele, Kefyalew Taye, Zelalem Tenaw, Zemenu Yohannes, Zerai Kassaye.

Project administration: Melese Siyoum.

Resources: Gezahegn Bekele.

Supervision: Melese Siyoum, Ayalew Astatkie, Shewangizaw Mekonnen, Gezahegn Bekele, Kefyalew Taye, Zelalem Tenaw, Zemenu Yohannes, Zerai Kassaye.

Validation: Melese Siyoum.

Visualization: Melese Siyoum, Shewangizaw Mekonnen, Gezahegn Bekele, Zelalem Tenaw, Zemenu Yohannes.

Writing – original draft: Melese Siyoum, Ayalew Astatkie, Shewangizaw Mekonnen, Gezahegn Bekele, Kefyalew Taye, Zelalem Tenaw, Zemenu Yohannes, Zerai Kassaye.

Writing – review & editing: Melese Siyoum.

References

1. Central Statistical Agency (CSA) [Ethiopia], ICF. Ethiopia Demographic and Health Survey 2016: Key Indicators Report. Addis Ababa, Ethiopia, and Rockville, Maryland, USA: CSA and ICF, 2016.
2. Federal Ministry of Health (FMOH). Management protocol on selected obstetrics topics. Addis Ababa, Ethiopia: FMOH, January 2010.
3. Berhan Y, Berhan A. Skilled health personnel attended delivery as a proxy indicator for maternal and perinatal mortality: A systematic review. *Ethiopian Journal of Health Sciences*. 2014; 24:69–80.
4. Carroli G, Rooney C, Villar J. How effective is antenatal care in preventing maternal mortality and serious morbidity? An overview of the evidence. *Paediatric and Perinatal Epidemiology*. 2001; 15(s1):1–42.
5. Central Statistical Agency (CSA) [Ethiopia]. Ethiopia Mini Demographic and Health Survey 2014. Addis Ababa, Ethiopia: CSA, July 2014.
6. Central Statistical Agency (CSA) [Ethiopia], ICF International. Ethiopia Demographic and Health Survey 2011. Addis Ababa, Ethiopia and Calverton, Maryland, USA: CSA and ICF International, 2012.
7. United Nations Population Fund (UNFPA). Trends in maternal health in Ethiopia: challenges in achieving the MDG for maternal mortality: in-depth analysis of the EDHS 2000–2011. Addis Ababa, Ethiopia: UNFPA, 2012.
8. Mills S, Williams JE, Adjuik M, Hodgson A. Use of health professionals for delivery following the availability of free obstetric care in northern Ghana. *Maternal and Child Health Journal*. 2008; 12(4):509–18. <https://doi.org/10.1007/s10995-007-0288-y> PMID: 17955355
9. Ekele BA, Tunau KA. Place of delivery among women who had antenatal care in a teaching hospital. *Acta Obstetrica et Gynecologica Scandinavica*. 2007; 86(5):627–30. <https://doi.org/10.1080/00016340601134622> PMID: 17464595
10. Faye A, Faye M, Bâ IO, Ndiaye P, Tal-Dia A. Facteurs de terminant le lieu d'accouchement chez des femmes ayant bénéficié au moins d'une consultation pré-natale dans une structure sanitaire (Sénégal) [Factors determining the place of delivery in women who attended at least one antenatal consultation in a health facility (Senegal)]. *Revue d'Epidémiologie et de Santé Publique*. 2010; 58(5):323–9. <https://doi.org/10.1016/j.respe.2010.05.004> PMID: 20880645
11. Nduka I, Nduka EC. Determinants of noninstitutional deliveries in an urban community in Nigeria. *Journal of Medical Investigations and Practice*. 2014; 9(3):102–7.
12. Wagle RR, Sabroe S, Nielsen BB. Socioeconomic and physical distance to the maternity hospital as predictors for place of delivery: an observation study from Nepal. *BMC Pregnancy and Childbirth*. 2004; 4(1):8. <https://doi.org/10.1186/1471-2393-4-8> PMID: 15154970
13. Kasaye HK, Desta MS, Gudayu TW, Endale ZM. Home delivery among antenatal care booked women in their last pregnancy and associated factors: community-based cross sectional study in Debrework town, North West Ethiopia, January 2016. *BMC Pregnancy and Childbirth*. 2017; 17(1):225. <https://doi.org/10.1186/s12884-017-1409-2> PMID: 28705188

14. Kibret GD. Prevalence and determinants of home birth after antenatal care attendance in Gozamin District, Northwest Ethiopia. *Health Science Journal*. 2015; 9(6):1–7.
15. Chinkhumba J, De Allegri M, Muula AS, Robberstad B. Maternal and perinatal mortality by place of delivery in sub-Saharan Africa: a meta-analysis of population-based cohort studies. *BMC Public Health*. 2014; 14(1):1.
16. Abebe F, Berhane Y, Girma B. Factors associated with home delivery in Bahirdar, Ethiopia: a case control study. *BMC Research Notes*. 2012; 5(1):653.
17. 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. *Reproductive Health*. 2014; 11(1):1. <https://doi.org/10.1186/1742-4755-11-1>
18. Desalegn E, Mekonnen A, Abeje G. Place of delivery after antenatal care: the case of Fogera district, Amhara Region, North West, Ethiopia; 2013. *Journal of Gynecology and Obstetrics*. 2014; 2(1):1–6.
19. Karkee R, Binns CW, Lee AH. Determinants of facility delivery after implementation of safer mother programme in Nepal: a prospective cohort study. *BMC Pregnancy and Childbirth*. 2013; 13(1):1.
20. Montagu D, Yamey G, Visconti A, Harding A, Yoong J. Where do poor women in developing countries give birth? A multi-country analysis of demographic and health survey data. *PloS One*. 2011; 6(2): e17155. <https://doi.org/10.1371/journal.pone.0017155> PMID: 21386886
21. Simkhada B, Teijlingen ER, Porter M, Simkhada P. Factors affecting the utilization of antenatal care in developing countries: systematic review of the literature. *Journal of Advanced Nursing*. 2008; 61(3):244–60. <https://doi.org/10.1111/j.1365-2648.2007.04532.x> PMID: 18197860
22. Teferra AS, Alemu FM, Woldeyohannes 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 and Childbirth*. 2012; 12(1):1.
23. Amano A, Gebeyehu A, Birhanu Z. Institutional delivery service utilization in Munisa Woreda, South East Ethiopia: a community based cross-sectional study. *BMC Pregnancy and Childbirth*. 2012; 12(1):105.
24. Birmeta K, Dibaba Y, Woldeyohannes D. Determinants of maternal health care utilization in Holeta town, central Ethiopia. *BMC Health Services Research*. 2013; 13(1):1.
25. Kucho B, Mekonnen N. Delivery at home and associated factors among women in child bearing age, who gave birth in the preceding two years in Zala Woreda, southern Ethiopia. *Journal of Public Health and Epidemiology*. 2017; 9(6):177–88.
26. Shiferaw S, Spigt M, Godefrooij M, Melkamu Y, Tekie M. Why do women prefer home births in Ethiopia? *BMC Pregnancy and Childbirth*. 2013; 13(1):1.
27. Tsegay Y, Gebrehiwot T, Goicolea I, Edin K, Lemma H, San Sebastian M. Determinants of antenatal and delivery care utilization in Tigray Region, Ethiopia: a cross-sectional study. *International Journal for Equity in Health*. 2013; 12(1):30.
28. Iyaniwura C, Yussuf Q. Utilization of antenatal care and delivery services in Sagamu, south western Nigeria. *African Journal of Reproductive Health*. 2009; 13(3).
29. Mengesha ZB, Biks GA, Ayele TA, Tessema GA, Koye DN. Determinants of skilled attendance for delivery in Northwest Ethiopia: a community based nested case control study. *BMC Public Health*. 2013; 13(1):130.
30. Zegeye K, Gebeyehu A, Melese T. The role of geographical access in the utilization of institutional delivery service in rural Jimma Horro District, Southwest Ethiopia. *Primary Health Care*. 2014; 4(1):2167–1079.1000150. <https://doi.org/10.4172/2167-1079.1000152>
31. Tadese F, Ali A. Determinants of use of skilled birth attendance among mothers who gave birth in the past 12 months in Raya Alamata District, North East Ethiopia. *Clinics in Mother and Child Health*. 2014; 11:164.
32. Tsegay R, Aregay A, Kidanu K, Alemayehu M, Yohannes G. Determinant factors of home delivery among women in Northern Ethiopia: a case control study. *BMC Public Health*. 2017; 17(1):289. <https://doi.org/10.1186/s12889-017-4159-1> PMID: 28372540