

BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email info.bmjopen@bmj.com

BMJ Open

Factors associated with the community-based newborn care program utilization in Geze Gofa rural district, south Ethiopia: a community based cross-sectional study

| | |
|-------------------------------|---|
| Journal: | <i>BMJ Open</i> |
| Manuscript ID | bmjopen-2020-037792 |
| Article Type: | Original research |
| Date Submitted by the Author: | 16-Feb-2020 |
| Complete List of Authors: | Gebremedhin, Tsegaye; University of Gondar College of Medicine and Health Sciences, Health Systems and policy Atnafu, Asmamaw; University of Gondar College of Medicine and Health Sciences, Health Systems and policy Dellie, Endalkachew; University of Gondar College of Medicine and Health Sciences, Health Systems and policy |
| Keywords: | Community child health < PAEDIATRICS, PUBLIC HEALTH, OBSTETRICS, HEALTH SERVICES ADMINISTRATION & MANAGEMENT |
| | |

SCHOLARONE™
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1
2
3
4 1 **Factors associated with the community-based newborn care**
5
6
7 2 **program utilization in Geze Gofa rural district, south Ethiopia: a**
8
9
10 3 **community based cross-sectional study**

11
12
13 4 **Tsegaye Gebremedhin***, Asmamaw Atnafu, Endalkachew Dellie

14
15
16 5 Department of Health Systems and Policy, Institute of Public Health, College of Medicine and
17
18 6 Health Sciences, University of Gondar, Ethiopia

19
20
21 7 **Email address:**

22
23 8 TG: tsegishg27@gmail.com

24
25 9 AA: asme2002@gmail.com

26
27
28 10 ED: endalkd.07@gmail.com

29
30
31 11 ***Corresponding author:**

32
33
34 12 TG: tsegishg27@gmail.com

35
36
37 13 Po. Box 196, University of Gondar, Gondar, Ethiopia

14 **Abstract**

15 **Objective:** This study aimed to identify the factors associated with the utilization of community-
16 based newborn care program among recently delivered women and newborns in Geze Gofa
17 district, Southern Ethiopia.

18 **Design:** cross-sectional study

19 **Setting:** A community-based

20 **Participants:** A randomly selected 371 recently delivered women were interviewed at home by
21 using an interviewer-administered structured questionnaire.

22 **Methods:** Binary logistic regression analysis was performed. In the multivariable logistic
23 regression analysis, a significant level at p-value <0.05 and Adjusted Odds Ratio (AOR) was
24 used to declare the associated factors.

25 **Outcomes:** community-based newborn care program utilization.

26 **Results:** The findings show that the overall utilization of the CBNC program among recently
27 delivered women and their newborns was 37.5% (95% CI: 32.6-42.6). Women who attended
28 elementary school (AOR: 1.76, 95% CI: 1.01-3.07) and college and above (AOR: 3.71, 95% CI:
29 1.12-12.24), farmer women (AOR: 0.35, 95% CI: 0.16-0.79), lowest wealth status (AOR: 3.76,
30 95% CI: 1.65-8.54) and middle quantile of wealth status (AOR: 1.96, 95% CI: 1.01-3.76, and
31 preference of visiting hospital if they had faced any danger sign (AOR: 0.29, 95% CI: 0.11-0.78)
32 were factors associated with the utilization of CBNC program.

33 **Conclusions:** Community-based newborn care program utilization in the study area was low.
34 Women attended elementary school and college and above, farmer occupation, wealth status in

1
2
3 35 the poorest and middle quantile, and preference of visiting the hospital if they had faced danger
4
5 36 signs among themselves and their newborns in the antepartum, intrapartum, and postpartum
6
7 37 period were factors associated with CBNC program utilization. Therefore, awareness creation
8
9 38 provision at the community level, convenient time arrangement, and increment of physical
10
11 39 access to a health facility are essential to improve the uptake of CBNC in the rural district.
12
13
14

15 40 **Keywords:** Utilization; community based newborn care; Geze Gofa district; Ethiopia
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

42 **Article summary**

43 **Strengths and limitations of this study**

- 44 • Since the community based newborn care is the new initiative provided by the health
45 extension workers, the finding gives an insight for program implementers and policymakers
46 to give accessibly and quality of services for mothers and newborn in the rural district.
- 47 • The study was not triangulated by qualitative methods.
- 48 • The study might be subjected to social desirability bias because the study used the
49 interviewer-administered questionnaire. To minimize this, we have recruited data collectors
50 from other district health facilities.
- 51 • Furthermore, women might experience recall bias, particularly on the services they had got
52 during their previous obstetrics, such as during ANC visits. But compared to other studies,
53 our study period asses in the last six months, which is shorter, and that might decrease the
54 recall bias.

56 **Introduction**

57 A community-based newborn care (CBNC) program is an initiative that includes a newborn care
58 package along the maternal and newborn health continuum of care ^{1 2}. It is carried out by the
59 Health Extension Workers (HEWs) at the community level and aimed to improve maternal and
60 newborn health' through the four Cs. These four Cs are prenatal and postnatal Contact; Case-
61 identification of newborns with signs of bacterial infection; Care, or treatment as early as
62 possible; and Completion of a full seven-day course of appropriate antibiotics at the community
63 level ³.

64 Community-based maternal and newborn care program has been implemented in low-income
65 countries, primarily for the improvement of maternal and newborn health status ⁴⁻⁷. In Malawi, a
66 community-based health promotion program is under implementation to increase access for areas
67 where facility care is limited, thereby removing key barriers for poor households such as distance
68 and transport costs. It also often offered free of charge and can be used to promote healthy
69 behaviors among the poorest and promote utilization of facility-based services, and in some
70 cases, provide treatment at home or community level ⁸.

71 In Ethiopia, 72% of women delivered at home without a skilled provider, and of these, more than
72 80% of home deliveries were among rural women ⁹. The first 48 hours of life is a critical phase
73 in the lives of mothers and newborns and a period in which many neonatal deaths occur. Thirteen
74 percent of newborns had a postnatal check within the first two days after birth, while 86% were
75 not received postpartum check-ups ⁹. Lack of postnatal health checks can delay the identification
76 of newborn complications and the initiation of appropriate care and treatment. Thus, early

1
2
3 77 postpartum care is critical to ensure the proper neonatal care which includes exclusive
4
5 78 breastfeeding, cord care and thermal care and prevention of infections ¹⁰.
6
7

8 79 Every year nearly 45% of all under-five child deaths are among newborn infants within the first
9
10 80 28 days, and three-quarters of all infant deaths occur in the first week of life. But two-thirds of
11
12 81 neonatal deaths can be prevented if effective health measures are provided at birth and during the
13
14 82 first week of life ^{11 12}.
15
16
17

18 83 Moreover, in developing countries, home care visits are not delivered at the standard days 1 and
19
20 84 3 of a newborn's life, and for the majority of mothers, a third visit does not conduct before the
21
22 85 end of the first week of life (day 7) ¹³. Therefore, this study was aimed to assess the utilization of
23
24 86 community based newborn care program utilization and associated factors among recently
25
26 87 delivered women and newborns in Geze Gofa district, Southern Ethiopia.
27
28
29

30 88 **Methods**

31 32 33 89 **Study design and settings**

34
35
36 90 The community-based cross-sectional study design was conducted in Geze Gofa district, Gamo
37
38 91 Gofa zone, South Nation Nationality, and Peoples Regional State, Ethiopia, from May 1 to 31,
39
40 92 2017, to assess the utilization of community-based newborn care program among recently
41
42 93 delivered women and newborns and its associated factors.
43
44
45

46 94 The district administratively divided into one urban and 29 rural kebeles with an entire residence
47
48 95 of 87,731 population. Of these 43,690 (49.8%) are males and 44,041 (50.2%) are females. There
49
50 96 are 20,441 (23.3%) women in the childbearing age group (15-49 years). There are also 3036
51
52
53
54
55
56
57
58
59
60

1
2
3 97 pregnant women and 13,695 under-five children in the district. Moreover, there are 3,036 and
4
5 98 2,799 neonates and under one-year infants, respectively, in the district.
6
7

8 99 All mothers in the childbearing age group who gave birth in the district in 2016/2017 were the
9
10
11 100 source population. Whereas, all mothers who gave birth in the district in the last six months
12
13 101 (since September first, 2016 to end of February 2017) were the study population.
14

15
16 102 Those mothers who gave birth both at home and health facility in the district six months before
17
18 103 the study were included. But mothers who gave birth in another district and came to the study
19
20 104 area, those who lost their babies and mothers critically ill and unable to respond to the interview
21
22 105 were excluded from the study.
23
24

25 106 **Sample size and sampling techniques**

26
27
28 107 The sample was determined using a single population proportion formula ($n = (Z_{\alpha/2})^2 * P (1 -$
29
30 108 $P) / (d)^2$) with the following assumptions of 50% of recently delivered women with their newborns
31
32 109 utilized all the components of community-based newborn care service, expected margin of error
33
34 110 (d) 5% and 95% confidence level. $n = (1.96)^2(0.5) (0.5) / (0.05)^2 = 384$. Then by adding 5% of
35
36 111 non-response rate, the final sample size was 403.
37
38
39

40
41 112 Initially using the lottery method, nine health posts (30% of the total health posts) were selected
42
43 113 ¹⁴. Then proportional allocation was applied for each health post chosen based on the number of
44
45 114 the mother who gave birth in the last six months, and the final study participant was selected
46
47 115 using simple random sampling techniques (lottery method) from the health post-registration to
48
49 116 find the required sample size. Then having the name and house number visited the mother at
50
51 117 home, and the interview was conducted. Mothers who gave birth at home and health institutions
52
53 118 in the last six months and alive infants were included in the study.
54
55

119 **Variables and measurements**

120 The dependent variable of the study was the utilization of community based newborn care
121 program. Whereas, the independent variables were; Socio-demographic and economic variables
122 of women (age, educational status, religion and ethnicity, economic status, occupational status,
123 parity), participation in health development army/Women health development team/meetings,
124 availability of drugs, visiting time by HEWs, distance of the health post, presence of danger sign
125 during pregnancy, delivery, postnatal period including for their newborn were the independent
126 variables.

127 Community-based newborn care program utilization was measured when a pregnant mother and
128 newborn received the following services during pregnancy, delivery and postnatal period up to
129 two months (identified early in the community and received focused antenatal care, institutional
130 childbirth and a newborn recognized for asphyxia and resuscitated, prevented and managed for
131 hypothermia, for pre-term and low birth weight, and managed for neonatal sepsis and very severe
132 diseases at community level by HEWs¹⁵⁻²⁰.

133 Antenatal care service utilization: According to WHO for healthy pregnancies, antenatal care
134 (ANC) should have at least four visits during the pregnancy in which the first within the first
135 trimester²¹. If the pregnancy is not healthy, the visit might be more than four times as per the
136 healthcare provider's decision.

137 Recently delivered women (RDW): A terminology used in this study to denote a woman aged
138 15-49 years who delivered irrespective of place of delivery from September 1st, 2016 to the end
139 of February 2017.

1
2
3 140 **Newborn:** A newborn baby in the first eight weeks after birth, which is eligible for community-
4
5 141 based newborn care program services according to the Ethiopian CBNC program
6
7 142 implementation guideline²².

9
10 143 Wealth index was assessed using household assets through principal component analysis adapted
11
12 144 from the Ethiopian demographic and health survey²³.

15 145 **Data collection tools and procedures**

16
17
18 146 An interviewer-administered standardized structured questionnaire was used after reviewing
19
20 147 different studies and guidelines^{13 16 19 20 22 24-31}. The tool was initially developed in English and
21
22 148 then translated into the local language (Amharic) and finally back to English to ensure its
23
24 149 consistency. Four trained Bachelor of Sciences in Nurse's data collectors and two trained
25
26 150 Bachelor of Sciences in Public Health Officer supervisors were recruited from Sawla health
27
28 151 center, which is located nearby district. During the data collection process, supervisors have
29
30 152 checked the data accuracy, consistency, and completeness daily.

31 153 **Data quality control**

32
33
34 154 Before data collection, a day training for data collectors and supervisors were given on the study
35
36 155 objectives, data collection instruments, techniques, and producers. Data collectors were
37
38 156 supervised daily, and every night the consistency and completeness of data were checked by the
39
40 157 principal investigator (PI). A pretest was conducted on 21 women (5% the sample size) in
41
42 158 Demba Gofa district (which is one of the neighbor districts and having almost similar
43
44 159 characteristics). Before the actual data collection, all findings from the pre-test were incorporated
45
46 160 into the final questionnaire, and necessary amendments were done.

161 **Data processing and analysis**

162 Data were cleaned and checked for completeness, consistency, coded, and entered into Epi-Data
163 version 3.1 software and exported to SPSS version 23 for analysis.

164 Descriptive statistics were used and presented with narration and tabular presentation. Both bi-
165 variable and multi-variable logistic regression analysis was computed to determine the associated
166 factors. Those variables having a p-value of less than 0.2 in the bivariable logistic regression
167 analysis were entered to multivariable logistic regression analysis to filter out confounding
168 factors after checking model fitness, chi-square, and multi-collinearity assumptions. In the final
169 multivariable logistic regression analysis model, a p-value less than 0.05 and AOR with 95% CI
170 were used to declare the associated factors.

171 **Results**

172 **Socio-demographic and economic characteristics of participants**

173 A total of 371 women responded to the interviewer-administered questionnaire with a response
174 rate of 92.1%. The mean age of the women was 27.6 (SD \pm 5) years. The majority of the women
175 (74.4%) were married, and 6.2% were single. Religiously, 46.4% and 7.5% of women were
176 protestant and Muslim followers, respectively. Regarding educational status, 42.3% of women
177 were attended elementary school, and 5.9% were attended college and above. Among the total
178 women, 72.5% were a housewife, and 4.0% were a government employee. Sixty-seven percent
179 of women were from Gofa ethnicity. The mean parity of women in this study was 3.5 (SD \pm 1.9).
180 Nearly 30% and 14.6% of the women were in the middle and rich wealth status, respectively
181 (Table 1).

182 Table 1: Socio-demographic and economic characteristics of study participants in Geze Gofa
 183 district, south Ethiopia, June 2017 (n=371).

| Variables | Responses | Frequency (n) | Percent (%) |
|---------------------|-------------------------------|---------------|-------------|
| Age in years | <24 | 109 | 29.4 |
| | 24-35 | 246 | 66.3 |
| | >35 | 16 | 4.3 |
| Marital status | Single | 23 | 6.2 |
| | Married | 276 | 74.4 |
| | Widowed | 32 | 8.6 |
| | Divorced | 40 | 10.8 |
| Religious status | Protestant | 172 | 46.4 |
| | Orthodox | 131 | 35.3 |
| | Muslim | 28 | 7.5 |
| | Catholic | 40 | 10.8 |
| Educational status | Unable to read and write | 116 | 31.3 |
| | Able to read and write | 25 | 6.7 |
| | Elementary school (Grade1- 8) | 157 | 42.3 |
| | High school | 51 | 13.7 |
| | College and above | 22 | 5.9 |
| Occupational status | Gov't employee | 15 | 4.0 |
| | Merchant | 31 | 8.4 |
| | Daily labor | 21 | 5.7 |
| | Farmer | 35 | 9.4 |
| | Housewife | 269 | 72.5 |
| Ethnicity | Gofa | 249 | 67.1 |
| | Gamo | 69 | 18.6 |
| | Wolayita | 27 | 7.3 |
| | Others* | 26 | 7.0 |
| Parity | Primipara | 53 | 16.5 |

| Variables | Responses | Frequency (n) | Percent (%) |
|------------------|-----------|---------------|-------------|
| | Multipara | 268 | 83.5 |
| Wealth quantiles | Poorest | 65 | 17.5 |
| | Poor | 63 | 17.0 |
| | Middle | 111 | 29.9 |
| | Rich | 54 | 14.6 |
| | Richest | 78 | 21.0 |

184 * Amhara, Guraghe, Kembata

185 Antenatal care and institutional delivery services

186 The study shows that all of the respondents know the health extension workers (HEWs) who
 187 work in their respective kebeles, and the majority (90.7%) of the women have received advice
 188 from the HEWs during their recent pregnancy and in the postpartum period. A total of 340
 189 (91.6%) women were responded that there is a health development team (1 to 5 network) in their
 190 community. Of those 323 (95.0%) are a member of the network and among those who were
 191 involved in the team 217 (67.1%) were attended the meeting during their recent pregnancy.
 192 Ninety-eight percent of women had received ANC visits during their last pregnancy. The mean
 193 age of pregnancy during the first ANC visit was 4.6 months ($SD \pm 1.3$), and 298 (81.9%) women
 194 were in their second trimester, and 8 (2.2%) were in their third trimester. Almost 80.2%, 15.4%,
 195 and 4.4% of women were going to health posts, health centers, and hospitals for their first ANC
 196 visits, respectively. Regarding ANC service packages for 95.6% of women abdominal
 197 examination (Leopold maneuver measurement), weight and blood pressure measurement were
 198 performed, and for 56.6% of women, routine laboratory investigation was conducted during their
 199 recent pregnancy. Moreover, 90.7%, 80.5%, and 6.6% of women have received tetanus toxoid
 200 vaccination, iron folate, and deworming during ANC visits for their recent pregnancy,

201 respectively. Of those who received ANC at least once, 285 (78.3%) of women were received
 202 ANC visit four and more times. Regarding knowledge of women about danger sign during
 203 pregnancy 79.2%, 75.5%, and 49.6% of women responded that vaginal bleeding, blurred vision,
 204 and convulsion are a sign of danger sign during pregnancy, respectively. One-fifth of the women
 205 faced at least one danger sign, and overall, 75.5% and 10% of the women mentioned that they
 206 went to health centers and hospitals, if they have faced any of the danger signs during their
 207 recent pregnancy. A total of 233 (62.8%) of women delivered at a health facility. Of that, 81.5%,
 208 14.6%, and 3.9% of deliveries were at the health center, hospital, and health posts, respectively.
 209 For forty-one percent of the women, to reach the nearest health post, it takes 30 to 60 minutes
 210 (Table 2).

211 Table 2: Antenatal care and institutional delivery services utilization among recently delivered
 212 women in Geze Gofa, district, south Ethiopia, June 2017 (n= 371).

| Variables | Responses | Frequency (n) | Percent (%) |
|--|--|------------------|----------------|
| Know the HEWs | Yes | 371 | 100.0 |
| | No | 0 | 0 |
| Types of services received from the HEWs (n=371) | General health information including the mother's group in the kebele | 328 | 88.4 |
| | Advice on pregnancy, delivery, and postnatal care including newborn care | 335 | 90.3 |
| | Advice on newborn and child disease and the management | 274 | 73.9 |
| | Supplies on condom and pills | 261 | 70.4 |
| | Vitamin A for the mothers | 176 | 47.4 |

| Variables | Responses | Frequency (n) | Percent (%) |
|---|-------------------------------|--------------------------|------------------------|
| | Advice on HIV/AIDS and others | 275 | 74.1 |
| | STI prevention and control | | |
| Presence of health development team (1 to 5 networks) in community (n= 371) | Yes | 340 | 91.6 |
| | No | 31 | 8.4 |
| Member of 1 to 5 network (n= 340) | Yes | 323 | 95.0 |
| | No | 17 | 5.0 |
| Attended the meeting during the recent pregnancy? (n=323) | Yes | 217 | 67.1 |
| | No | 106 | 32.3 |
| ANC follow up for the recent pregnancy | Yes | 364 | 98.1 |
| | No | 7 | 1.9 |
| Number of ANC visit (n=364) | Only Once | 14 | 3.9 |
| | Twice | 26 | 7.1 |
| | Three times | 39 | 10.7 |
| | Four and above | 285 | 78.3 |
| Age of gestation during the first ANC visit (n=364) | First trimester | 58 | 15.9 |
| | Second trimester | 298 | 81.9 |
| | Third trimester | 8 | 2.2 |
| Type of health facility for the first ANC visit | Hospital | 16 | 4.4 |
| | Health center | 56 | 15.4 |
| | Health post | 292 | 80.2 |
| Knowing about danger sign during pregnancy | Swelling of hands and face | 237 | 63.9 |
| | Blurred vision | 280 | 75.5 |
| | Convulsion | 184 | 49.6 |
| | Severe headache | 248 | 66.8 |
| | Severe lower abdominal pain | 206 | 55.5 |
| | Vaginal bleeding | 294 | 79.2 |

| Variables | Responses | Frequency | Percent |
|---|-----------------------|-----------|---------|
| | | (n) | (%) |
| Place of visits, if they have faced danger signs | Hospital | 37 | 10.0 |
| | Health center | 280 | 75.5 |
| | Health post | 54 | 14.6 |
| Faced danger sign during the recent pregnancy, delivery, and postnatal period | Yes | 75 | 20.2 |
| | No | 289 | 77.8 |
| Place of delivery | Health facility | 233 | 62.8 |
| | Home | 138 | 37.2 |
| Type of health facility attended during delivery (n= 233) | Hospital | 34 | 14.6 |
| | Health center | 190 | 81.5 |
| | Health post | 9 | 3.9 |
| Time takes to reach the nearest health post | Less than 30 minutes | 79 | 21.3 |
| | 30 to 60 minutes | 151 | 40.7 |
| | 60 to 120 minutes | 109 | 29.4 |
| | More than 120 minutes | 32 | 8.6 |

213 **Postpartum and immediate newborn care services**

214 At the time of delivery or in the early days after the birth, 246 (66.3%) of women received
 215 postnatal care visits. From those, 100 (40.7%) of women were visited within the first 48 hours,
 216 38 (15.4%) on the third day, and the rest after the third day. Immediately after delivery of those
 217 newborns delivered at home, for 13 (9.4%) of newborns after cutting the cord, anything was
 218 applied other than the ointment. From the total newborns, 336 (90.6%) of newborns started
 219 breastfeeding within the first hour, and the rest began between 1 and 48 hours after delivery.
 220 Moreover, 74.1% of newborns feed exclusive breastfeeding. Three fourth of women received

221 information about breastfeeding for the first time from health extension workers, and 24 (6.5%)
 222 obtained from mass media (Table 3).

223 Table 3: Postpartum and immediate newborn care services utilization among recently delivered
 224 women and newborns in Geze Gofa district, south Ethiopia, June 2017 (n= 371).

| Variables | Responses | Frequency (n) | Percent (%) |
|---|--|------------------|----------------|
| Postnatal visit | Yes | 246 | 66.3 |
| | No | 125 | 33.7 |
| Postnatal care visiting time (n=246) | <48 hours | 100 | 40.7 |
| | 3 rd day | 38 | 15.4 |
| | After 3 rd day | 108 | 43.9 |
| Something applied on the cord (n=138) | Yes | 13 | 9.4 |
| | No | 125 | 90.6 |
| Timing of breast feeding | < 1hr | 336 | 90.6 |
| | ≥1hrs | 35 | 9.4 |
| Exclusive breastfeeding | Yes | 275 | 74.1 |
| | No | 96 | 25.9 |
| Source of information about breastfeeding | HEWs | 278 | 74.9 |
| | Health care provider from health canter | 49 | 13.2 |
| | Mass media | 24 | 6.5 |
| | Relatives/friends | 10 | 2.7 |
| | Other* | 10 | 2.7 |

225 *Health development army leader, community group, traditional birth attendant

226 **Newborn care services during the first two months of age**

227 From the total respondents, 256 (69.0%) mothers had information about community-based
 228 newborn care provided by HEW at health post (HP) and community level.

229 During the first two months after delivery, 224(60.4%) of newborns were received postnatal
 230 follow up from HEWs at home. Of those who received a postpartum follow-up, 41 (18.3%)
 231 newborns checked once, and 87 (38.8%) newborns checked three and above times. The majority
 232 of the newborns 299 (80.6%) were weighed their birth weight within seven days. Of those, 271
 233 (90.6%) and 12 (4.0%) were normal and overweight, respectively.

234 Among the total newborns, 56 (15.1%) faced health problems after delivery in the postnatal
 235 periods. The mean age of the young infants when experiences health problems was 40 (SD ± 13)
 236 days and 34 (60.7%) of young infants have consulted the HEWs and visited health posts to
 237 receive medical services (Table 4).

238 Table 4: Community-based newborn care services during the first two months of age in Geze
 239 Gofa district, south Ethiopia, June 2017 (n= 371).

| Variables | Responses | Frequency (n) | Percent (%) |
|---|----------------------|------------------|----------------|
| Having information about the CBNC program | Yes | 256 | 69.0 |
| | No | 115 | 30.9 |
| Newborn received postnatal follow up from HEWs at home within two months of age | Yes | 224 | 60.4 |
| | No | 147 | 39.6 |
| Frequency of follow up received from HEWs (n=224) | Once | 41 | 18.3 |
| | Twice | 96 | 42.9 |
| | ≥ Three times | 87 | 38.8 |
| Baby's weight was measured within the first seven days of birth | Yes | 299 | 80.6 |
| | No | 72 | 19.4 |
| Birth weight of the newborn (n=299) | Low birth weight | 271 | 90.6 |
| | Normal weight | 16 | 5.4 |
| | Big baby/over weight | 12 | 4.0 |
| Newborn faced a health problem during the | Yes | 56 | 15.1 |

| | | | |
|--|---------------|-----|------|
| first two months of age | No | 315 | 84.9 |
| Types of facility visited for medical services (n=56) | Health posts | 34 | 60.7 |
| | Health center | 15 | 26.8 |
| | Hospital | 7 | 12.5 |

240 Overall community based newborn care program utilization

241 A community-based newborn care program utilization was measured when a woman and her
 242 newborn received all the components of the program (antenatal care + institutional delivery +
 243 postnatal care + neonatal care up to two months of age) continually at home and health post
 244 level. Accordingly, 37.5% (95% CI: 32.6-42.6) of women with their newborn's utilized full
 245 components of community based newborn care program (which is a continuum of maternal and
 246 newborn care services), and the rest had not received the complete parts of the program.

247 Factors associated with community based newborn care program utilization

248 In this study, bivariable and multivariable logistic regression analyses were performed to
 249 investigate the association of independent variables with the dependent variable of community
 250 based newborn care program utilization. These predictor variables that have a P-value of less
 251 than 0.2 during bivariable analysis were entered into multivariable logistic regression analysis.

252 In the bivariable logistic regression women's age, educational status, occupational status,
 253 ethnicity, wealth status, time is taken to reach the nearest health post, types of facility they went
 254 when having danger sign during pregnancy and after delivery, and previous information about
 255 community-based newborn care program were candidate variables. In the multivariable logistic
 256 regression analysis, educational status, occupational status, wealth status, and types of facility
 257 they visit when they having danger signs during pregnancy and after delivery up to two months
 258 were significantly associated with the utilization of community-based newborn care program.

259 Accordingly, women who attended elementary school were 1.7 times more utilized the program
 260 (AOR: 1.76, 95% CI: 1.01-3.07) and women who attended college and above were 3.7 times
 261 more utilized the program (AOR: 3.71, 95% CI: 1.12-12.24) compared to those who were
 262 unable to read and write. Those farmer women were a 65% lower utilization of the program
 263 compared to those housewife women (AOR: 0.35, 95% CI: 0.16-0.79). Women who were in the
 264 poorest wealth status were 3.76 times more utilized the program (AOR: 3.76, 95% CI: 1.65-8.54)
 265 and those who are in the middle quantile of wealth status were 1.96 times more utilized the
 266 program (AOR: 1.96, 95% CI: 1.03-3.76) compared to those who are in the highest quantile of
 267 wealth status. Moreover, women who preferred visiting the hospital if they had any danger signs
 268 were 70.4% less likely to utilize the services compared to those who would go to health posts
 269 (AOR: 0.29, 95% CI: 0.11-0.78) (Table 5).

270 Table 5: Bi-variable and multi-variable logistic regression analysis of community-based newborn
 271 care program utilization among recently delivered women in Geze Gofa district, south Ethiopia,
 272 June 2017 (n= 371).

| Variables | CBNC | CNBC | COR (95% CI) | AOR (95% CI) |
|--------------------------|-------------------|-----------------------|---------------------|------------------------------|
| | utilized n (%) | non-utilized n (%) | | |
| Age in years | | | | |
| ≤24 | 36 | 73 | 2.028 (0.704-5.842) | 1.413(0.419-4.758) |
| 25-35 | 95 | 151 | 1.589 (0.577-4.377) | 1.344 (0.440-4.100) |
| >35 | 8 | 8 | 1 | 1 |
| Educational status | | | | |
| Unable to read and write | 49 | 67 | 1 | 1 |
| Able to read and write | 12 | 13 | 0.792 (0.333-1.885) | 0.836 (0.323-2.165) |
| Elementary school | 47 | 110 | 1.712 (1.036-2.829) | 1.762 (1.012-3.071) * |

| Variables | CBNC | CNBC | COR (95% CI) | AOR (95% CI) |
|--|----------|--------------|---------------------|-------------------------------|
| | utilized | non-utilized | | |
| | n (%) | n (%) | | |
| High school | 26 | 25 | 0.703 (0.363-1.362) | 0.804 (0.363-1.779) |
| College and above | 5 | 17 | 2.487 (0.859-7.199) | 3.705 (1.122-12.235) * |
| Occupational status | | | | |
| Government employee | 8 | 7 | 0.425 (0.149-1.211) | 0.406 (0.128-1.289) |
| Merchant | 14 | 17 | 0.590 (0.278-1.252) | 0.500 (0.218-1.146) |
| Daily labour | 9 | 12 | 0.648 (0.263-1.596) | 0.397 (0.146-1.079) |
| Farmer | 20 | 15 | 0.365 (0.178-0.746) | 0.350 (0.156-0.788) * |
| House wife | 88 | 181 | 1 | 1 |
| Ethnicity | | | | |
| Goffa | 86 | 163 | 1 | 1 |
| Gamo | 30 | 39 | 0.686 (0.399-1.180) | 0.756 (0.415-1.378) |
| Wolayita | 13 | 14 | 0.568 (0.256-1.263) | 0.465 (0.195-1.110) |
| Others* | 10 | 16 | 0.844 (0.367-1.940) | 1.267 (0.494-3.246) |
| Wealth status | | | | |
| Poorest | 13 | 52 | 4.211 (1.984-8.937) | 3.756 (1.651-8.544) * |
| Poor | 22 | 41 | 1.962 (0.992-3.881) | 1.921 (0.908-4.064) |
| Middle | 39 | 72 | 1.943 (1.076-3.508) | 1.963 (1.025-3.758) * |
| Rich | 25 | 29 | 1.221 (0.609-2.447) | 1.258 (0.566-2.798) |
| Richest | 40 | 38 | 1 | 1 |
| Time takes to reach the nearest health posts | | | | |
| < 30 minutes | 28 | 51 | 0.510 (0.196-1.327) | 0.581 (0.206-1.637) |
| 30-60 minutes | 59 | 92 | 0.437 (0.178-1.073) | 0.483 (0.178-1.311) |
| 60-120 minutes | 45 | 64 | 0.398 (0.159-1.000) | 0.408 (0.146-1.140) |
| > 120 minutes | 7 | 25 | 1 | 1 |
| Place of visit, if they have faced danger sign during their recent pregnancy | | | | |
| Hospital | 20 | 17 | 0.298 (0.122-0.723) | 0.296 (0.113-0.777) * |
| Health center | 105 | 175 | 0.583 (0.303-1.123) | 0.584 (0.288-1.183) |

| Variables | CBNC | CNBC | COR (95% CI) | AOR (95% CI) |
|---|----------|--------------|---------------------|---------------------|
| | utilized | non-utilized | | |
| | n (%) | n (%) | | |
| Health post | 14 | 40 | 1 | 1 |
| Having information about the CBNC program | | | | |
| Yes | 90 | 166 | 1 | 1 |
| No | 49 | 66 | 0.730 (0.466-1.145) | 0.726 (0.434-1.212) |

273 *others: Amhara, Guraghe, and Kembata* * statistically significant at p -value <0.05

274 Discussion

275 Overall, 37.5% of recently delivered women and their newborns have received the full
 276 component of community based newborn care program continually measured by ANC fourth
 277 visit, institutional delivery, postnatal care visit, and neonatal care up to two months of age.

278 Our result is higher than a study conducted in Xaybouathong district in Khammouane province,
 279 Lao PDR shows only 6.8% continued to receive all 10 services used in modified composite
 280 coverage index which includes ANC 4 or more, neonatal tetanus protection, facility-based
 281 delivery, delivery attended by skilled birth attendant (SBA), PNC for mother and newborn, BCG,
 282 Penta, Polio, and family planning ¹⁵, a study finding in Ghana shows that throughout the
 283 pregnancy to post-delivery, 7.9% of women and children received the continuum of care through
 284 continuous visits to health facilities ¹⁶, and another study done in Ghana shows that only 8.0% of
 285 the women completed continuum of care measured as women who received ANC4+, SBA, and
 286 PNC within 48 hours, at two weeks, and six weeks ²⁰. The dissonance could be justified; in this
 287 study, the inclusion of continuum of care includes only ANC, institutional delivery, immediate
 288 postnatal care, and newborn care services up to two months of age.

1
2
3 289 Moreover, our finding is higher than a study finding in Pakistan from the trends of a composite
4
5 290 measure of the continuum of care, including antenatal care, delivery assistance, and postpartum
6
7 291 care shows 27.4%¹⁸. This difference might be due to variation of the study period, which
8
9
10 292 includes those women who gave birth five years before the survey, which might increase their
11
12 293 bias to remember the services received before five years and the study area, which covers at the
13
14 294 national level that contribute for low result findings. But lower than a study done at Sohag
15
16 295 governorate, Egypt shows that 50.4% of women had achieved continuum of care measured
17
18 296 (ANC+4 visit, delivered by skilled birth attendant and had PNC)¹⁷ and a study conducted in
19
20 297 Cambodia shows that 60% of women had the full range of services for the continuum of
21
22 298 maternal and newborn health care³². This discrepancy might be the study includes only ANC,
23
24 299 institutional delivery, and postnatal which does not include the newborn care in their continuum
25
26 300 of care that gives a higher result. The other possible reason might be the difference in sample
27
28
29 301 size and socio-cultural variations.
30
31
32

33 302 The results of this study showed that 98.1% of women received ANC services once, 76.8% four,
34
35 303 and above times, 62.8% of women were delivered at a health facility, and 60.3% of newborns'
36
37 304 health status was checked by HEWs up to two months of age. This study finding is higher than a
38
39 305 study conducted in Ratanakiri province, Cambodia shows only 32.6% of women received ANC
40
41 306 four and above visits for their recent pregnancy in the continuum of maternal, newborn, and
42
43 307 child health services³³. The possible explanation might be due to the difference in target group,
44
45 308 which includes those women who gave birth two years before the study might forget the services
46
47 309 they have taken. The other possible reason might be the difference in the service delivery pace
48
49 310 for their ANC follow up; our study includes services taken at the health post level, but their study
50
51 311 measures ANC services follow up only at health centers and hospitals. But lower than a study
52
53
54
55
56
57
58
59
60

1
2
3 312 conducted in at Sohag Governorate, Egypt shows 90% of women had antenatal care four and
4
5 313 above visits ¹⁷. Our lower finding might be explained by the small sample size and rural
6
7
8 314 residence of the study participants.

9
10 315 The study revealed that women who attended elementary school and college and above were 1.7
11
12 316 and 3.7 times more chance of utilization of the program, respectively, than those who were
13
14
15 317 unable to read and write. This finding is comparable with that of a study done in Xaybouathong
16
17 318 district in Khammouane province, Lao PDR shows women's education was positively associated
18
19 319 with the continuum of maternal, newborn and child health services utilization ¹⁵. These findings
20
21 320 might be explained by as a woman education level increase her knowledge and awareness about
22
23 321 the importance of the services also increase.

24
25
26
27 322 Community based newborn care program utilization was lower by 65% among farmer women
28
29 323 compared to those housewife women. This result is supported by a study done in the
30
31 324 Xaybouathong district in Khammouane province, Lao PDR, which shows being farmers as
32
33 325 occupations negatively associated with the continuum of maternal, newborn, and child health
34
35 326 services utilization ¹⁵. This result might be explained by the inconvenience of service delivery
36
37 327 time for those farmer women.

38
39
40
41 328 Those women who are in the poorest and middle quantiles of wealth status were 3.76 and 1.96
42
43 329 times more likely to utilize the community based newborn care program compared to women
44
45 330 who are in the richest quantile. This finding is in disagreement with studies in Sohag
46
47 331 Governorate, Egypt that shows women in the higher economic status were 1.6 times more
48
49 332 utilized the continuum of maternal, newborn, and child health services compared to those women
50
51 333 in the lower economic status ¹⁷, in Ghana women and children from richest households were

334 more likely to achieve the continuum of care ¹⁶, in Africa it shows on average there is a three-
335 fold disparity in use of continuum of care for the wealthiest 20% of African women compared to
336 the poorest ³⁴, and in Pakistan, it showed that the richest women had received 7 times more the
337 complete continuum of care than poorest ¹⁸. This disagreement might be explained by the
338 community based newborn care program in our study area is aimed to serve the poorest
339 households at the health post and home level for the increment of health care services access. The
340 other possible explanation might be the wealthier families can afford the direct and indirect costs
341 associated with antepartum, intrapartum, and postpartum services in a health facility and seeking
342 quality services at the higher hospital.

343 In this study, those women who preferred visiting the hospital if they had faced any danger sign
344 in the pre and postpartum period for themselves and their newborns were a 70.4% lower chance
345 of the community based newborn care program utilization compared to those who were preferred
346 visiting health posts which might be related with distance problem. This result is in line with a
347 study in Pakistan showed having not a big problem in case of distance and transport arrangement
348 to access health facility for medical care utilized the continuum of maternal, newborn, and child
349 healthcare services, 76.1% and 72.9%, respectively ¹⁸. The other possible explanation might be
350 the effectiveness of community health workers for delivering preventive maternal and child
351 health interventions in low- and-middle income countries ³⁵ increase the utilization of
352 community-based newborn care program.

353 **Limitation of the study**

354 This finding was not triangulated by qualitative methods and also might be subjected to social
355 desirability bias because the study used the interviewer-administered questionnaire. To minimize

1
2
3 356 this, we have recruited data collectors from other district health facilities. Furthermore, women
4
5 357 might experience recall bias, particularly on the services they had got during their previous
6
7
8 358 obstetrics such as during ANC visits. But compared to other studies, our study period assesses in the
9
10 359 last six months, which is shorter, and that might decrease the recall bias.
11

12 13 360 **Conclusions and implications**

14
15
16 361 The study showed that community based newborn care program utilization in the study area was
17
18 362 low, which was measured (ANC 4+ visit, institutional delivery, postnatal care, and newborn care
19
20
21 363 up to two months of age). Women attended elementary school and college and above, having
22
23 364 farmer occupation, wealth status in the poorest and middle quantile, and preference of visiting
24
25
26 365 the hospital if they had faced danger sign among themselves and their newborns in the
27
28 366 antepartum, intrapartum, and postpartum period were factors associated with community-based
29
30 367 newborn care program utilization. Therefore, awareness creation provision at the community
31
32 368 level for those illiterate women, arranging the convenient time for those farmer women, and
33
34 369 constructing health facilities to the nearby the residents of the community could improve
35
36
37 370 community-based newborn care program utilization for those resides in the rural district.
38

39
40 371 **Acknowledgment:** The authors would like to thank all respondents for their willingness to
41
42 372 participated in the study. We are also grateful to the Geze Gofa district health office. Finally, our
43
44 373 appreciation goes to the data collectors for their unreserved contribution in data collection
45
46
47 374 activities.
48

49
50 375 **Author Contributions:** TG conceptualized the study. The methods and materials were
51
52 376 developed, and the data analysis, interpretation, and drafting of the paper were undertaken by
53
54 377 TG, AA, and ED. All authors invest significant contributions and approved the final draft.
55

1
2
3 378 **Funding statement:** This research received no specific grant from any funding agency in public,
4
5 379 commercial, or not-for-profit sectors.
6
7

8 380 **Competing interests:** The authors declare that they have no conflict of interest.
9
10

11 381 **Patient consent:** obtained
12
13

14 382 **Ethical approval:** Ethical approval was obtained from the ethical review board of Jimma
15
16 383 University (Ref. No. IHRPGC/418/2017). The official letter of co-operation was obtained from
17
18 384 the Geze Gofa district health office.
19
20

21 385 **Data sharing statement:** all the relevant data are provided in the manuscript. Data can be
22
23 386 provided by the contact of the corresponding author on a reasonable request.
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

388 References

- 389 1. Mathewos B, Owen H, Sitrin D, et al. Community-Based Interventions for Newborns in
390 Ethiopia (COMBINE): Cost-effectiveness analysis. *Health Policy Plan*
391 2017;32(suppl_1):i21-i32. doi: 10.1093/heapol/czx054 [published Online First:
392 2017/10/06]
- 393 2. Berhanu D, Avan B. Community Based Newborn Care in Ethiopia: Quality of CBNC
394 programme assessment Midline Evaluation Report March 2017. 2017
- 395 3. Banteyerga H. Ethiopia's health extension program: improving health through community
396 involvement. *MEDICC review* 2014;13(3):46-49.
- 397 4. Perry HB, Zulliger R, Rogers MM. Community health workers in low-, middle-, and high-
398 income countries: an overview of their history, recent evolution, and current
399 effectiveness. *Annual review of public health* 2014;35:399-421.
- 400 5. Reducing intrapartum-related neonatal deaths in low-and middle-income countries—what
401 works? *Seminars in perinatology*; 2010. Elsevier.
- 402 6. Nair N, Tripathy P, Prost A, et al. Improving newborn survival in low-income countries:
403 community-based approaches and lessons from South Asia. *PLoS medicine*
404 2010;7(4):e1000246.
- 405 7. Maulik P, Darmstadt G. Community-based interventions to optimize early childhood
406 development in low resource settings. *Journal of Perinatology* 2009;29(8):531.
- 407 8. Callaghan-Koru JA, Nonyane BA, Guenther T, et al. Contribution of community-based
408 newborn health promotion to reducing inequities in healthy newborn care practices and
409 knowledge in Malawi. 2013
- 410 9. Central Statistical Agency Addis Ababa E. Ethiopia Demographic and Health Survey 2016
411 Addis Ababa, Ethiopia 2016
- 412 10. Callaghan-Koru JA, Abiy Seifu MT, Graft-Johnson Jd, et al. Newborn care practices at home
413 and in health facilities in 4 regions of Ethiopia. 2013
- 414 11. World Health Organization. Global, regional and national neonatal health status. Fact sheet,
415 2016.
- 416 12. World Health Organization Regional Office for Africa. Newborn Health key facts. 2017.
417 <https://www.afro.who.int/health-topics/newborn>.

- 1
2
3 418 13. Zulfiqar A. Bhutta GLD, Babar S. Hasan and Rachel A. Haws. Community-Based
4
5 419 Interventions for Improving Perinatal and Neonatal Health Outcomes in Developing
6
7 420 Countries: A Review of the Evidence. 2005 doi: 10.1542/peds.2004-1441
8
9 421 14. Sambo LG, Chatora RR, Goosen E. Tools for assessing the operationality of district health
10
11 422 systems. *Brazzaville: World Health Organization, Regional Office for Africa* 2003
12
13 423 15. Sakuma S, Yasuoka J, Phongluxa K, et al. Determinants of continuum of care for maternal,
14
15 424 newborn, and child health services in rural Khammouane, Lao PDR. *PloS one*
16
17 425 2019;14(4):e0215635.
18
19 426 16. Shibanuma A, Yeji F, Okawa S, et al. The coverage of continuum of care in maternal,
20
21 427 newborn and child health: a cross-sectional study of woman-child pairs in Ghana. *BMJ*
22
23 428 *Global Health* 2018;3(4):e000786. doi: 10.1136/bmjgh-2018-000786
24
25 429 17. Hamed AF, Roshdy E, Sabry M. Egyptian status of continuum of care for maternal, newborn,
26
27 430 and child health: Sohag Governorate as an example. *International Journal of Medical*
28
29 431 *Science and Public Health* 2018;7(6):417-27.
30
31 432 18. Iqbal S, Maqsood S, Zakar R, et al. Continuum of care in maternal, newborn and child health
32
33 433 in Pakistan: analysis of trends and determinants from 2006 to 2012. *BMC Health Services*
34
35 434 *Research* 2017;17(1):189. doi: 10.1186/s12913-017-2111-9
36
37 435 19. Engmann CM, Hodgson A, Aborigo R, et al. Addressing the continuum of maternal and
38
39 436 newborn care in Ghana: implications for policy and practice. *Health Policy and Planning*
40
41 437 2016;31(10):1355-63. doi: 10.1093/heapol/czw072
42
43 438 20. Yeji F, Shibanuma A, Oduro A, et al. Continuum of care in a maternal, newborn and child
44
45 439 health program in Ghana: Low completion rate and multiple obstacle factors. *PloS one*
46
47 440 2015;10(12):e0142849.
48
49 441 21. World Health Organization. WHO recommendations on antenatal care for a positive
50
51 442 pregnancy experience: World Health Organization 2016.
52
53 443 22. Federal Ministry of Health E. Community Based Newborn Care Implementation Guideline
54
55 444 2013.
56
57 445 23. [Ethiopia] CSAC. Ethiopia Mini Demographic and Health Survey 2014. Addis Ababa,
58
59 446 Ethiopia. 2014
60
61 447 24. Federal Ministry of Health E. Maternal, newborn, child and adolescent health guideline 2012

- 1
2
3 448 25. Tuladhar S. The Determinants of Good Newborn Care Practices in the Rural Areas of Nepal.
4
5 449 2010
6
7 450 26. Owili PO, Muga MA, Chou Y-J, et al. Associations in the continuum of care for maternal,
8
9 451 newborn and child health: a population-based study of 12 sub-Saharan Africa countries.
10
11 452 *BMC public health* 2016;16(1):414.
12 453 27. Quayyum Z, Khan MNU, Quayyum T, et al. “Can community level interventions have an
13
14 454 impact on equity and utilization of maternal health care”—Evidence from rural
15
16 455 Bangladesh. *International journal for equity in health* 2013;12(1):22.
17 456 28. Veirum JE, Biai S, Jakobsen M, et al. Persisting high hospital and community childhood
18
19 457 mortality in an urban setting in Guinea-Bissau. *Acta paediatrica (Oslo, Norway : 1992)*
20
21 458 2007;96(10):1526-30. doi: 10.1111/j.1651-2227.2007.00467.x [published Online First:
22
23 459 2007/09/14]
24 460 29. Kerber KJ, de Graft-Johnson JE, Bhutta ZA, et al. Continuum of care for maternal, newborn,
25
26 461 and child health: from slogan to service delivery. *The Lancet* 2007;370(9595):1358-69.
27
28 462 doi: [https://doi.org/10.1016/S0140-6736\(07\)61578-5](https://doi.org/10.1016/S0140-6736(07)61578-5)
29 463 30. Sule SS, Onayade AA. Community-based antenatal and perinatal interventions and newborn
30
31 464 survival. *Nigerian journal of medicine : journal of the National Association of Resident*
32
33 465 *Doctors of Nigeria* 2006;15(2):108-14. [published Online First: 2006/06/30]
34 466 31. Telfair J. An evaluation of state perinatal community-based programs in Alabama: overview.
35
36 467 *Public health reports (Washington, DC : 1974)* 2003;118(5):484-6. doi:
37
38 468 10.1093/phr/118.5.484 [published Online First: 2003/08/28]
39 469 32. Wang W. Levels and determinants of continuum of care for maternal and newborn health in
40
41 470 Cambodia-evidence from a population-based survey. *BMC Pregnancy and Childbirth*
42
43 471 2015;15 doi: 10.1186/s12884-015-0497-0
44
45 472 33. Yasuoka J, Nanishi K, Kikuchi K, et al. Barriers for pregnant women living in rural,
46
47 473 agricultural villages to accessing antenatal care in Cambodia: A community-based cross-
48
49 474 sectional study combined with a geographic information system. *PLoS One*
50
51 475 2018;13(3):e0194103. doi: 10.1371/journal.pone.0194103 [published Online First:
52
53 476 2018/03/20]
54 477 34. de Graft-Johnson J, Kerber K, Tinker A, et al. The maternal, newborn and child health
55
56 478 continuum of care. *Opportunities for Africa's newborns* 2006:23-36.

1
2
3 479 35. Gilmore B, McAuliffe E. Effectiveness of community health workers delivering preventive
4
5 480 interventions for maternal and child health in low-and middle-income countries: a
6
7 481 systematic review. *BMC public health* 2013;13(1):847.
8

9 482
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

| Section/Topic | Item # | Recommendation | Reported on page # |
|------------------------------|--------|--|--------------------|
| Title and abstract | 1 | (a) Indicate the study's design with a commonly used term in the title or the abstract | 1 |
| | | (b) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| Introduction | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 5-6 |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | 6 |
| Methods | | | |
| Study design | 4 | Present key elements of study design early in the paper | 6 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 6, 7 |
| Participants | 6 | (a) Give the eligibility criteria, and the sources and methods of selection of participants | 7 |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 8 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 8, 9 |
| Bias | 9 | Describe any efforts to address potential sources of bias | 9 |
| Study size | 10 | Explain how the study size was arrived at | 9 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 10 |
| Statistical methods | 12 | (a) Describe all statistical methods, including those used to control for confounding | 10 |
| | | (b) Describe any methods used to examine subgroups and interactions | 10 |
| | | (c) Explain how missing data were addressed | |
| | | (d) If applicable, describe analytical methods taking account of sampling strategy | 10 |
| | | (e) Describe any sensitivity analyses | |
| Results | | | |

| | | | |
|--------------------------|-----|---|---------------------|
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram | 10 |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest | 10, 11 12, 18 |
| Outcome data | 15* | Report numbers of outcome events or summary measures | 18 |
| Main results | 16 | (a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | 18-20 18-20 - |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | - |
| Discussion | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 21 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 24 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 21-24 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 25 |
| Other information | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 26 |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Community-based newborn care utilization and associated factors in Geze Gofa rural district, south Ethiopia: a community-based cross-sectional study

| | |
|---------------------------------|---|
| Journal: | <i>BMJ Open</i> |
| Manuscript ID | bmjopen-2020-037792.R1 |
| Article Type: | Original research |
| Date Submitted by the Author: | 01-Jun-2020 |
| Complete List of Authors: | Gebremedhin, Tsegaye; University of Gondar College of Medicine and Health Sciences, Health Systems and policy Atnafu, Asmamaw; University of Gondar College of Medicine and Health Sciences, Health Systems and policy Dellie, Endalkachew; University of Gondar College of Medicine and Health Sciences, Health Systems and policy |
| Primary Subject Heading: | Health services research |
| Secondary Subject Heading: | Obstetrics and gynaecology, Public health |
| Keywords: | Community child health < PAEDIATRICS, PUBLIC HEALTH, OBSTETRICS, HEALTH SERVICES ADMINISTRATION & MANAGEMENT |
| | |

SCHOLARONE™
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1
2
3
4 1 **Community-based newborn care utilization and associated factors in**
5
6
7 2 **Geze Gofa rural district, south Ethiopia: a community-based cross-**
8
9
10 3 **sectional study**

11
12
13 4 **Tsegaye Gebremedhin***, Asmamaw Atnafu, Endalkachew Dellie

14
15
16 5 Department of Health Systems and Policy, Institute of Public Health, College of Medicine and
17
18 6 Health Sciences, University of Gondar, Ethiopia

19
20
21 7 **Email address:**

22
23 8 TG: tsegishg27@gmail.com

24
25 9 AA: asme2002@gmail.com

26
27
28 10 ED: endalkd.07@gmail.com

29
30
31 11 ***Corresponding author:**

32
33
34 12 TG: tsegishg27@gmail.com

35
36
37 13 Po. Box 196, University of Gondar, Gondar, Ethiopia

14 Abstract

15 **Objective:** The community-based newborn care (CBNC) is a newborn care package along the
16 maternal and newborn health continuum of care that has been implemented at the community level
17 in Ethiopia. The utilization which might be affected by several factors has not been well assessed.
18 Thus, this study aimed to examine the utilization of community-based newborn care and associated
19 factors among women who delivered recently in Geze Gofa rural district, south Ethiopia.

20 **Design:** Cross-sectional study

21 **Setting:** Community-based

22 **Participants:** Three-hundred seventy-one women who had their newborns recently were
23 randomly selected. Then, they were interviewed at their places using an interviewer-administered
24 structured questionnaire.

25 **Methods:** A binary logistic regression analysis was done. In the multivariable logistic regression
26 analysis, a p-value of <0.05 and Adjusted Odds Ratio (AOR) with 95% confidence interval (CI)
27 were used to identify factors statistically associated with community-based newborn care
28 utilization.

29 **Outcomes:** Community-based newborn care utilization

30 **Results:** The findings showed that the overall utilization of CBNC by women who delivered
31 recently with their newborns was 37.5% (95% CI: 32.6-42.6). Factors associated with the
32 utilization of CBNC included women who attended elementary school (AOR: 1.76, 95% CI: 1.01-
33 3.07), college and above (AOR: 3.71, 95% CI: 1.12-12.24), farmer women (AOR: 0.35, 95% CI:
34 0.16-0.79), women in the lowest (AOR: 3.76, 95% CI: 1.65-8.54) and middle quantile of wealth

1
2
3 35 status (AOR: 1.96, 95% CI: 1.01-3.76, and those whose preference was visiting hospital they faced
4
5 36 any signs of danger (AOR: 0.29, 95% CI: 0.11-0.78).
6
7

8 37 **Conclusions:** The use of the community-based newborn care program in the study area was
9
10 38 surprisingly low. To increase utilization and potentially improve the outcomes of these neonates,
11
12 39 we need to increase awareness at community levels, make convenient arrangements, and increase
13
14 40 the availability of services at nearby health facilities that are essential to improve the uptake of
15
16 41 CBNC in the rural district.
17
18

19
20 42 **Keywords:** Utilization; community-based newborn care; Geze Gofa district; Ethiopia
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

43 **Article summary**

44 **Strengths and limitations of this study**

- 45 • The finding is expected to give insight to program implementers and policymakers who aim to
46 raise the accessibility and quality of community-based newborn care services in the area.
- 47 • Qualitative methods did not triangulate the study.
- 48 • The study might be subjected to social desirability bias because of the use of an interviewer-
49 administered questionnaire which was in fact minimized through the use of experienced and
50 trained data collectors from other district health facilities.
- 51 • Furthermore, women might experience recall bias, particularly regarding services they
52 received during their previous obstetrics, such as ANC visits.

53 Introduction

54 Neonatal period, from birth to the first 28 days of life, is the most critical phase of life in which
55 the risk for death is the highest and therefore needs more attention and care ^{1 2}.

56 Globally, 2.6 million newborns die in their first 28 days of life every year, and three-fourths of all
57 newborn deaths occur in the first week of life ³. The majority (98%) of the neonatal deaths are
58 from preventable causes, occurring in middle-and low-income countries, including Ethiopia ^{1 4}.
59 Ethiopia was one of the highest contributors in Africa with 187,000 neonatal mortality in 2015 ⁵.
60 According to the Ethiopian Demographic and Health Survey (EDHS) 2016, the neonatal mortality
61 rate in the country was 29 per 1000 live births ⁶.

62 A community-based maternal and newborn care program has been implemented in low-income
63 countries, primarily for the improvement of maternal and newborn health status ⁷⁻¹⁰. Two-thirds of
64 neonatal deaths can be prevented if effective health measures are provided at birth and during the
65 first week of life ¹¹. Similarly, community-based health interventions increase access to areas
66 where facility of care is limited. Therefore, removing key barriers such as distance and transport
67 costs for the poor and promoting the utilization of facility-based services, and in some cases,
68 providing treatment at community levels need to be considered ¹².

69 In Ethiopia, a community-based newborn care (CBNC) program is an initiative that includes a
70 newborn care package along the maternal and newborn health continuum of care ^{13 14}. It is carried
71 out by Health Extension Workers (HEWs) at community levels and aims at improving maternal
72 and newborn health through the four Cs, prenatal and postnatal contact, case-identification of
73 newborns with signs of bacterial infections, care or treatment as early as possible, and the
74 completion of a full seven-day course of appropriate antibiotics at the community level ¹⁵.

1
2
3 75 Newborns in Ethiopia face multitude of barriers in accessing health care. Some of these are related
4
5 76 to culture and fatalism and others to physical access due to distance and limited communication.
6
7 77 Although nearly all the HEWs have been trained to treat severe newborn infections in the
8
9 78 Community-Based Newborn Care (CBNC) program, relatively few sick newborns have been
10
11 79 identified and treated in the country ^{16 17}.

12
13
14
15 80 The utilization of available maternal and child health services is very low in Ethiopia ¹⁸⁻²¹. A
16
17 81 community-based child care household survey in 194 clusters in 46 woredas across four regions
18
19 82 on newborn and child health service utilization showed that only 4.0% of the newborns had a
20
21 83 postnatal check within the recommended first two days of life ²². For this low CBNC program
22
23 84 service utilization, socioeconomic and demographic factors are the most important contributing
24
25 85 variables ^{16 20 22}.

26
27
28
29 86 Despite the increasing availability of key maternal and newborn health services, low utilization
30
31 87 and lack of quality services continue to be a challenge in Ethiopia ²³⁻²⁵. Of the total 72% of women
32
33 88 who delivered at home without skilled assistance, 80% were from rural residents. Besides, only
34
35 89 thirteen percent of the newborns had a postnatal check within the critical first two days after birth,
36
37 90 while 86% did not receive postpartum ⁶. Lack of postnatal health checks can delay the
38
39 91 identification of newborn complications and initiate appropriate care and treatment. Thus, early
40
41 92 postpartum service is critical to ensure proper neonatal care which includes exclusive
42
43 93 breastfeeding, cord and thermal care and the prevention of infections ²⁶.

44
45
46
47
48 94 Moreover, home care visits are not delivered on the standard days (1 and 3) of a newborn's life,
49
50 95 and for the majority of mothers a third visit does not occur before the end of the first week of life
51
52 96 (day 7) in developing countries ²⁷.

1
2
3 97 In Ethiopia, implementing the CBNC program has been taken as one of the core interventions to
4
5 98 reduce child mortality and to attain the Sustainable Development Goals (SDGs) of reducing under-
6
7
8 99 five mortality to less than 25 per 1000 live births and neonatal mortality to 12 or fewer per 1000
9
10 100 live births by 2030 ²⁸ ²⁹. However, studies that show the implementation status of these
11
12 101 interventions are rare. Hence, this study aimed to inform policymakers, program managers, and
13
14 102 care providers about the utilization level of the CBNC program and the extent to which its key
15
16 103 components were implemented as intended in the study area and in similar settings. Therefore, the
17
18 104 objective of this study was to assess the community-based newborn care utilization and associated
19
20 105 factors among women who delivered recently and their newborns in the Geze Gofa district,
21
22 106 southern Ethiopia.

107 **Methods**

108 **Study design and settings**

109 A community-based cross-sectional study was conducted in Geze Gofa district, Gamo Gofa zone,
110 Southern Nation Nationalities and Peoples' Region (SNNPR), Ethiopia, from May 1 to 31, 2017.
111 Geze Gofa district is one of the seventeen districts in Gamo Gofa zone located 535km to the
112 southwest of Addis Ababa, the capital of Ethiopia.

113 Administratively, the district is divided into one urban and 29 rural kebeles with 87,731 people.
114 Of these, 43,690 (49.8%) were male and 44,041 (50.2%) female; 20,441 (23.3%) of the women
115 were in the childbearing age group (15-49 years), and 3036 of the women were pregnant with
116 13,695 under-five children in the district; there also were 3,036 and 2,799 neonates and under one-
117 year infants, respectively.

1
2
3 118 All mothers in the childbearing age group and gave birth in 2016 -2017 were the source population,
4
5 119 whereas all mothers who delivered from September 1, 2016 to February 28, 2017 were the study
6
7
8 120 population.

9
10 121 Mothers who gave birth both at home and in health facilities in the district six months before the
11
12 122 study and live young infants were included. Mothers who delivered in another district and came
13
14
15 123 to the study area, lost their babies before two months of age, critically ill, and unable to respond to
16
17 124 interviews were excluded.

125 **Sample size and sampling techniques**

126 The sample size was determined using the single population proportion formula ($n = \frac{P(1-P)(Z_{\alpha/2})^2}{d^2}$)
127 and assuming a 50% proportion (P) of service utilization of women and newborns, 5% expected
128 margin of error (d), 95% confidence level (CI), and 10% non-response that yielded a sample of
129 403.

130 Initially, nine health posts (30% of the total health posts) were selected using the lottery method
131³⁰. Then, the sample was proportionally allocated to the nine health posts based on the estimated
132 number of mothers who gave birth in the last six months. The final participants were selected using
133 the simple random sampling technique (lottery method) from the delivery registries of the health
134 posts. Then, home visits and interviews were conducted using household numbers.

135 **Variables and measurements**

136 The outcome variable of the study was the utilization of community-based newborn care program.
137 It was measured based on participant service uptake of such components of the program as early
138 identification pregnancy, receiving focused antenatal care (ANC), institutional delivery, postnatal

1
2
3 139 care (PNC) for mother and child within two months of the postpartum period, and identification
4
5 140 and management of sick newborns at community level up to the age of two months ³¹⁻³⁶.
6
7
8 141 Accordingly, if the mothers received all the five components of the program, we considered them
9
10 142 as “utilized” the community-based newborn care program; otherwise as “not utilized”.

11
12
13 143 Antenatal care service utilization was measured according to WHO guidelines for healthy
14
15 144 pregnancies the mother should make at least four visits during the pregnancy the first of which
16
17 145 must be within the first trimester ³⁷. If the pregnancy is unhealthy, the visit might be more than
18
19
20 146 four times as per the healthcare provider's decision.

21
22
23 147 Institutional delivery service was measured when a woman gives birth at a health post, health
24
25 148 center, hospital, or other private health facilities; otherwise, it is considered as home delivery

26
27
28 149 Similarly, postnatal care service was considered as received if the mother and her newborn
29
30 150 received healthcare services and were visited by providers within two months of birth.

31
32
33 151 In this study, a woman who has delivered recently was used to denote a mother aged 15-49 years
34
35 152 and delivered from September 1, 2016 to February 28, 2017.

36
37
38 153 A newborn in our study was taken as a child in its first eight weeks after birth and taken as a target
39
40 154 for community-based newborn care services according to the Ethiopian CBNC program
41
42 155 implementation guidelines ³⁸. Birth weight was assessed by asking the mother and labelling as
43
44
45 156 small (<2.5 kg), average (2.5-4.0 kg) and large (>4.0 kg).

46
47
48 157 The explanatory variables were the age of women (<24, 24-35, >35 years), marital status (single,
49
50 158 married, widowed, divorced), educational status (unable to read and write, able to read and write,
51
52 159 elementary school, high school, college and above), religion (Protestant, Orthodox, Muslim,
53
54
55 160 Catholic), ethnicity (Gofa, Gamo, Wolayita, Others), occupational status (Government employee,

1
2
3 161 merchant, daily labor, farmer, housewife), household wealth status (poorest, poorer, middle, richer,
4
5 162 richest), parity (primipara, multipara), participation in the women health development team
6
7 163 meetings (yes, no), visited by HEWs (yes, no), time it takes to the health post (<30,30-60, 60-120,
8
9 164 >120 minutes), type of health facility visited for danger sign (hospital, health center, health post),
10
11 165 and information about CBNC (yes, no).

12
13
14
15 166 Wealth index was assessed using household assets through principal component analysis adapted
16
17 167 from the EDHS ³⁹ and ranked into five (poorest, poorer, middle, richer, and richest) levels.

18 19 20 168 **Data collection tools and procedures**

21
22
23 169 An interviewer-administered standardized structured questionnaire was used after reviewing
24
25 170 different studies and guidelines ^{27 32 35 36 38 40-47}. The tool was initially developed in English and
26
27 171 translated into the local language (Amharic) and finally back to English to ensure consistency.
28
29 172 Four trained BSc. degree graduate nurses and two public health officers of the same qualification
30
31 173 from the nearby Sawla district were recruited as data collectors and supervisors, respectively. The
32
33 174 supervisors checked data accuracy, consistency and completeness daily.

34 35 36 37 38 175 **Data quality control**

39
40
41 176 Before data collection, a one day training was given to data collectors and supervisors on the
42
43 177 objectives of the study, data collection instruments, techniques and producers. The data collectors
44
45 178 were supervised daily, and the consistency and completeness of data were checked by the principal
46
47 179 investigator every night. A pretest was conducted on 21 women (5% of the sample size) of Demba
48
49 180 Gofa (one of the neighboring districts with similar characteristics). Before the actual data
50
51 181 collection, all findings from the pretest were incorporated into the final questionnaire and
52
53 182 amendments were made.

183 **Data processing and analysis**

184 Data were cleaned and checked for completeness and consistency before they were coded and
185 entered into Epi-Data version 3.1 software and exported to SPSS version 23 for analysis.

186 Descriptive statistics used were presented in narrations and tabular forms. Both bi-variable and
187 multivariable logistic regression analyses was computed to determine the associated factors.
188 Variables with p-values of less than 0.2 in the bivariable logistic regression were candidates for
189 the multivariable analysis after checking model fitness, chi-square, and multi-collinearity
190 assumptions. In the final multivariable logistic regression analysis model, a p-value of less than
191 0.05 and adjusted odds ratio (AOR) with a 95% confidence interval (CI) were used to identify
192 statistically associated factors.

193 **Patient and public involvement**

194 No patients or the public were directly involved in the development of the research questions,
195 outcomes, recruitment and the design of the study. However, the participants and administrative
196 officials were informed about the research questions and objectives. The findings will be
197 disseminated to the Geze Gofa District Health Office and Gamo Gofa Zonal Health Department.
198 Besides, the results will be distributed to potential stakeholders who have been involved in
199 program implementation after being published in a peer-reviewed scientific journal.

200 **Ethical considerations**

201 Ethical clearance was obtained from the ethical review board of Jimma University (Ref. No.
202 IHRPGC/418/2017) and official letter of support was secured from Geze Gofa District Health
203 Office. Informed written consent was obtained from each respondent after a brief explanation of

204 the risk and benefit of the study to ensure their voluntariness to participate before the actual data
 205 collection. Participants had the right to withdraw at any time or to skip for a single question or
 206 segment of questions they did not want to answer or refuse to participate at all with no negative
 207 repercussions, and the interview has stayed averagely for 15 minutes.

208 Results

209 Sociodemographic and economic characteristics of participants

210 Table 1 shows the sociodemographic and economic characteristics of the study participants. A
 211 total of 371 women responded to the interviewer-administered questionnaire with a response rate
 212 of 92.1%. The mean age of the women was 27.6 (SD \pm 5) years; the majority (74.4%) were married
 213 and 6.2% single. Religious preference for 46.4 and 7.5% of the women were Protestant and
 214 Muslim, respectively; 42.3% went to elementary school, while 5.9% attended college or above;
 215 72.5% were housewives and 4.0% government employees; 67.1% were Gofa by ethnicity.
 216 Additionally, the mean parity was 3.5 (SD \pm 1.9), and approximately 30 and 14.6% were in the
 217 middle and richer wealth status, respectively.

218 Table 1 Sociodemographic and economic characteristics of study participants in Geze Gofa
 219 district, south Ethiopia, June 2017 (n=371)

| Variables | Responses | Frequency (n) | Percent (%) |
|----------------|-----------|---------------|-------------|
| Age in years | <24 | 109 | 29.4 |
| | 24-35 | 246 | 66.3 |
| | >35 | 16 | 4.3 |
| Marital status | Single | 23 | 6.2 |
| | Married | 276 | 74.4 |
| | Widowed | 32 | 8.6 |

| Variables | Responses | Frequency (n) | Percent (%) |
|---------------------|-------------------------------|---------------|-------------|
| | Divorced | 40 | 10.8 |
| Religion | Protestant | 172 | 46.4 |
| | Orthodox | 131 | 35.3 |
| | Muslim | 28 | 7.5 |
| | Catholic | 40 | 10.8 |
| Educational status | Unable to read and write | 116 | 31.3 |
| | Able to read and write | 25 | 6.7 |
| | Elementary school (Grade1- 8) | 157 | 42.3 |
| | High school | 51 | 13.7 |
| | College and above | 22 | 5.9 |
| Occupational status | Gov't employee | 15 | 4.0 |
| | Merchant | 31 | 8.4 |
| | Daily labor | 21 | 5.7 |
| | Farmer | 35 | 9.4 |
| | Housewife | 269 | 72.5 |
| Ethnicity | Gofa | 249 | 67.1 |
| | Gamo | 69 | 18.6 |
| | Wolayita | 27 | 7.3 |
| | Others* | 26 | 7.0 |
| Wealth quantiles | Poorest | 65 | 17.5 |
| | Poorer | 63 | 17.0 |
| | Middle | 111 | 29.9 |
| | Richer | 54 | 14.6 |
| | Richest | 78 | 21.0 |

220 Gov't employee: Government employee, * others: Amhara, Guraghe, Kembata

221 **Health extension program services and other related characteristics**

222 All of the respondents knew the health extension workers (HEWs) who worked in their respective
 223 kebeles. The majority (90.7%) of the women received advice from the HEWs during their recent

1
2
3 224 pregnancies and postpartum period. Similarly, 88.4, 74.1, 73.9, 70.4, and 47.4% of the women
4
5 225 received information about the HEP packages, advice on STI, newborn and child diseases as well
6
7
8 226 as supplies and vitamin A, respectively. A total of 340 (91.6%) women said that there was a Health
9
10 227 Development team (in 1 to 5 networks) in their community. Of those, 323 women (95.0%) were
11
12 228 members of the networks, and 217 (67.1%) attended meetings during their recent pregnancies.
13
14
15 229 Moreover, the nearest health post took less than 30, 30-60, 60-120 and more than 120 minutes of
16
17 230 on foot travel for 21.3, 40.7, 29.4, and 8.6% of the participants, respectively.
18
19

20 231 **Obstetric history and maternal health services**

21
22
23 232 As shown in Table 2 below, 98.1% of the women had ANC visits during their recent pregnancies,
24
25 233 and the mean age of the pregnancies during the first ANC visit was 4.6 months (SD \pm 1.3).
26
27 234 Similarly, 80.2 and 4.4% of the women went to health posts and hospitals for their first ANC,
28
29
30 235 respectively.

31
32 236 During their recent ANC visits, physical examinations and routine laboratory investigations were
33
34
35 237 done for 95.6 and 56.6% of the women, respectively. Moreover, 90.7, 80.5, and 6.6% of the women
36
37 238 received tetanus toxoid vaccination, iron folate supplementation, and deworming during ANC
38
39 239 follow ups, respectively. Of those who had ANC follow ups, 285 (78.3%) made ANC visits four
40
41 240 times and above. Regarding knowledge of danger signs during pregnancies, 79.2, 75.5, and 49.6%
42
43
44 241 stated that their danger signs were vaginal bleeding, blurred vision, and convulsion, respectively.
45
46 242 One-fifth of the women faced at least one danger sign, while 75.5 and 10% said that they went to
47
48 243 health centers and hospitals when they have faced any of the danger signs, respectively. Of the
49
50
51 244 total respondents, 233 (62.8%) delivered at health facilities.
52
53
54
55
56
57
58
59
60

245 Table 2: Obstetric characteristics and maternal health services in Geze Gofa district, south
 246 Ethiopia, June 2017 (n= 371)

| Variables | Responses | Frequency | Percent |
|---|-----------------------------|-----------|---------|
| | | (n) | (%) |
| Parity | Primipara | 53 | 16.5 |
| | Multipara | 268 | 83.5 |
| ANC follow up | Yes | 364 | 98.1 |
| | No | 7 | 1.9 |
| Number of ANC visits (n=364) | Once | 14 | 3.9 |
| | Twice | 26 | 7.1 |
| | Three times | 39 | 10.7 |
| | Four and above | 285 | 78.3 |
| Timing of first ANC visit (n=364) | First trimester | 58 | 15.9 |
| | Second trimester | 298 | 81.9 |
| | Third trimester | 8 | 2.2 |
| Type of health facility for the first ANC visit | Hospital | 16 | 4.4 |
| | Health center | 56 | 15.4 |
| | Health post | 292 | 80.2 |
| Knowing about danger sign during pregnancy | Swelling of hands and face | 237 | 63.9 |
| | Blurred vision | 280 | 75.5 |
| | Convulsion | 184 | 49.6 |
| | Severe headache | 248 | 66.8 |
| | Severe lower abdominal pain | 206 | 55.5 |
| | Vaginal bleeding | 294 | 79.2 |
| Place of visits, if they have faced danger signs | Hospital | 37 | 10.0 |
| | Health center | 280 | 75.5 |
| | Health post | 54 | 14.6 |
| Faced danger sign | Yes | 75 | 20.2 |

| Variables | Responses | Frequency | Percent |
|--|-----------------|-----------|---------|
| | | (n) | (%) |
| | No | 289 | 77.8 |
| Place of delivery | Health facility | 233 | 62.8 |
| | Home | 138 | 37.2 |
| Type of health facility attended during delivery (n=233) | Hospital | 34 | 14.6 |
| | Health center | 190 | 81.5 |
| | Health post | 9 | 3.9 |

247 Postpartum and immediate newborn care services

248 The postpartum and immediate newborn care services are presented in Table 3. Of the total
 249 participants, 246 (66.3%) received postnatal care within seven days after birth. Nearly 41% of
 250 them visited in the first 48 hours of delivery; 13 (9.4%) of those who delivered at home were made
 251 to use local material (buffer, dung, and others) to apply on cord. Of the total newborns, 336 (90.6%)
 252 started breastfeeding within an hour of delivery. Moreover, 74.1% of the newborns breastfed
 253 exclusively. Three-fourths of the women received information about breastfeeding for the first
 254 time from HEWs, while 24 (6.5%) obtained from the mass media.

255 Table 3: Postpartum and immediate newborn care services in Geze Gofa district, south Ethiopia,
 256 June 2017 (n= 371)

| Variables | Responses | Frequency | Percent |
|--------------------------------------|---------------------------|-----------|---------|
| | | (n) | (%) |
| Postnatal visit | Yes | 246 | 66.3 |
| | No | 125 | 33.7 |
| Postnatal care visiting time (n=246) | <48 hours | 100 | 40.7 |
| | 3 rd day | 38 | 15.4 |
| | After 3 rd day | 108 | 43.9 |

| | | | |
|---|---|-----|------|
| Timing of breastfeeding initiation | < 1hr | 336 | 90.6 |
| | ≥1hrs | 35 | 9.4 |
| Exclusive breastfeeding | Yes | 275 | 74.1 |
| | No | 96 | 25.9 |
| Source of information about breastfeeding | HEWs | 278 | 74.9 |
| | Healthcare providers from health canter | 49 | 13.2 |
| | Mass media | 24 | 6.5 |
| | Relatives/friends | 10 | 2.7 |
| | Other* | 10 | 2.7 |

*others: health development army leader, community group, traditional birth attendant

258 **Newborn care services during the first two months of age**

259 Table 4 shows newborn care services during the first two months of age; 69.0% of the mothers
 260 had information about community-based newborn care provided by HEWs at community level
 261 health posts. During the first two months after delivery, 224 (60.4%) of the newborns received
 262 postnatal follow ups from HEWs at home. Of the newborns, 41 (18.3%) were checked once, and
 263 87 (38.8%) three and above times. The majority of the newborns, 299 (80.6%), were weighed
 264 within seven days, and 271 (90.6%) and 12 (4.0%) of them had average and large birth weight,
 265 respectively. Out of the total newborns, 56 (15.1%) faced health problems within two months of
 266 the postnatal period, and 34 (60.7%) consulted HEWs and visited health posts to receive medical
 267 services.

268 Table 4: Newborn care services during the first two months of age in Geze Gofa district, south
 269 Ethiopia, June 2017 (n= 371)

| Variables | Responses | Frequency (n) | Percent (%) |
|---|---------------|------------------|----------------|
| Having information about the CBNC program | Yes | 256 | 69.0 |
| | No | 115 | 30.9 |
| Newborn received PNC from HEWs at home within two months of age | Yes | 224 | 60.4 |
| | No | 147 | 39.6 |
| Frequency of follow up received from HEWs (n=224) | Once | 41 | 18.3 |
| | Twice | 96 | 42.9 |
| | ≥ Three times | 87 | 38.8 |
| Baby's weight was measured within the first seven days of birth | Yes | 299 | 80.6 |
| | No | 72 | 19.4 |
| Birth weight of the newborn (n=299) | Small | 271 | 90.6 |
| | Average | 16 | 5.4 |
| | Large | 12 | 4.0 |
| Newborn faced a health problem during the first two months of age | Yes | 56 | 15.1 |
| | No | 315 | 84.9 |
| Types of facility visited for medical services (n=56) | Health post | 34 | 60.7 |
| | Health center | 15 | 26.8 |
| | Hospital | 7 | 12.5 |

270 **Community-based newborn care utilization**

271 A community-based newborn care program utilization was measured when a woman and her
 272 newborn received all the components of the program (antenatal care + institutional delivery +
 273 postnatal care + neonatal care up to two months of age) continually at home and/or health post
 274 level. Accordingly, 37.5% (95% CI: 32.6-42.6) of the women and their newborns utilized the full
 275 community-based newborn care program while the rest did not receive the entire program.

276 **Factors associated with community-based newborn care utilization**

277 In the bivariable logistic regression, age, educational level, occupational status, ethnicity, wealth
 278 status, time taken to reach the nearest health post, types of facility visited during danger signs and
 279 previous information about CBNC were candidate variables. In the multivariable logistic
 280 regression analysis, educational level, occupational status, wealth status, and types of facility
 281 visited when they had danger signs were variables significantly associated as presented in Table
 282 5.

283 Accordingly, women who attended elementary school, college and above were 1.76 (AOR: 1.76,
 284 95% CI: 1.01-3.07) and 3.71 (AOR: 3.71, 95% CI: 1.12-12.24) times more likely to utilize the
 285 program compared to those who were unable to read and write, respectively. Farmer women were
 286 65% less likely to utilize the program compared to housewives (AOR: 0.35, 95% CI: 0.16-0.79).
 287 Women who were in the poorest and middle wealth status were 3.76 (AOR: 3.76, 95% CI: 1.65-
 288 8.54) and 1.96 (AOR: 1.96, 95% CI: 1.03-3.76) times more likely to utilize the program than the
 289 richest women. Moreover, women who preferred visiting the hospital if they had any danger signs
 290 were 70.4% times less likely to utilize the services than those who chose to go to health posts
 291 (AOR: 0.29, 95% CI: 0.11-0.78).

292 Table 5: Bivariable and multivariable logistic regression analysis of factors associated with
 293 community-based newborn care utilization in Geze Gofa district, south Ethiopia, June 2017 (n=
 294 371)

| Variables | CBNC | CNBC | COR (95% CI) | AOR (95% CI) |
|--------------|-----------|--------------|------------------|------------------|
| | utilized | not utilized | | |
| | n (%) | n (%) | | |
| Age in years | | | | |
| ≤24 | 36 (33.0) | 73 (67.0) | 2.03 (0.70-5.84) | 1.41 (0.42-4.76) |
| 25-35 | 95 (38.6) | 151 (61.4) | 1.59 (0.58-4.38) | 1.34 (0.44-4.10) |

| Variables | CBNC | CNBC | COR (95% CI) | AOR (95% CI) |
|--|-----------|--------------|-------------------|---------------------|
| | utilized | not utilized | | |
| | n (%) | n (%) | | |
| >35 | 8 (50.0) | 8 (50.0) | 1 | 1 |
| Educational status | | | | |
| Unable to read & write | 49 (42.2) | 67 (57.8) | 1 | 1 |
| Able to read & write | 12 (48.0) | 13 (52.0) | 0.79 (0.33-1.88) | 0.84 (0.32-2.17) |
| Elementary school | 47 (29.9) | 110 (70.1) | 1.71 (1.04-2.83) | 1.76 (1.01-3.07) * |
| High school | 26 (51.0) | 25 (49.0) | 0.70 (0.36-1.36) | 0.80 (0.36-1.78) |
| College and above | 5 (22.7) | 17 (77.3) | 2.49 (0.86-7.20) | 3.71 (1.12-12.24) * |
| Occupational status | | | | |
| Government employee | 8 (53.3) | 7 (46.7) | 0.43 (0.15-1.21) | 0.41 (0.13-1.29) |
| Merchant | 14 (45.2) | 17 (54.8) | 0.59 (0.28-1.25) | 0.50 (0.22-1.15) |
| Daily labour | 9 (42.9) | 12 (57.1) | 0.65 (0.26-1.60) | 0.40 (0.15-1.08) |
| Farmer | 20 (57.1) | 15 (42.9) | 0.37 (0.18-0.75) | 0.35 (0.16-0.79) * |
| Housewife | 88 (32.7) | 181 (67.3) | 1 | 1 |
| Ethnicity | | | | |
| Gofa | 86 (34.5) | 163 (65.5) | 1 | 1 |
| Gamo | 30 (43.5) | 39 (56.5) | 0.69 (0.40-1.18) | 0.76 (0.42-1.38) |
| Wolayita | 13 (48.1) | 14 (51.9) | 0.57 (0.26-1.26) | 0.47 (0.20-1.11) |
| Others* | 10 (38.5) | 16 (61.5) | 0.84 (0.37-1.94) | 1.27 (0.49-3.25) |
| Wealth status | | | | |
| Poorest | 13 (20.0) | 52 (80.0) | 4.21 (1.98-8.94) | 3.76 (1.65-8.54) * |
| Poorer | 22 (35.0) | 41 (65.0) | 1.96 (0.99-3.88) | 1.92 (0.91-4.06) |
| Middle | 39 (35.1) | 72 (64.9) | 1.943 (1.07-3.51) | 1.96 (1.03-3.76) * |
| Richer | 25 (46.3) | 29 (53.7) | 1.221 (0.61-2.45) | 1.26 (0.57-2.80) |
| Richest | 40 (51.3) | 38 (48.7) | 1 | 1 |
| Time takes to reach the nearest health posts (in minutes) | | | | |
| < 30 | 28 (35.4) | 51 (64.6) | 0.51 (0.20-1.33) | 1 |
| 30-60 | 59 (39.0) | 92 (61.0) | 0.44 (0.18-1.07) | 0.83 (0.45-1.55) |
| 60-120 | 45 (41.3) | 64 (58.7) | 0.39 (0.16-1.00) | 0.70 (0.36-1.37) |

| Variables | CBNC | CNBC | COR (95% CI) | AOR (95% CI) |
|--|------------|--------------|------------------|--------------------|
| | utilized | not utilized | | |
| | n (%) | n (%) | | |
| > 120 | 7 (21.9) | 25 (78.1) | | 1.72 (0.61-4.85) |
| Place of visit (if they have faced danger signs) | | | | |
| Hospital | 20 (54.0) | 17 (46.0) | 0.29 (0.12-0.72) | 0.29 (0.11-0.78) * |
| Health center | 105 (37.5) | 175 (62.5) | 0.58 (0.30-1.12) | 0.58 (0.29-1.18) |
| Health post | 14 (25.9) | 40 (74.1) | 1 | 1 |
| Information about CBNC program | | | | |
| Yes | 90 (35.2) | 166 (64.8) | 1 | 1 |
| No | 49 (42.6) | 66 (57.4) | 0.73 (0.47-1.15) | 0.73 (0.43-1.21) |

295 Others*: Amhara, Guraghe, and Kembata, *statistically significant at p-value <0.05

296 Discussion

297 Overall, 37.5% of the women who delivered recently and their newborns received the full
 298 components of the community-based newborn care program. This finding is higher than that of a
 299 study conducted at Xaybouathong district, Lao PDR. In this study, only 6.8% the women received
 300 all the modified composite coverage index components of maternal and child health services
 301 (ANC 4 or more, neonatal tetanus protection, facility-based delivery, delivery assisted by skilled
 302 birth attendant (SBA), PNC for mother and newborn, BCG, Penta, Polio, and family planning)³¹.
 303 A study in Ghana showed that from pregnancy to post-delivery, 7.9% of women and children
 304 received the continuum of care³², while another study in Ghana indicated that only 8.0% of the
 305 women completed the continuum of maternal and newborn care services³⁶. Our finding is higher
 306 than that of a study conducted in Pakistan and showed that the continuum of maternal care was
 307 27.4%³⁴. The possible justification for the discrepancy could be the inclusion of the continuum
 308 of care as measured by ANC, institutional delivery, immediate postnatal care, and newborn care

1
2
3 309 services up to two months of age, whereas in others studies the continuum of care included a child
4
5 310 health services until the age of one year. The other possible explanation might be the use of a
6
7
8 311 longer study period retrospectively to assess the utilization that included five years before the
9
10 312 survey, which might increased their recall bias about the services they received for the last five
11
12 313 years and the sociodemographic variations of study areas. Moreover, stronger and more resilient
13
14 314 health systems which focus on community-based service provisions like the health extension
15
16 315 program in Ethiopia may explain some of the discordance in the findings of the current and other
17
18 316 studies ⁴⁸⁻⁵⁰. Results however were lower than that of a study done at Sohag Governorate, Egypt,
19
20 317 and showed that 50.4% of the women achieved the continuum of care as measured by ANC+4
21
22 318 visits, delivery by a skilled birth attendant and PNC ³³. In addition, a study conducted in Cambodia
23
24 319 showed that 60% of women had the full range of services for the continuum of maternal and
25
26 320 newborn healthcare ⁵¹. This discrepancy might be due to the use of only maternal continuum of
27
28 321 care which did not include newborn care that could give a higher result. The other possible reason
29
30
31 322 might be differences in study areas. A study conducted in Cambodia used a national survey which
32
33 323 might have resulted in a higher findings and socio-cultural variations.

34
35
36
37
38 324 Our study showed that 98.1% of the women received ANC services once, 76.8% four times and
39
40 325 above; 62.8% of women delivered at a health facility, and the health status of 60.3% of newborns
41
42 326 was checked by HEWs until two months of age. Our finding is higher than that of a study
43
44 327 conducted in Ratanakiri province, Cambodia, in which only 32.6% of the women made four and
45
46 328 above visits in the continuum of maternal, newborn, and child health services ⁵². The possible
47
48 329 explanation might be the difference in the target group, which included women who gave birth
49
50 330 two years before the study which might have resulted in forgetting the services they took. The
51
52 331 other possible reason might be the difference in the service delivery pace for ANC follow ups. Our
53
54
55

1
2
3 332 study included services taken at the health post level, while their study measured ANC service
4
5 333 follow ups at health centers and hospitals only. Our findings is lower than that of a study conducted
6
7 334 in Sohag Governorate, Egypt, which showed that 90% of the women had four and above antenatal
8
9 335 care visits ³³. The explanation for our low result might be the sociodemographic variation in that
10
11 336 we assessed the utilization for rural dwellers only. Moreover, the presence of better maternal and
12
13 337 child health services achievement in Egypt might be the possible explanation for this higher
14
15 338 findings ⁵³.

16
17
18
19 339 Our study showed that women who attended elementary school, college and above had 1.7 and 3.7
20
21 340 times more chance of getting CBNC service utilization compared to mothers who were unable to
22
23 341 read and write, respectively. This finding was comparable with that of a study done in
24
25 342 Xaybouathong district, Lao PDR, and showed women's education was positively associated with
26
27 343 the continuum of maternal, newborn and child health service utilization ³¹. These findings might
28
29 344 be explained by the fact a woman's education increases her knowledge and awareness about the
30
31 345 importance of the services and the chance of getting information.

32
33
34
35 346 In this study, CBNC utilization was lower by 65% among farmer women compared to housewives.
36
37 347 This result is supported by a study done in the Xaybouathong district, Lao PDR, which shows
38
39 348 farming as an occupation is negatively associated with the continuum of maternal, newborn, and
40
41 349 child health service utilization ³¹. This result might be explained by the inconvenience of the time
42
43 350 of service delivery for farmer women since services are provided at the community level.

44
45
46
47 351 Women who are in the poorest and middle wealth quantile were 3.76 and 1.96 times more likely
48
49 352 to utilize the community-based newborn care program compared to those who were in the richest.
50
51 353 This finding is different from those studies in Sohag Governorate, Egypt, that shows women in
52
53
54
55

1
2
3 354 the higher economic status utilized 1.6 times more of the continuum of maternal, newborn, and
4
5 355 child health services compared to those in the lower economic status³³. A study in Ghana showed
6
7 356 that women and children in the richest households were more likely to utilize the continuum of
8
9
10 357 care³². Another study in Africa showed that there was a three-fold disparity in the use of the
11
12 358 continuum of care between the wealthiest 20% of African women compared to the poorest⁵⁴. In
13
14 359 Pakistan, a study showed that the richest women were seven times more likely to utilize the
15
16 360 continuum of care than the poorest³⁴. This disagreement might be explained by the fact that the
17
18 361 program in our study area aimed to serve the poorest households at health post and household
19
20 362 levels to increase service access. The other possible explanation might be that wealthier families
21
22 363 can afford the direct and indirect costs of services of health centers or hospitals and seek more
23
24 364 quality care at higher facilities by well-trained providers. Additionally, the program in our case is
25
26 365 a free service that does not incur any cost on those who cannot seek other services at advanced or
27
28 366 higher facilities.

29
30
31
32
33 367 In this study, women who preferred to visit hospitals when they faced danger signs had a 70.4%
34
35 368 lower chance of utilization of the community-based newborn care services compared to those who
36
37 369 preferred health posts. According to the Ethiopian health tier system, health posts are more
38
39 370 accessible than hospitals; so, those who want to visit hospitals might not get the services as easily
40
41 371 as they need⁵⁵. This result is in line with that of a study in Pakistan and showed that the absence
42
43 372 of problems relating to distance and travel arrangements to access health facilities increases the
44
45 373 utilization of the continuum of maternal, newborn, and child healthcare services by 76.1% and
46
47 374 72.9%, respectively³⁴. The other possible explanation might be that the effectiveness of
48
49 375 community health workers in delivering preventive maternal and child health interventions in low-

1
2
3 376 and-middle income countries ⁵⁶ increases community-based service acceptability in rural
4
5 377 communities.

8 378 **Limitations of the study**

10
11 379 The finding was not triangulated by qualitative methods which are also subject to social
12
13 380 desirability bias owing to our use of an interviewer-administered questionnaire. To minimize the
14
15 381 impact, data collectors were recruited from other districts. Moreover, the women might have
16
17 382 experienced recall bias, particularly regarding the services they received during their previous
18
19 383 obstetrics, ANC visits, for instance. Compared to other studies however our work assessed later
20
21 384 events that preceded the study by only six months. On top of that, the data collectors were highly
22
23 385 experienced and well-trained on the tools to explain the questions and extend the time for
24
25 386 respondents so they recall events later.

30 387 **Conclusion and implications**

32
33
34 388 The study showed that community-based newborn care utilization in the study area was low
35
36 389 compared to the current national recommendations. Elementary school, college and above
37
38 390 education as well as the poorest and middle wealth status affected the utilization positively,
39
40 391 whereas farming occupation and preference of hospitals in case of danger signs affected the
41
42 392 utilization negatively. Therefore, awareness creation at community levels for illiterate women,
43
44 393 arranging convenient time for farmer women and providing full components of maternal and
45
46 394 newborn services in nearby community level health facilities could improve the utilization of
47
48 395 community-based newborn care program in rural districts. Furthermore, subsequent studies must
49
50 396 explore the barriers for low utilization of community-based newborn care services using
51
52
53
54
55
56
57
58
59
60

1
2
3 397 qualitative methods and also better if studies assessed the effectiveness of the program on maternal
4
5 398 and child health outcomes.
6
7

8 399 **Acknowledgment:** The authors would like to thank all respondents for their willingness to
9
10 400 participated in the study. We are also grateful to the Geze Gofa district health office. Finally, our
11
12 401 appreciation goes to the data collectors for their unreserved contribution in data collection
13
14 402 activities.
15
16

17
18 403 **Author Contributions:** TG conceptualized the study. AA and ED developed the methods and
19
20 404 materials. TG, AA, and ED undertook the data analysis, interpretation, and drafting of the paper.
21
22 405 All authors invest significant contributions and approved the final draft.
23
24

25 406 **Funding statement:** This research received no specific grant from any funding agency in public,
26
27 407 commercial, or not-for-profit sectors.
28
29

30 408 **Competing interests:** The authors declare that they have no conflict of interest.
31
32

33 409 **Patient consent:** obtained
34
35

36
37 410 **Ethical approval:** Ethical approval was obtained from the ethical review board of Jimma
38
39 411 University (Ref. No. IHRPGC/418/2017). The official letter of co-operation was obtained from
40
41 412 the Geze Gofa district health office.
42
43

44 413 **Data sharing statement:** all the relevant data are provided in the manuscript. Data can be provided
45
46 414 by the contact of the corresponding author on a reasonable request.
47
48
49
50
51
52
53
54
55

416 References

- 417 1. World Health Organization. Global, regional and national neonatal health status. Fact sheet,
418 2016.
- 419 2. Kliegman RM, Staton B, Gene J. Nelson Textbook of Pediatrics 20th. *Neurology part p*
420 2015:2863-74.
- 421 3. Organization WH. Global health observatory (GHO) data: Neonatal mortality. *World Health*
422 *Organization Retrieved from: www.who.int/gho/child_health/mortality/neonatal/en* 2016
- 423 4. Organization WH. Newborns: reducing mortality [https://www.who.int/news-room/fact-](https://www.who.int/news-room/fact-sheets/detail/newborns-reducing-mortality)
424 [sheets/detail/newborns-reducing-mortality](https://www.who.int/news-room/fact-sheets/detail/newborns-reducing-mortality) 2018.
- 425 5. UNICEF. Committing to Child Survival: A promise renewed—progress report 2015. Retrieved
426 August 8, 2017, 2017.
- 427 6. Central Statistical Agency Addis Ababa E. Ethiopia Demographic and Health Survey 2016
428 Addis Ababa, Ethiopia 2016
- 429 7. Perry HB, Zulliger R, Rogers MM. Community health workers in low-, middle-, and high-
430 income countries: an overview of their history, recent evolution, and current effectiveness.
431 *Annual review of public health* 2014;35:399-421.
- 432 8. Reducing intrapartum-related neonatal deaths in low-and middle-income countries—what
433 works? *Seminars in perinatology*; 2010. Elsevier.
- 434 9. Nair N, Tripathy P, Prost A, et al. Improving newborn survival in low-income countries:
435 community-based approaches and lessons from South Asia. *PLoS medicine*
436 2010;7(4):e1000246.
- 437 10. Maulik P, Darmstadt G. Community-based interventions to optimize early childhood
438 development in low resource settings. *Journal of Perinatology* 2009;29(8):531.
- 439 11. World Health Organization Regional Office for Africa. Newborn Health key facts. 2017.
440 <https://www.afro.who.int/health-topics/newborn>.
- 441 12. Callaghan-Koru JA, Nonyane BA, Guenther T, et al. Contribution of community-based
442 newborn health promotion to reducing inequities in healthy newborn care practices and
443 knowledge in Malawi. 2013
- 444 13. Mathewos B, Owen H, Sitrin D, et al. Community-Based Interventions for Newborns in
445 Ethiopia (COMBINE): Cost-effectiveness analysis. *Health Policy Plan*

- 1
2
3 446 2017;32(suppl_1):i21-i32. doi: 10.1093/heapol/czx054 [published Online First:
4 447 2017/10/06]
5
6
7 448 14. Berhanu D, Avan B. Community Based Newborn Care in Ethiopia: Quality of CBNC
8 449 programme assessment Midline Evaluation Report March 2017. 2017
9
10 450 15. Banteyerga H. Ethiopia's health extension program: improving health through community
11 451 involvement. *MEDICC review* 2014;13(3):46-49.
12
13 452 16. Mathewos B, Owen H, Sitrin D, et al. Community-based interventions for newborns in
14 453 Ethiopia (COMBINE): cost-effectiveness analysis. *Health policy and planning*
15 454 2017;32(suppl_1):i21-i32.
16
17 455 17. Degefe Hailegebriel T, Mulligan B, Cousens S, et al. Effect on Neonatal Mortality of Newborn
18 456 Infection Management at Health Posts When Referral Is Not Possible: A Cluster-
19 457 Randomized Trial in Rural Ethiopia. *Global health, science and practice* 2017;5(2):202-
20 458 16. doi: 10.9745/ghsp-d-16-00312 [published Online First: 2017/06/15]
21
22 459 18. Alamneh Y, Adane F, Yirga T, et al. Essential newborn care utilization and associated factors
23 460 in Ethiopia: a systematic review and meta-analysis. *BMC Pregnancy and Childbirth*
24 461 2020;20(1):1-9.
25
26 462 19. Mathewos B, Musema Y, Bekele A, et al. Community-based Newborn Care in Ethiopia:
27 463 Implementation Strength and Lessons Learned. *Ethiopian Medical Journal* 2019(3)
28
29 464 20. Gebremariam A, Mohammed H, Hailemichael A, et al. Community-Based Newborn Care in
30 465 Afar: Lessons Learned. *Ethiopian Medical Journal* 2019(3)
31
32 466 21. Ameha A, Legesse H, Sylla M, et al. The Effect of Community-Based Newborn Care
33 467 Intervention on Service Utilization for Sick Newborn and Children. *Ethiopian Medical*
34 468 *Journal* 2019(3)
35
36 469 22. Okwaraji YB, Berhanu D, Persson LA. Community-based child care: household and health-
37 470 facility perspectives. Dagu Baseline Survey, Ethiopia, December 2016-February 2017.
38 471 *Community-based child care: household and health facility perspectives* 2017
39
40 472 23. Zimmerman LA, Shiferaw S, Seme A, et al. Evaluating consistency of recall of maternal and
41 473 newborn care complications and intervention coverage using PMA panel data in SNNPR,
42 474 Ethiopia. *PloS one* 2019;14(5)
43
44 475 24. Canavan ME, Brault MA, Tatek D, et al. Maternal and neonatal services in Ethiopia: measuring
45 476 and improving quality. *Bulletin of the World Health Organization* 2017;95(6):473.

- 1
2
3 477 25. Bobo FT, Yesuf EA, Woldie M. Inequities in utilization of reproductive and maternal health
4 478 services in Ethiopia. *International journal for equity in health* 2017;16(1):105.
5
6 479 26. Callaghan-Koru JA, Abiy Seifu MT, Graft-Johnson Jd, et al. Newborn care practices at home
7 480 and in health facilities in 4 regions of Ethiopia. 2013
8
9 481 27. Zulfiqar A. Bhutta GLD, Babar S. Hasan and Rachel A. Haws. Community-Based
10 482 Interventions for Improving Perinatal and Neonatal Health Outcomes in Developing
11 483 Countries: A Review of the Evidence. 2005 doi: 10.1542/peds.2004-1441
12
13 484 28. Taylor ME. Community Based Newborn Care in Ethiopia: Introduction to the Special Issue.
14 485 *Ethiopian Medical Journal* 2019(3)
15
16 486 29. Semu Y, Tekle E, Bekele A, et al. Making Community Based Newborn Care Sustainable in
17 487 Ethiopia. *Ethiopian Medical Journal* 2019(3)
18
19 488 30. Sambo LG, Chatora RR, Goosen E. Tools for assessing the operationality of district health
20 489 systems. *Brazzaville: World Health Organization, Regional Office for Africa* 2003
21
22 490 31. Sakuma S, Yasuoka J, Phongluxa K, et al. Determinants of continuum of care for maternal,
23 491 newborn, and child health services in rural Khammouane, Lao PDR. *PloS one*
24 492 2019;14(4):e0215635.
25
26 493 32. Shibanuma A, Yeji F, Okawa S, et al. The coverage of continuum of care in maternal, newborn
27 494 and child health: a cross-sectional study of woman-child pairs in Ghana. *BMJ Global*
28 495 *Health* 2018;3(4):e000786. doi: 10.1136/bmjgh-2018-000786
29
30 496 33. Hamed AF, Roshdy E, Sabry M. Egyptian status of continuum of care for maternal, newborn,
31 497 and child health: Sohag Governorate as an example. *International Journal of Medical*
32 498 *Science and Public Health* 2018;7(6):417-27.
33
34 499 34. Iqbal S, Maqsood S, Zakar R, et al. Continuum of care in maternal, newborn and child health
35 500 in Pakistan: analysis of trends and determinants from 2006 to 2012. *BMC Health Services*
36 501 *Research* 2017;17(1):189. doi: 10.1186/s12913-017-2111-9
37
38 502 35. Engmann CM, Hodgson A, Aborigo R, et al. Addressing the continuum of maternal and
39 503 newborn care in Ghana: implications for policy and practice. *Health Policy and Planning*
40 504 2016;31(10):1355-63. doi: 10.1093/heapol/czw072
41
42 505 36. Yeji F, Shibanuma A, Oduro A, et al. Continuum of care in a maternal, newborn and child
43 506 health program in Ghana: Low completion rate and multiple obstacle factors. *PloS one*
44 507 2015;10(12):e0142849.

- 1
2
3 508 37. World Health Organization. WHO recommendations on antenatal care for a positive pregnancy
4 experience: World Health Organization 2016.
5 509
6
7 510 38. Federal Ministry of Health E. Community Based Newborn Care Implementation Guideline
8 511 2013.
9
10 512 39. [Ethiopia] CSAC. Ethiopia Mini Demographic and Health Survey 2014. Addis Ababa,
11 Ethiopia. 2014
12 513
13 514 40. Federal Ministry of Health E. Maternal, newborn, child and adolescent health guideline 2012
14
15 515 41. Tuladhar S. The Determinants of Good Newborn Care Practices in the Rural Areas of Nepal.
16 2010
17 516
18
19 517 42. Owili PO, Muga MA, Chou Y-J, et al. Associations in the continuum of care for maternal,
20 newborn and child health: a population-based study of 12 sub-Saharan Africa countries.
21 518 *BMC public health* 2016;16(1):414.
22 519
23
24 520 43. Quayyum Z, Khan MNU, Quayyum T, et al. “Can community level interventions have an
25 impact on equity and utilization of maternal health care”–Evidence from rural Bangladesh.
26 521 *International journal for equity in health* 2013;12(1):22.
27 522
28
29 523 44. Veirum JE, Biai S, Jakobsen M, et al. Persisting high hospital and community childhood
30 mortality in an urban setting in Guinea-Bissau. *Acta paediatrica (Oslo, Norway : 1992)*
31 524 2007;96(10):1526-30. doi: 10.1111/j.1651-2227.2007.00467.x [published Online First:
32 525 2007/09/14]
33
34 526
35
36 527 45. Kerber KJ, de Graft-Johnson JE, Bhutta ZA, et al. Continuum of care for maternal, newborn,
37 and child health: from slogan to service delivery. *The Lancet* 2007;370(9595):1358-69.
38 528 doi: 10.1016/s0140-6736(07)61578-5
39 529
40
41 530 46. Sule SS, Onayade AA. Community-based antenatal and perinatal interventions and newborn
42 survival. *Nigerian journal of medicine : journal of the National Association of Resident*
43 531 *Doctors of Nigeria* 2006;15(2):108-14. [published Online First: 2006/06/30]
44 532
45
46 533 47. Telfair J. An evaluation of state perinatal community-based programs in Alabama: overview.
47 *Public health reports (Washington, DC : 1974)* 2003;118(5):484-6. doi:
48 534 10.1093/phr/118.5.484 [published Online First: 2003/08/28]
49 535
50
51 536 48. Fetene N, Linnander E, Fekadu B, et al. The Ethiopian health extension program and variation
52 in health systems performance: what matters? *PloS one* 2016;11(5)
53 537
54
55
56
57
58
59
60

- 1
2
3 538 49. Admasu K-B. Designing a resilient National health system in Ethiopia: the role of leadership.
4
5 539 *Health Systems & Reform* 2016;2(3):182-86.
6
7 540 50. Afework MF, Admassu K, Mekonnen A, et al. Effect of an innovative community based health
8
9 541 program on maternal health service utilization in north and south central Ethiopia: a
10
11 542 community based cross sectional study. *Reproductive health* 2014;11(1):28.
12
13 543 51. Wang W. Levels and determinants of continuum of care for maternal and newborn health in
14
15 544 Cambodia-evidence from a population-based survey. *BMC Pregnancy and Childbirth*
16
17 545 2015;15 doi: 10.1186/s12884-015-0497-0
18
19 546 52. Yasuoka J, Nanishi K, Kikuchi K, et al. Barriers for pregnant women living in rural,
20
21 547 agricultural villages to accessing antenatal care in Cambodia: A community-based cross-
22
23 548 sectional study combined with a geographic information system. *PLoS One*
24
25 549 2018;13(3):e0194103. doi: 10.1371/journal.pone.0194103 [published Online First:
26
27 550 2018/03/20]
28
29 551 53. Benova L, Campbell OM, Sholkamy H, et al. Socio-economic factors associated with maternal
30
31 552 health-seeking behaviours among women from poor households in rural Egypt.
32
33 553 *International journal for equity in health* 2014;13(1):111.
34
35 554 54. de Graft-Johnson J, Kerber K, Tinker A, et al. The maternal, newborn and child health
36
37 555 continuum of care. *Opportunities for Africa's newborns* 2006:23-36.
38
39 556 55. Federal Ministry of Health E. The Ethiopian health tire system, 2010.
40
41 557 <https://ethiopiahealth.blogs.wm.edu/ethiopian-health-system>.
42
43 558 56. Gilmore B, McAuliffe E. Effectiveness of community health workers delivering preventive
44
45 559 interventions for maternal and child health in low-and middle-income countries: a
46
47 560 systematic review. *BMC public health* 2013;13(1):847.
48
49
50
51
52
53
54
55
56
57
58
59
60

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

| Section/Topic | Item # | Recommendation | Reported on page # |
|------------------------------|--------|--|--------------------|
| Title and abstract | 1 | (a) Indicate the study's design with a commonly used term in the title or the abstract | 1 |
| | | (b) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| Introduction | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 5-7 |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | 7 |
| Methods | | | |
| Study design | 4 | Present key elements of study design early in the paper | 7 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 7-8 |
| Participants | 6 | (a) Give the eligibility criteria, and the sources and methods of selection of participants | 8 |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 8-10 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 9-10 |
| Bias | 9 | Describe any efforts to address potential sources of bias | 10 |
| Study size | 10 | Explain how the study size was arrived at | 8 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 11 |
| Statistical methods | 12 | (a) Describe all statistical methods, including those used to control for confounding | 11 |
| | | (b) Describe any methods used to examine subgroups and interactions | 11 |
| | | (c) Explain how missing data were addressed | |
| | | (d) If applicable, describe analytical methods taking account of sampling strategy | 11 |
| | | (e) Describe any sensitivity analyses | |
| Results | | | |

| | | | |
|--------------------------|-----|---|---------------------|
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram | 12 |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest | 12-13 13-18 |
| Outcome data | 15* | Report numbers of outcome events or summary measures | 18 |
| Main results | 16 | (a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | 18-21 18-21 - |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | - |
| Discussion | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 21 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 25 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 21-25 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 25 |
| Other information | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 26 |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Community-based newborn care utilization and associated factors in Geze Gofa rural district, south Ethiopia: a community-based cross-sectional study

| | |
|---------------------------------|---|
| Journal: | <i>BMJ Open</i> |
| Manuscript ID | bmjopen-2020-037792.R2 |
| Article Type: | Original research |
| Date Submitted by the Author: | 27-Jul-2020 |
| Complete List of Authors: | Gebremedhin, Tsegaye; University of Gondar College of Medicine and Health Sciences, Health Systems and policy Atnafu, Asmamaw; University of Gondar College of Medicine and Health Sciences, Health Systems and policy Dellie, Endalkachew; University of Gondar College of Medicine and Health Sciences, Health Systems and policy |
| Primary Subject Heading: | Health services research |
| Secondary Subject Heading: | Obstetrics and gynaecology, Public health |
| Keywords: | Community child health < PAEDIATRICS, PUBLIC HEALTH, OBSTETRICS, HEALTH SERVICES ADMINISTRATION & MANAGEMENT |
| | |

SCHOLARONE™
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1
2
3
4 1 **Community-based newborn care utilization and associated factors in**
5
6
7 2 **Geze Gofa rural district, south Ethiopia: a community-based cross-**
8
9
10 3 **sectional study**

11
12
13 4 **Tsegaye Gebremedhin***, Asmamaw Atnafu, Endalkachew Dellie

14
15
16 5 Department of Health Systems and Policy, Institute of Public Health, College of Medicine and
17
18 6 Health Sciences, University of Gondar, Gondar, Ethiopia

19
20
21 7 **Email address:**

22
23 8 TG: tsegishg27@gmail.com

24
25 9 AA: asme2002@gmail.com

26
27
28 10 ED: endalkd.07@gmail.com

29
30
31 11 ***Corresponding author:**

32
33
34 12 TG: tsegishg27@gmail.com

35
36
37 13 Po. Box 196, University of Gondar, Gondar, Ethiopia

14 ABSTRACT

15 **Objective** The community-based newborn care (CBNC) is a newborn care package along the
16 maternal and newborn health continuum of care that has been implemented at the community level
17 in Ethiopia. The utilization which might be affected by several factors has not been well assessed.
18 Thus, this study aimed to examine the utilization of community-based newborn care and associated
19 factors among women who delivered recently in Geze Gofa rural district, south Ethiopia.

20 **Design** Cross-sectional study

21 **Setting** Community-based

22 **Participants** Three-hundred seventy-one women who had their newborns recently were randomly
23 selected. Then, they were interviewed at their places using an interviewer-administered structured
24 questionnaire.

25 **Methods** A binary logistic regression analysis was done. In the multivariable logistic regression
26 analysis, a p-value of <0.05 and Adjusted Odds Ratio (AOR) with 95% confidence interval (CI)
27 were used to identify factors statistically associated with community-based newborn care
28 utilization.

29 **Outcomes** Community-based newborn care utilization

30 **Results** The findings showed that the overall utilization of CBNC by women who delivered
31 recently with their newborns was 37.5% (95% CI: 32.6-42.6). Factors associated with the
32 utilization of CBNC included women who attended elementary school (AOR: 1.76, 95% CI: 1.01-
33 3.07), college and above (AOR: 3.71, 95% CI: 1.12-12.24), farmer women (AOR: 0.35, 95% CI:
34 0.16-0.79), women in the lowest (AOR: 3.76, 95% CI: 1.65-8.54) and middle quantile of wealth

1
2
3 35 status (AOR: 1.96, 95% CI: 1.01-3.76, and those whose preference was visiting hospital they faced
4
5 36 any signs of danger (AOR: 0.29, 95% CI: 0.11-0.78).
6
7

8 37 **Conclusions** The use of the community-based newborn care program in the study area was
9
10 38 surprisingly low. To increase utilization and potentially improve the outcomes of these neonates,
11
12 39 we need to increase awareness at community levels, make convenient arrangements, and increase
13
14 40 the availability of services at nearby health facilities that are essential to improve the uptake of
15
16 41 CBNC in the rural district.
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 **42 Article summary**
4
5

6 **43 Strengths and limitations of this study**
7

- 8
9 44 • The finding is expected to give insight to program implementers and policymakers who aim to
10
11 45 raise the accessibility and quality of community-based newborn care services in the area.
12
13 46 • Qualitative methods did not triangulate the study.
14
15
16 47 • The study might be subjected to social desirability bias because of the use of an interviewer-
17
18 48 administered questionnaire which was in fact minimized through the use of experienced and
19
20 49 trained data collectors from other district health facilities.
21
22
23 50 • Furthermore, women might experience recall bias, particularly regarding services they
24
25 51 received during their previous obstetrics, such as ANC visits.
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51

52 INTRODUCTION

53 Neonatal period, from birth to the first 28 days of life, is the most critical phase of life in which
54 the risk for death is the highest and therefore needs more attention and care.^{1 2}

55 Globally, 2.6 million newborns die in their first 28 days of life every year, and three-fourths of all
56 newborn deaths occur in the first week of life.³ The majority (98%) of the neonatal deaths are from
57 preventable causes, occurring in middle-and low-income countries, including Ethiopia.^{1 4} Ethiopia
58 was one of the highest contributors in Africa, with 187,000 neonatal mortality in 2015.⁵ According
59 to the Ethiopian Demographic and Health Survey (EDHS) 2016, the neonatal mortality rate in the
60 country was 29 per 1000 live births.⁶

61 A community-based maternal and newborn care program has been implemented in low-income
62 countries, primarily for the improvement of maternal and newborn health status.⁷⁻¹⁰ Two-thirds of
63 neonatal deaths can be prevented if effective health measures are provided at birth and during the
64 first week of life.¹¹ Similarly, community-based health interventions increase access to areas where
65 facility of care is limited. Therefore, removing key barriers such as distance and transport costs for
66 the poor and promoting the utilization of facility-based services, and in some cases, providing
67 treatment at community levels need to be considered.¹²

68 In Ethiopia, a community-based newborn care (CBNC) program is an initiative that includes a
69 newborn care package along the maternal and newborn health continuum of care.^{13 14} It is carried
70 out by Health Extension Workers (HEWs) at community levels and aims at improving maternal
71 and newborn health through the four Cs, prenatal and postnatal contact, case-identification of
72 newborns with signs of bacterial infections, care or treatment as early as possible, and the
73 completion of a full seven-day course of appropriate antibiotics at the community level.¹⁵

1
2
3 74 Newborns in Ethiopia face multitude of barriers in accessing health care. Some of these are related
4
5 75 to culture and fatalism and others to physical access due to distance and limited communication.
6
7
8 76 Although nearly all the HEWs have been trained to treat severe newborn infections in the
9
10 77 Community-Based Newborn Care (CBNC) program, relatively few sick newborns have been
11
12 78 identified and treated in the country.^{13 16}

13
14
15 79 The utilization of available maternal and child health services is very low in Ethiopia.¹⁷⁻²⁰ A
16
17 80 community-based child care household survey in 194 clusters in 46 woredas across four regions
18
19 81 on newborn and child health service utilization showed that only 4.0% of the newborns had a
20
21 82 postnatal check within the recommended first two days of life.²¹ For this low CBNC program
22
23 83 service utilization, socioeconomic and demographic factors are the most important contributing
24
25 84 variables.^{13 19 21}

26
27
28
29 85 Despite the increasing availability of key maternal and newborn health services, low utilization
30
31 86 and lack of quality services continue to be a challenge in Ethiopia.²²⁻²⁴ Of the total 72% of women
32
33 87 who delivered at home without skilled assistance, 80% were from rural residents. Besides, only
34
35 88 thirteen percent of the newborns had a postnatal check within the critical first two days after birth,
36
37 89 while 86% did not receive postpartum.⁶ Lack of postnatal health checks can delay the identification
38
39 90 of newborn complications and initiate appropriate care and treatment. Thus, early postpartum
40
41 91 service is critical to ensure proper neonatal care which includes exclusive breastfeeding, cord and
42
43 92 thermal care and the prevention of infections.²⁵

44
45
46
47
48 93 Moreover, home care visits are not delivered on the standard days (1 and 3) of a newborn's life,
49
50 94 and for the majority of mothers, a third visit does not occur before the end of the first week of life
51
52 95 (day 7) in developing countries.²⁶

1
2
3 96 In Ethiopia, implementing the CBNC program has been taken as one of the core interventions to
4
5 97 reduce child mortality and to attain the Sustainable Development Goals (SDGs) of reducing under-
6
7 98 five mortality to less than 25 per 1000 live births and neonatal mortality to 12 or fewer per 1000
8
9
10 99 live births by 2030.^{27 28} However, studies that show the implementation status of these
11
12 100 interventions are rare. Hence, this study aimed to inform policymakers, program managers, and
13
14 101 care providers about the utilization level of the CBNC program and the extent to which its key
15
16 102 components were implemented as intended in the study area and in similar settings. Therefore, the
17
18 103 objective of this study was to assess the community-based newborn care utilization and associated
19
20 104 factors among women who delivered recently and their newborns in the Geze Gofa district,
21
22 105 southern Ethiopia.

106 **METHODS**

107 **Study design and settings**

108 A community-based cross-sectional study was conducted in Geze Gofa district, Gamo Gofa zone,
109 Southern Nation Nationalities and Peoples' Region (SNNPR), Ethiopia, from May 1 to 31, 2017.
110 Geze Gofa district is one of the seventeen districts in Gamo Gofa zone located 535km to the
111 southwest of Addis Ababa, the capital of Ethiopia.
112 Administratively, the district is divided into one urban and 29 rural kebeles with 87,731 people.
113 Of these, 43,690 (49.8%) were male and 44,041 (50.2%) female; 20,441 (23.3%) of the women
114 were in the childbearing age group (15-49 years), and 3036 of the women were pregnant with
115 13,695 under-five children in the district; there also were 3,036 and 2,799 neonates and under one-
116 year infants, respectively.

1
2
3 117 All mothers in the childbearing age group and gave birth in 2016 -2017 were the source population,
4
5 118 whereas all mothers who delivered from September 1, 2016 to February 28, 2017 were the study
6
7
8 119 population.

9
10 120 Mothers who gave birth both at home and in health facilities in the district six months before the
11
12 121 study and live young infants were included. Mothers who delivered in another district and came
13
14
15 122 to the study area, lost their babies before two months of age, critically ill, and unable to respond to
16
17 123 interviews were excluded.

124 **Sample size and sampling techniques**

125 The sample size was determined using the single population proportion formula ($n = \frac{P(1-P)(Z_{\alpha/2})^2}{d^2}$)
126 and assuming a 50% proportion (P) of service utilization of women and newborns, 5% expected
127 margin of error (d), 95% confidence level (CI), and 10% non-response that yielded a sample of
128 403.

129 Initially, nine health posts (30% of the total health posts) were selected using the lottery method.²⁹
130 Then, the sample was proportionally allocated to the nine health posts based on the estimated
131 number of mothers who gave birth in the last six months. The final participants were selected using
132 the simple random sampling technique (lottery method) from the delivery registries of the health
133 posts. Then, home visits and interviews were conducted using household numbers.

134 **Variables and measurements**

135 The outcome variable of the study was the utilization of community-based newborn care program.
136 It was measured based on participant service uptake of such components of the program as early
137 identification pregnancy, receiving focused antenatal care (ANC), institutional delivery, postnatal

1
2
3 138 care (PNC) for mother and child within two months of the postpartum period, and identification
4
5 139 and management of sick newborns at community level up to the age of two months.³⁰⁻³⁵
6
7
8 140 Accordingly, if the mothers received all the five components of the program, we considered them
9
10 141 as “utilized” the community-based newborn care program; otherwise as “not utilized”.

11
12
13 142 Antenatal care service utilization was measured according to WHO guidelines for healthy
14
15 143 pregnancies the mother should make at least four visits during the pregnancy, the first of which
16
17 144 must be within the first trimester.³⁶ If the pregnancy is unhealthy, the visit might be more than four
18
19 145 times as per the healthcare provider's decision.

20
21
22 146 Institutional delivery service was measured when a woman gives birth at a health post, health
23
24 147 center, hospital, or other private health facilities; otherwise, it is considered as home delivery

25
26
27 148 Similarly, postnatal care service was considered as received if the mother and her newborn
28
29 149 received healthcare services and were visited by providers within two months of birth.

30
31
32
33 150 In this study, a woman who has delivered recently was used to denote a mother aged 15-49 years
34
35 151 and delivered from September 1, 2016 to February 28, 2017.

36
37
38 152 A newborn in our study was taken as a child in its first eight weeks after birth and taken as a target
39
40 153 for community-based newborn care services according to the Ethiopian CBNC program
41
42 154 implementation guidelines.³⁷ Birth weight was assessed by asking the mother and labelling as
43
44 155 small (<2.5 kg), average (2.5-4.0 kg) and large (>4.0 kg).

45
46
47 156 The explanatory variables were the age of women (<24, 24-35, >35 years), marital status (single,
48
49 157 married, widowed, divorced), educational status (unable to read and write, able to read and write,
50
51 158 elementary school, high school, college and above), religion (Protestant, Orthodox, Muslim,
52
53 159 Catholic), ethnicity (Gofa, Gamo, Wolayita, Others), occupational status (Government employee,

1
2
3 160 merchant, daily labor, farmer, housewife), household wealth status (poorest, poorer, middle, richer,
4
5 161 richest), parity (primipara, multipara), participation in the women health development team
6
7 162 meetings (yes, no), visited by HEWs (yes, no), time it takes to the health post (<30,30-60, 60-120,
8
9 163 >120 minutes), type of health facility visited for danger sign (hospital, health center, health post),
10
11 164 and information about CBNC (yes, no).

12
13
14
15 165 Wealth index was assessed using household assets through principal component analysis adapted
16
17 166 from the EDHS³⁸ and ranked into five (poorest, poorer, middle, richer, and richest) levels.

18 19 20 167 **Data collection tools and procedures**

21
22
23 168 An interviewer-administered standardized structured questionnaire was used after reviewing
24
25 169 different studies and guidelines.^{26 31 34 35 37 39-46} The tool was initially developed in English and
26
27 170 translated into the local language (Amharic) and finally back to English to ensure consistency.
28
29 171 Four trained BSc. degree graduate nurses and two public health officers of the same qualification
30
31 172 from the nearby Sawla district were recruited as data collectors and supervisors, respectively. The
32
33 173 supervisors checked data accuracy, consistency and completeness daily.

34 35 36 37 174 **Data quality control**

38
39
40
41 175 Before data collection, a one day training was given to data collectors and supervisors on the
42
43 176 objectives of the study, data collection instruments, techniques and producers. The data collectors
44
45 177 were supervised daily, and the consistency and completeness of data were checked by the principal
46
47 178 investigator every night. A pretest was conducted on 21 women (5% of the sample size) of Demba
48
49 179 Gofa (one of the neighboring districts with similar characteristics). Before the actual data
50
51 180 collection, all findings from the pretest were incorporated into the final questionnaire and
52
53 181 amendments were made.

182 **Data processing and analysis**

183 Data were cleaned and checked for completeness and consistency before they were coded and
184 entered into Epi-Data version 3.1 software and exported to SPSS version 23 for analysis.

185 Descriptive statistics used were presented in narrations and tabular forms. Both bi-variable and
186 multivariable logistic regression analyses were computed to determine the associated factors.
187 Variables with p-values of less than 0.2 in the bivariable logistic regression were candidates for
188 the multivariable analysis after checking model fitness, chi-square, and multi-collinearity
189 assumptions. In the final multivariable logistic regression analysis model, a p-value of less than
190 0.05 and adjusted odds ratio (AOR) with a 95% confidence interval (CI) were used to identify
191 statistically associated factors.

192 **Patient and public involvement**

193 No patients or the public were directly involved in the development of the research questions,
194 outcomes, recruitment and the design of the study. However, the participants and administrative
195 officials were informed about the research questions and objectives. The findings will be
196 disseminated to the Geze Gofa District Health Office and Gamo Gofa Zonal Health Department.
197 Besides, the results will be distributed to potential stakeholders who have been involved in
198 program implementation after being published in a peer-reviewed scientific journal.

199 **Ethical considerations**

200 Ethical clearance was obtained from the ethical review board of Jimma University (Ref. No.
201 IHRPGC/418/2017) and an official letter of support was secured from Geze Gofa District Health
202 Office. Informed written consent was obtained from each respondent after a brief explanation of

203 the risk and benefit of the study to ensure their voluntariness to participate before the actual data
 204 collection. Participants had the right to withdraw at any time or to skip for a single question or
 205 segment of questions they did not want to answer or refuse to participate at all with no negative
 206 repercussions, and the interview has stayed averagely for 15 minutes.

207 RESULTS

208 Sociodemographic and economic characteristics of participants

209 Table 1 shows the sociodemographic and economic characteristics of the study participants. A
 210 total of 371 women responded to the interviewer-administered questionnaire with a response rate
 211 of 92.1%. The mean age of the women was 27.6 (SD \pm 5) years; the majority (74.4%) were married
 212 and 6.2% single. Religious preference for 46.4 and 7.5% of the women were Protestant and
 213 Muslim, respectively; 42.3% went to elementary school, while 5.9% attended college or above;
 214 72.5% were housewives and 4.0% government employees; 67.1% were Gofa by ethnicity.
 215 Additionally, the mean parity was 3.5 (SD \pm 1.9), and approximately 30 and 14.6% were in the
 216 middle and richer wealth status, respectively.

217 Table 1 Sociodemographic and economic characteristics of study participants in Geze Gofa
 218 district, south Ethiopia, June 2017 (n=371)

| Variables | Responses | Frequency (n) | Percent (%) |
|----------------|-----------|---------------|-------------|
| Age in years | <24 | 109 | 29.4 |
| | 24-35 | 246 | 66.3 |
| | >35 | 16 | 4.3 |
| Marital status | Single | 23 | 6.2 |
| | Married | 276 | 74.4 |
| | Widowed | 32 | 8.6 |

| Variables | Responses | Frequency (n) | Percent (%) |
|---------------------|--------------------------------|---------------|-------------|
| | Divorced | 40 | 10.8 |
| Religion | Protestant | 172 | 46.4 |
| | Orthodox | 131 | 35.3 |
| | Muslim | 28 | 7.5 |
| | Catholic | 40 | 10.8 |
| Educational status | Unable to read and write | 116 | 31.3 |
| | Able to read and write | 25 | 6.7 |
| | Elementary school (Grade 1- 8) | 157 | 42.3 |
| | High school (Grade 9-12) | 51 | 13.7 |
| | College and above | 22 | 5.9 |
| Occupational status | Gov't employee | 15 | 4.0 |
| | Merchant | 31 | 8.4 |
| | Daily labor | 21 | 5.7 |
| | Farmer | 35 | 9.4 |
| | Housewife | 269 | 72.5 |
| Ethnicity | Gofa | 249 | 67.1 |
| | Gamo | 69 | 18.6 |
| | Wolayita | 27 | 7.3 |
| | Others* | 26 | 7.0 |
| Wealth quantiles | Poorest | 65 | 17.5 |
| | Poorer | 63 | 17.0 |
| | Middle | 111 | 29.9 |
| | Richer | 54 | 14.6 |
| | Richest | 78 | 21.0 |

219 Gov't employee: Government employee, * others: Amhara, Guraghe, Kembata

220 **Health extension program services and other related characteristics**

221 All of the respondents knew the health extension workers (HEWs) who worked in their respective
 222 kebeles. The majority (90.7%) of the women received advice from the HEWs during their recent

1
2
3 223 pregnancies and postpartum period. Similarly, 88.4, 74.1, 73.9, 70.4, and 47.4% of the women
4
5 224 received information about the HEP packages, advice on STI, newborn and child diseases as well
6
7
8 225 as supplies and vitamin A, respectively. A total of 340 (91.6%) women said that there was a Health
9
10 226 Development team (in 1 to 5 networks) in their community. Of those, 323 women (95.0%) were
11
12 227 members of the networks, and 217 (67.1%) attended meetings during their recent pregnancies.
13
14 228 Moreover, the nearest health post took less than 30, 30-60, 60-120 and more than 120 minutes of
15
16
17 229 on foot travel for 21.3, 40.7, 29.4, and 8.6% of the participants, respectively.

20 230 **Obstetric history and maternal health services**

21
22
23 231 As shown in Table 2 below, 98.1% of the women had ANC visits during their recent pregnancies,
24
25 232 and the mean age of the pregnancies during the first ANC visit was 4.6 months (SD \pm 1.3).
26
27 233 Similarly, 80.2 and 4.4% of the women went to health posts and hospitals for their first ANC,
28
29
30 234 respectively.

31
32 235 During their recent ANC visits, physical examinations and routine laboratory investigations were
33
34
35 236 done for 95.6 and 56.6% of the women, respectively. Moreover, 90.7, 80.5, and 6.6% of the women
36
37 237 received tetanus toxoid vaccination, iron folate supplementation, and deworming during ANC
38
39 238 follow ups, respectively. Of those who had ANC follow ups, 285 (78.3%) made ANC visits four
40
41
42 239 times and above. Regarding knowledge of danger signs during pregnancies, 79.2, 75.5, and 49.6%
43
44 240 stated that their danger signs were vaginal bleeding, blurred vision, and convulsion, respectively.
45
46 241 One-fifth of the women faced at least one danger sign, while 75.5 and 10% said that they went to
47
48 242 health centers and hospitals when they have faced any of the danger signs, respectively. Of the
49
50
51 243 total respondents, 233 (62.8%) delivered at health facilities.

244 Table 2 Obstetric characteristics and maternal health services in Geze Gofa district, south Ethiopia,
245 June 2017 (n= 371)

| Variables | Responses | Frequency (n) | Percent (%) |
|---|-----------------------------|---------------|-------------|
| Parity | Primipara | 53 | 16.5 |
| | Multipara | 268 | 83.5 |
| ANC follow up | Yes | 364 | 98.1 |
| | No | 7 | 1.9 |
| Number of ANC visits (n=364) | Once | 14 | 3.9 |
| | Twice | 26 | 7.1 |
| | Three times | 39 | 10.7 |
| | Four and above | 285 | 78.3 |
| Timing of first ANC visit (n=364) | First trimester | 58 | 15.9 |
| | Second trimester | 298 | 81.9 |
| | Third trimester | 8 | 2.2 |
| Type of health facility for the first ANC visit | Hospital | 16 | 4.4 |
| | Health center | 56 | 15.4 |
| | Health post | 292 | 80.2 |
| Knowing about danger sign during pregnancy | Swelling of hands and face | 237 | 63.9 |
| | Blurred vision | 280 | 75.5 |
| | Convulsion | 184 | 49.6 |
| | Severe headache | 248 | 66.8 |
| | Severe lower abdominal pain | 206 | 55.5 |
| Place of visits, if they have faced danger signs | Vaginal bleeding | 294 | 79.2 |
| | Hospital | 37 | 10.0 |
| | Health center | 280 | 75.5 |
| | Health post | 54 | 14.6 |
| Faced danger sign | Yes | 75 | 20.2 |
| | No | 289 | 77.8 |

| Variables | Responses | Frequency (n) | Percent (%) |
|--|-----------------|---------------|-------------|
| Place of delivery | Health facility | 233 | 62.8 |
| | Home | 138 | 37.2 |
| Type of health facility attended during delivery (n=233) | Hospital | 34 | 14.6 |
| | Health center | 190 | 81.5 |
| | Health post | 9 | 3.9 |

246 Postpartum and immediate newborn care services

247 The postpartum and immediate newborn care services are presented in Table 3. Of the total
 248 participants, 246 (66.3%) received postnatal care within seven days after birth. Nearly 41% of
 249 them visited in the first 48 hours of delivery; 13 (9.4%) of those who delivered at home were made
 250 to use local material (buffer, dung, and others) to apply on cord. Of the total newborns, 336 (90.6%)
 251 started breastfeeding within an hour of delivery. Moreover, 74.1% of the newborns breastfed
 252 exclusively. Three-fourths of the women received information about breastfeeding for the first
 253 time from HEWs, while 24 (6.5%) obtained from the mass media.

254 Table 3 Postpartum and immediate newborn care services in Geze Gofa district, south Ethiopia,
 255 June 2017 (n= 371)

| Variables | Responses | Frequency (n) | Percent (%) |
|--------------------------------------|---------------------------|---------------|-------------|
| Postnatal visit | Yes | 246 | 66.3 |
| | No | 125 | 33.7 |
| Postnatal care visiting time (n=246) | <48 hours | 100 | 40.7 |
| | 3 rd day | 38 | 15.4 |
| | After 3 rd day | 108 | 43.9 |
| Timing of breastfeeding initiation | < 1hr | 336 | 90.6 |
| | ≥1hrs | 35 | 9.4 |
| Exclusive breastfeeding | Yes | 275 | 74.1 |

| | | | |
|---|---|-----|------|
| | No | 96 | 25.9 |
| Source of information about breastfeeding | HEWs | 278 | 74.9 |
| | Healthcare providers from health center | 49 | 13.2 |
| | Mass media | 24 | 6.5 |
| | Relatives/friends | 10 | 2.7 |
| | Other* | 10 | 2.7 |

256 *others: health development army leader, community group, traditional birth attendant

257 **Newborn care services during the first two months of age**

258 Table 4 shows newborn care services during the first two months of age; 69.0% of the mothers
 259 had information about community-based newborn care provided by HEWs at community level
 260 health posts. During the first two months after delivery, 224 (60.4%) of the newborns received
 261 postnatal follow ups from HEWs at home. Of the newborns, 41 (18.3%) were checked once, and
 262 87 (38.8%) three and above times. The majority of the newborns, 299 (80.6%), were weighed
 263 within seven days, and 271 (90.6%) and 12 (4.0%) of them had average and large birth weight,
 264 respectively. Out of the total newborns, 56 (15.1%) faced health problems within two months of
 265 the postnatal period, and 34 (60.7%) consulted HEWs and visited health posts to receive medical
 266 services.

267 Table 4 Newborn care services during the first two months of age in Geze Gofa district, south
 268 Ethiopia, June 2017 (n= 371)

| Variables | Responses | Frequency (n) | Percent (%) |
|---|-----------|---------------|-------------|
| Having information about the CBNC program | Yes | 256 | 69.0 |
| | No | 115 | 30.9 |
| Newborn received PNC from HEWs at | Yes | 224 | 60.4 |

| | | | |
|---|---------------|-----|------|
| home within two months of age | No | 147 | 39.6 |
| Frequency of follow up received from HEWs (n=224) | Once | 41 | 18.3 |
| | Twice | 96 | 42.9 |
| | ≥ Three times | 87 | 38.8 |
| Baby's weight was measured within the first seven days of birth | Yes | 299 | 80.6 |
| | No | 72 | 19.4 |
| Birth weight of the newborn (n=299) | Small | 271 | 90.6 |
| | Average | 16 | 5.4 |
| | Large | 12 | 4.0 |
| Newborn faced a health problem during the first two months of age | Yes | 56 | 15.1 |
| | No | 315 | 84.9 |
| Types of facility visited for medical services (n=56) | Health post | 34 | 60.7 |
| | Health center | 15 | 26.8 |
| | Hospital | 7 | 12.5 |

269 **Community-based newborn care utilization**

270 A community-based newborn care program utilization was measured when a woman and her
 271 newborn received all the components of the program (antenatal care + institutional delivery +
 272 postnatal care + neonatal care up to two months of age) continually at home and/or health post
 273 level. Accordingly, 37.5% (95% CI: 32.6-42.6) of the women and their newborns utilized the full
 274 community-based newborn care program while the rest did not receive the entire program.

275 **Factors associated with community-based newborn care utilization**

276 In the bivariable logistic regression, age, educational level, occupational status, ethnicity, wealth
 277 status, time taken to reach the nearest health post, types of facility visited during danger signs and
 278 previous information about CBNC were candidate variables. In the multivariable logistic
 279 regression analysis, educational level, occupational status, wealth status, and types of facility

280 visited when they had danger signs were variables significantly associated, as presented in Table
281 5.

282 Accordingly, women who attended elementary school, college and above were 1.76 (AOR: 1.76,
283 95% CI: 1.01-3.07) and 3.71 (AOR: 3.71, 95% CI: 1.12-12.24) times more likely to utilize the
284 program compared to those who were unable to read and write, respectively. Farmer women were
285 65% less likely to utilize the program compared to housewives (AOR: 0.35, 95% CI: 0.16-0.79).
286 Women who were in the poorest and middle wealth status were 3.76 (AOR: 3.76, 95% CI: 1.65-
287 8.54) and 1.96 (AOR: 1.96, 95% CI: 1.03-3.76) times more likely to utilize the program than the
288 richest women. Moreover, women who preferred visiting the hospital if they had any danger signs
289 were 70.4% times less likely to utilize the services than those who chose to go to health posts
290 (AOR: 0.29, 95% CI: 0.11-0.78).

291 Table 5 Bivariable and multivariable logistic regression analysis of factors associated with
292 community-based newborn care utilization in Geze Gofa district, south Ethiopia, June 2017 (n=
293 371)

| Variables | CBNC | CNBC | COR (95% CI) | AOR (95% CI) |
|---------------------------|-----------|--------------|------------------|--------------------|
| | utilized | not utilized | | |
| | n (%) | n (%) | | |
| Age in years | | | | |
| ≤24 | 36 (33.0) | 73 (67.0) | 2.03 (0.70-5.84) | 1.41 (0.42-4.76) |
| 25-35 | 95 (38.6) | 151 (61.4) | 1.59 (0.58-4.38) | 1.34 (0.44-4.10) |
| >35 | 8 (50.0) | 8 (50.0) | 1 | 1 |
| Educational status | | | | |
| Unable to read & write | 49 (42.2) | 67 (57.8) | 1 | 1 |
| Able to read & write | 12 (48.0) | 13 (52.0) | 0.79 (0.33-1.88) | 0.84 (0.32-2.17) |
| Elementary school | 47 (29.9) | 110 (70.1) | 1.71 (1.04-2.83) | 1.76 (1.01-3.07) * |

| Variables | CBNC | CNBC | COR (95% CI) | AOR (95% CI) |
|--|------------|--------------|-------------------|---------------------|
| | utilized | not utilized | | |
| | n (%) | n (%) | | |
| High school | 26 (51.0) | 25 (49.0) | 0.70 (0.36-1.36) | 0.80 (0.36-1.78) |
| College and above | 5 (22.7) | 17 (77.3) | 2.49 (0.86-7.20) | 3.71 (1.12-12.24) * |
| Occupational status | | | | |
| Government employee | 8 (53.3) | 7 (46.7) | 0.43 (0.15-1.21) | 0.41 (0.13-1.29) |
| Merchant | 14 (45.2) | 17 (54.8) | 0.59 (0.28-1.25) | 0.50 (0.22-1.15) |
| Daily labour | 9 (42.9) | 12 (57.1) | 0.65 (0.26-1.60) | 0.40 (0.15-1.08) |
| Farmer | 20 (57.1) | 15 (42.9) | 0.37 (0.18-0.75) | 0.35 (0.16-0.79) * |
| Housewife | 88 (32.7) | 181 (67.3) | 1 | 1 |
| Ethnicity | | | | |
| Gofa | 86 (34.5) | 163 (65.5) | 1 | 1 |
| Gamo | 30 (43.5) | 39 (56.5) | 0.69 (0.40-1.18) | 0.76 (0.42-1.38) |
| Wolayita | 13 (48.1) | 14 (51.9) | 0.57 (0.26-1.26) | 0.47 (0.20-1.11) |
| Others* | 10 (38.5) | 16 (61.5) | 0.84 (0.37-1.94) | 1.27 (0.49-3.25) |
| Wealth status | | | | |
| Poorest | 13 (20.0) | 52 (80.0) | 4.21 (1.98-8.94) | 3.76 (1.65-8.54) * |
| Poorer | 22 (35.0) | 41 (65.0) | 1.96 (0.99-3.88) | 1.92 (0.91-4.06) |
| Middle | 39 (35.1) | 72 (64.9) | 1.943 (1.07-3.51) | 1.96 (1.03-3.76) * |
| Richer | 25 (46.3) | 29 (53.7) | 1.221 (0.61-2.45) | 1.26 (0.57-2.80) |
| Richest | 40 (51.3) | 38 (48.7) | 1 | 1 |
| Time takes to reach the nearest health posts (in minutes) | | | | |
| < 30 | 28 (35.4) | 51 (64.6) | 0.51 (0.20-1.33) | 1 |
| 30-60 | 59 (39.0) | 92 (61.0) | 0.44 (0.18-1.07) | 0.83 (0.45-1.55) |
| 60-120 | 45 (41.3) | 64 (58.7) | 0.39 (0.16-1.00) | 0.70 (0.36-1.37) |
| > 120 | 7 (21.9) | 25 (78.1) | | 1.72 (0.61-4.85) |
| Place of visit (if they have faced danger signs) | | | | |
| Hospital | 20 (54.0) | 17 (46.0) | 0.29 (0.12-0.72) | 0.29 (0.11-0.78) * |
| Health center | 105 (37.5) | 175 (62.5) | 0.58 (0.30-1.12) | 0.58 (0.29-1.18) |

| Variables | CBNC | CNBC | COR (95% CI) | AOR (95% CI) |
|--------------------------------|-----------|--------------|------------------|------------------|
| | utilized | not utilized | | |
| | n (%) | n (%) | | |
| Health post | 14 (25.9) | 40 (74.1) | 1 | 1 |
| Information about CBNC program | | | | |
| Yes | 90 (35.2) | 166 (64.8) | 1 | 1 |
| No | 49 (42.6) | 66 (57.4) | 0.73 (0.47-1.15) | 0.73 (0.43-1.21) |

294 Others*: Amhara, Guraghe, and Kembata, *statistically significant at p-value <0.05

295 DISCUSSION

296 Overall, 37.5% of the women who delivered recently and their newborns received the full
 297 components of the community-based newborn care program. This finding is higher than that of a
 298 study conducted at Xaybouathong district, Lao PDR. In this study, only 6.8% the women received
 299 all the modified composite coverage index components of maternal and child health services (ANC
 300 4+, neonatal tetanus protection, facility-based delivery, PNC, immunization, and family
 301 planning).³⁰ A study in Ghana showed that from pregnancy to post-delivery, 7.9% of women and
 302 children received the continuum of care,³¹ while another study in Ghana indicated that only 8.0%
 303 of the women completed the continuum of maternal and newborn care services.³⁵ Our finding is
 304 higher than that of a study conducted in Pakistan and showed that the continuum of maternal care
 305 was 27.4%.³³ The possible justification for the discrepancy could be the inclusion of the continuum
 306 of care as measured by ANC, institutional delivery, immediate postnatal care, and newborn care
 307 services up to two months of age, whereas in others studies the continuum of care included a child
 308 health services until the age of one year. The other possible explanation might be the use of a
 309 longer study period retrospectively to assess the utilization that included five years before the
 310 survey, which might increased their recall bias about the services they received and the

1
2
3 311 sociodemographic variations of study areas. Moreover, stronger and more resilient health systems
4
5 312 which focus on community-based service provisions like the health extension program in Ethiopia
6
7
8 313 may explain some of the discordance in the findings of the current and other studies.⁴⁷⁻⁴⁹ Results
9
10 314 however were lower than that of a study done at Sohag Governorate, Egypt, and showed that 50.4%
11
12 315 of the women achieved the continuum of care.³² In addition, a study conducted in Cambodia
13
14 316 showed that 60% of women had the full range of services for the continuum of maternal and
15
16 317 newborn healthcare.⁵⁰ This discrepancy might be due to the use of only maternal continuum of
17
18 318 care which did not include newborn care that could give a higher result. A study conducted in
19
20 319 Cambodia used a national survey which might have resulted in a higher findings and the study area
21
22 320 and socio-cultural variations might be other possible reasons.

23
24
25
26 321 Our study showed that 98.1% of the women received ANC services once, 76.8% four times and
27
28 322 above; 62.8% of women delivered at a health facility, and the health status of 60.3% of newborns
29
30 323 was checked by HEWs until two months of age. Our finding is higher than that of a study
31
32 324 conducted in Ratanakiri province, Cambodia, in which only 32.6% of the women made four and
33
34 325 above visits in the continuum of maternal, newborn, and child health services.⁵¹ The possible
35
36 326 explanation might be the difference in the target group, which included women who gave birth
37
38 327 two years before the study which might have resulted in forgetting the services they took. The
39
40 328 other possible reason might be the difference in the service delivery pace for ANC follow ups. Our
41
42 329 study included services taken at the health post level, while their study measured ANC service
43
44 330 follow ups at health centers and hospitals only. Our findings is lower than that of a study conducted
45
46 331 in Sohag Governorate, Egypt, which showed that 90% of the women visited four and above
47
48 332 antenatal care.³² The reason for our low results may be the sociodemographic variability, as we
49
50 333 have only assessed the utilization for rural residents. Moreover, the presence of better maternal
51
52
53
54
55

1
2
3 334 and child health services achievement in Egypt might be the possible explanation for this higher
4
5 335 findings.⁵²
6
7

8 336 Our study showed that women who attended elementary school, college and above had 1.7 and 3.7
9
10 337 times more chance of getting CBNC service utilization compared to mothers who were unable to
11
12 338 read and write, respectively. This finding was comparable with that of a study done in Nepal South
13
14 339 Asia and sub-Sahara countries in which women's education was positively associated with the
15
16 340 maternal and newborn health service utilization.^{53 54} These findings might be explained by the fact
17
18 341 that an education for a woman increases her knowledge and awareness about the importance of the
19
20 342 services and the chance of getting information.
21
22
23

24
25 343 In this study, CBNC utilization was lower by 65% among farmer women compared to housewives.
26
27 344 This result is supported by a study done in the district of Xaybouathong, Lao PDR, showing that
28
29 345 agriculture is detrimental to the use of maternal, newborn and child health services.³⁰ This result
30
31 346 might be explained by the difficulty of serving women farmers because services are delivered at
32
33 347 the community level.
34
35
36

37 348 Women who are in the poorest and middle wealth quantile were 3.76 and 1.96 times more likely
38
39 349 to use the community-based newborn care program compared to those who were in the richest.
40
41 350 This finding is different from those studies done in the a rural community of south eastern Nigeria
42
43 351 and western regions of china showing women with higher economic status increased maternal and
44
45 352 child service utilization.^{55 56} A study in Ghana showed that women and children in the richest
46
47 353 households were more likely to utilize the continuum of care.³¹ Another study in Africa showed
48
49 354 that there was a three-fold disparity in the use of the continuum of care between the wealthiest
50
51 355 20% of African women compared to the poorest.⁵⁷ This disagreement might be explained by the
52
53
54
55
56
57
58
59
60

1
2
3 356 fact that the program in our study area aimed to serve the poorest households at health post and
4
5 357 household levels to increase service access. The other possible explanation might be that wealthier
6
7 358 families can afford the direct and indirect costs of services of health centers or hospitals and seek
8
9 359 more quality care at higher facilities by well-trained providers. Additionally, the program in our
10
11 360 case is a free service that does not incur any cost on those who cannot seek other services at
12
13 361 advanced or higher facilities.
14
15

16
17 362 In this study, women who preferred to visit hospitals when they faced danger signs had a 70.4%
18
19 363 lower chance of utilization of the community-based newborn care services compared to those who
20
21 364 preferred health posts. According to the Ethiopian health tier system, health posts are more
22
23 365 accessible than hospitals; so, those who want to visit hospitals might not get the services as easily
24
25 366 as they need.⁵⁸ This result is in line with that of a study in Pakistan and showed that the absence
26
27 367 of difficulties for access to health facilities increases the use of maternal, newborn, and child
28
29 368 healthcare continuum by 76.1 and 72.9%, respectively.³³ The other possible explanation might be
30
31 369 that the effectiveness of community health workers in delivering preventive maternal and child
32
33 370 health interventions in low- and middle- income countries⁵⁹ increases community-based service
34
35 371 acceptability in rural communities.
36
37
38
39
40

41 372 **Limitations of the study**

42
43
44 373 The finding was not triangulated by qualitative methods which are also subject to social
45
46 374 desirability bias owing to our use of an interviewer-administered questionnaire. To minimize the
47
48 375 impact, data collectors were recruited from other districts. Moreover, the women might have
49
50 376 experienced recall bias, particularly regarding the services they received during their previous
51
52 377 obstetrics, ANC visits, for instance. Compared to other studies however our work assessed later
53
54
55

1
2
3 378 events that preceded the study by only six months. On top of that, the data collectors were highly
4
5 379 experienced and well-trained on the tools to explain the questions and extend the time for
6
7
8 380 respondents so they recall events later.
9

10 381 **CONCLUSIONS**

11
12
13
14 382 The study showed that community-based newborn care utilization in the study area was low
15
16 383 compared to the current national recommendations. Elementary school, college and above
17
18 384 education as well as the poorest and middle wealth status affected the utilization positively,
19
20
21 385 whereas farming occupation and preference of hospitals in case of danger signs affected the
22
23 386 utilization negatively. Therefore, awareness creation at community levels for illiterate women,
24
25 387 arranging convenient time for farmer women and providing full components of maternal and
26
27 388 newborn services in nearby community level health facilities could improve the utilization of
28
29 389 community-based newborn care program in rural districts. Furthermore, subsequent studies must
30
31 390 explore the barriers for low utilization of community-based newborn care services using
32
33 391 qualitative methods and also better if studies assessed the effectiveness of the program on maternal
34
35 392 and child health outcomes.
36
37
38

39 393 **Acknowledgment** The authors would like to thank all respondents for their willingness to
40
41 394 participated in the study. We are also grateful to the Geze Gofa district health office. Finally, our
42
43 395 appreciation goes to the data collectors for their unreserved contribution in data collection
44
45 396 activities.
46
47
48

49 397 **Author Contributions** TG conceptualized the study. AA and ED developed the methods and
50
51 398 materials. TG, AA, and ED undertook the data analysis, interpretation, and drafting of the paper.
52
53 399 All authors invest significant contributions and approved the final draft.
54
55

1
2
3 400 **Funding statement** This research received no specific grant from any funding agency in public,
4
5 401 commercial, or not-for-profit sectors.

6
7
8 402 **Competing interests** The authors declare that they have no conflict of interest.

9
10
11 403 **Patient consent** Obtained

12
13
14 404 **Ethical approval** Ethical approval was obtained from the ethical review board of Jimma
15
16 405 University (Ref. No. IHRPGC/418/2017). The official letter of co-operation was obtained from
17
18 406 the Geze Gofa district health office.

19
20
21 407 **Data sharing statement** All the relevant data are provided in the manuscript. Data can be provided
22
23 408 by the contact of the corresponding author on a reasonable request.
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

410 REFERENCES

- 411 1. World Health Organization. Global, regional and national neonatal health status. Fact sheet,
412 2016.
- 413 2. Kliegman RM, Staton B, Gene J. Nelson Textbook of Pediatrics 20th. *Neurology part p*
414 2015:2863-74.
- 415 3. Organization WH. Global health observatory (GHO) data: Neonatal mortality. *World Health*
416 *Organization Retrieved from: www who int/gho/child_health/mortality/neonatal/en* 2016
- 417 4. Organization WH. Newborns: reducing mortality [https://www.who.int/news-room/fact-](https://www.who.int/news-room/fact-sheets/detail/newborns-reducing-mortality)
418 [sheets/detail/newborns-reducing-mortality](https://www.who.int/news-room/fact-sheets/detail/newborns-reducing-mortality) 2018.
- 419 5. UNICEF. Committing to Child Survival: A promise renewed—progress report 2015. Retrieved
420 August 8, 2017, 2017.
- 421 6. Central Statistical Agency Addis Ababa E. Ethiopia Demographic and Health Survey 2016
422 Addis Ababa, Ethiopia 2016
- 423 7. Perry HB, Zulliger R, Rogers MM. Community health workers in low-, middle-, and high-
424 income countries: an overview of their history, recent evolution, and current effectiveness.
425 *Annual review of public health* 2014;35:399-421.
- 426 8. Reducing intrapartum-related neonatal deaths in low-and middle-income countries—what
427 works? *Seminars in perinatology*; 2010. Elsevier.
- 428 9. Nair N, Tripathy P, Prost A, et al. Improving newborn survival in low-income countries:
429 community-based approaches and lessons from South Asia. *PLoS medicine*
430 2010;7(4):e1000246.
- 431 10. Maulik P, Darmstadt G. Community-based interventions to optimize early childhood
432 development in low resource settings. *Journal of Perinatology* 2009;29(8):531.

- 1
2
3 433 11. World Health Organization Regional Office for Africa. Newborn Health key facts. 2017.
4
5 434 <https://www.afro.who.int/health-topics/newborn>.
6
7
8 435 12. Callaghan-Koru JA, Nonyane BA, Guenther T, et al. Contribution of community-based
9
10 436 newborn health promotion to reducing inequities in healthy newborn care practices and
11
12 437 knowledge in Malawi. 2013
13
14 438 13. Mathewos B, Owen H, Sitrin D, et al. Community-Based Interventions for Newborns in
15
16 439 Ethiopia (COMBINE): Cost-effectiveness analysis. *Health policy and planning*
17
18 440 2017;32(1):21-32. doi: 10.1093/heapol/czx054 [published Online First: 2017/10/06]
19
20
21 441 14. Berhanu D, Avan B. Community Based Newborn Care in Ethiopia: Quality of CBNC
22
23 442 programme assessment Midline Evaluation Report March 2017. 2017
24
25
26 443 15. Banteyerga H. Ethiopia's health extension program: improving health through community
27
28 444 involvement. *MEDICC review* 2014;13(3):46-49.
29
30
31 445 16. Degeffie Hailegebriel T, Mulligan B, Cousens S, et al. Effect on Neonatal Mortality of Newborn
32
33 446 Infection Management at Health Posts When Referral Is Not Possible: A Cluster-
34
35 447 Randomized Trial in Rural Ethiopia. *Global health, science and practice* 2017;5(2):202-
36
37 448 16. doi: 10.9745/ghsp-d-16-00312 [published Online First: 2017/06/15]
38
39
40 449 17. Alamneh Y, Adane F, Yirga T, et al. Essential newborn care utilization and associated factors
41
42 450 in Ethiopia: a systematic review and meta-analysis. *BMC Pregnancy and Childbirth*
43
44 451 2020;20(1):1-9.
45
46
47 452 18. Mathewos B, Musema Y, Bekele A, et al. Community-based Newborn Care in Ethiopia:
48
49 453 Implementation Strength and Lessons Learned. *Ethiopian Medical Journal* 2019(3)
50
51 454 19. Gebremariam A, Mohammed H, Hailemichael A, et al. Community-Based Newborn Care in
52
53 455 Afar: Lessons Learned. *Ethiopian Medical Journal* 2019(3)

- 1
2
3 456 20. Ameha A, Legesse H, Sylla M, et al. The Effect of Community-Based Newborn Care
4
5 457 Intervention on Service Utilization for Sick Newborn and Children. *Ethiopian Medical*
6
7 458 *Journal* 2019(3)
- 8
9
10 459 21. Okwaraji YB, Berhanu D, Persson LA. Community-based child care: household and health-
11
12 460 facility perspectives. Dagu Baseline Survey, Ethiopia, December 2016-February 2017.
13
14 461 *Community-based child care: household and health facility perspectives* 2017
- 15
16
17 462 22. Zimmerman LA, Shiferaw S, Seme A, et al. Evaluating consistency of recall of maternal and
18
19 463 newborn care complications and intervention coverage using PMA panel data in SNNPR,
20
21 464 Ethiopia. *PloS one* 2019;14(5)
- 22
23
24 465 23. Canavan ME, Brault MA, Tatek D, et al. Maternal and neonatal services in Ethiopia: measuring
25
26 466 and improving quality. *Bulletin of the World Health Organization* 2017;95(6):473.
- 27
28
29 467 24. Bobo FT, Yesuf EA, Woldie M. Inequities in utilization of reproductive and maternal health
30
31 468 services in Ethiopia. *International journal for equity in health* 2017;16(1):105.
- 32
33 469 25. Callaghan-Koru JA, Abiy Seifu MT, Graft-Johnson Jd, et al. Newborn care practices at home
34
35 470 and in health facilities in 4 regions of Ethiopia. 2013
- 36
37
38 471 26. Zulfiqar A. Bhutta GLD, Babar S. Hasan and Rachel A. Haws. Community-Based
39
40 472 Interventions for Improving Perinatal and Neonatal Health Outcomes in Developing
41
42 473 Countries: A Review of the Evidence. 2005 doi: 10.1542/peds.2004-1441
- 43
44
45 474 27. Taylor ME. Community Based Newborn Care in Ethiopia: Introduction to the Special Issue.
46
47 475 *Ethiopian Medical Journal* 2019(3)
- 48
49 476 28. Semu Y, Tekle E, Bekele A, et al. Making Community Based Newborn Care Sustainable in
50
51 477 Ethiopia. *Ethiopian Medical Journal* 2019(3)
- 52
53
54
55
56
57
58
59
60

- 1
2
3 478 29. Sambo LG, Chatora RR, Goosen E. Tools for assessing the operationality of district health
4
5 479 systems. *Brazzaville: World Health Organization, Regional Office for Africa* 2003
6
7
8 480 30. Sakuma S, Yasuoka J, Phongluxa K, et al. Determinants of continuum of care for maternal,
9
10 481 newborn, and child health services in rural Khammouane, Lao PDR. *PloS one*
11
12 482 2019;14(4):e0215635.
13
14
15 483 31. Shibnuma A, Yeji F, Okawa S, et al. The coverage of continuum of care in maternal, newborn
16
17 484 and child health: a cross-sectional study of woman-child pairs in Ghana. *BMJ Global*
18
19 485 *Health* 2018;3(4):e000786. doi: 10.1136/bmjgh-2018-000786
20
21
22 486 32. Hamed AF, Roshdy E, Sabry M. Egyptian status of continuum of care for maternal, newborn,
23
24 487 and child health: Sohag Governorate as an example. *International Journal of Medical*
25
26 488 *Science and Public Health* 2018;7(6):417-27.
27
28
29 489 33. Iqbal S, Maqsood S, Zakar R, et al. Continuum of care in maternal, newborn and child health
30
31 490 in Pakistan: analysis of trends and determinants from 2006 to 2012. *BMC Health Services*
32
33 491 *Research* 2017;17(1):189. doi: 10.1186/s12913-017-2111-9
34
35
36 492 34. Engmann CM, Hodgson A, Aborigo R, et al. Addressing the continuum of maternal and
37
38 493 newborn care in Ghana: implications for policy and practice. *Health policy and planning*
39
40 494 2016;31(10):1355-63. doi: 10.1093/heapol/czw072
41
42
43 495 35. Yeji F, Shibnuma A, Oduro A, et al. Continuum of care in a maternal, newborn and child
44
45 496 health program in Ghana: Low completion rate and multiple obstacle factors. *PloS one*
46
47 497 2015;10(12):e0142849.
48
49
50 498 36. World Health Organization. WHO recommendations on antenatal care for a positive pregnancy
51
52 499 experience: World Health Organization 2016.
53
54
55
56
57
58
59
60

- 1
2
3 500 37. Federal Ministry of Health E. Community Based Newborn Care Implementation Guideline
4
5 501 2013.
6
7
8 502 38. [Ethiopia] CSAC. Ethiopia Mini Demographic and Health Survey 2014. Addis Ababa,
9
10 503 Ethiopia. 2014
11
12 504 39. Federal Ministry of Health E. Maternal, newborn, child and adolescent health guideline 2012
13
14
15 505 40. Tuladhar S. The Determinants of Good Newborn Care Practices in the Rural Areas of Nepal.
16
17 506 2010
18
19 507 41. Owili PO, Muga MA, Chou Y-J, et al. Associations in the continuum of care for maternal,
20
21 508 newborn and child health: a population-based study of 12 sub-Saharan Africa countries.
22
23 509 *BMC public health* 2016;16(1):414.
24
25
26 510 42. Quayyum Z, Khan MNU, Quayyum T, et al. “Can community level interventions have an
27
28 511 impact on equity and utilization of maternal health care”–Evidence from rural Bangladesh.
29
30 512 *International journal for equity in health* 2013;12(1):22.
31
32
33 513 43. Veirum JE, Biai S, Jakobsen M, et al. Persisting high hospital and community childhood
34
35 514 mortality in an urban setting in Guinea-Bissau. *Acta paediatrica (Oslo, Norway : 1992)*
36
37 515 2007;96(10):1526-30. doi: 10.1111/j.1651-2227.2007.00467.x [published Online First:
38
39 516 2007/09/14]
40
41
42 517 44. Kerber KJ, de Graft-Johnson JE, Bhutta ZA, et al. Continuum of care for maternal, newborn,
43
44 518 and child health: from slogan to service delivery. *The Lancet* 2007;370(9595):1358-69.
45
46 519 doi: 10.1016/s0140-6736(07)61578-5
47
48
49 520 45. Sule SS, Onayade AA. Community-based antenatal and perinatal interventions and newborn
50
51 521 survival. *Nigerian journal of medicine : journal of the National Association of Resident*
52
53 522 *Doctors of Nigeria* 2006;15(2):108-14. [published Online First: 2006/06/30]
54
55

- 1
2
3 523 46. Telfair J. An evaluation of state perinatal community-based programs in Alabama: overview.
4
5 524 *Public health reports (Washington, DC : 1974)* 2003;118(5):484-6. doi:
6
7 525 10.1093/phr/118.5.484 [published Online First: 2003/08/28]
8
9
10 526 47. Fetene N, Linnander E, Fekadu B, et al. The Ethiopian health extension program and variation
11
12 527 in health systems performance: what matters? *PloS one* 2016;11(5)
13
14 528 48. Admasu K-B. Designing a resilient National health system in Ethiopia: the role of leadership.
15
16 529 *Health Systems & Reform* 2016;2(3):182-86.
17
18
19 530 49. Afework MF, Admassu K, Mekonnen A, et al. Effect of an innovative community based health
20
21 531 program on maternal health service utilization in north and south central Ethiopia: a
22
23 532 community based cross sectional study. *Reproductive health* 2014;11(1):28.
24
25
26 533 50. Wang W. Levels and determinants of continuum of care for maternal and newborn health in
27
28 534 Cambodia-evidence from a population-based survey. *BMC Pregnancy and Childbirth*
29
30 535 2015;15 doi: 10.1186/s12884-015-0497-0
31
32
33 536 51. Yasuoka J, Nanishi K, Kikuchi K, et al. Barriers for pregnant women living in rural,
34
35 537 agricultural villages to accessing antenatal care in Cambodia: A community-based cross-
36
37 538 sectional study combined with a geographic information system. *PLoS One*
38
39 539 2018;13(3):e0194103. doi: 10.1371/journal.pone.0194103 [published Online First:
40
41 540 2018/03/20]
42
43
44 541 52. Benova L, Campbell OM, Sholkamy H, et al. Socio-economic factors associated with maternal
45
46 542 health-seeking behaviours among women from poor households in rural Egypt.
47
48 543 *International journal for equity in health* 2014;13(1):111.
49
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 544 53. Bhatta DN, Aryal UR. Paternal Factors and Inequity Associated with Access to Maternal
4
5 545 Health Care Service Utilization in Nepal: A Community Based Cross-Sectional Study.
6
7 546 *PLOS ONE* 2015;10(6):e0130380. doi: 10.1371/journal.pone.0130380
8
9
10 547 54. Singh K, Story WT, Moran AC. Assessing the continuum of care pathway for maternal health
11
12 548 in South Asia and sub-Saharan Africa. *Maternal and child health journal* 2016;20(2):281-
13
14 549 89.
15
16
17 550 55. Agunwa C, Obi I, Ndu A, et al. Determinants of patterns of maternal and child health service
18
19 551 utilization in a rural community in south eastern Nigeria. *BMC Health Services Research*
20
21 552 2017;17(1):715.
22
23
24 553 56. Qian Y, Zhou Z, Gao J, et al. An economy-related equity analysis of health service utilization
25
26 554 by women in economically underdeveloped regions of western China. *International*
27
28 555 *journal for equity in health* 2017;16(1):186.
29
30
31 556 57. De Graft-Johnson J, Kerber K, Tinker A, et al. The maternal, newborn and child health
32
33 557 continuum of care. *Opportunities for Africa's newborns* 2006:23-36.
34
35 558 58. Federal Ministry of Health E. The Ethiopian health tire system, 2010.
36
37 559 <https://ethiopiahealth.blogs.wm.edu/ethiopian-health-system>.
38
39
40 560 59. Gilmore B, McAuliffe E. Effectiveness of community health workers delivering preventive
41
42 561 interventions for maternal and child health in low-and middle-income countries: a
43
44 562 systematic review. *BMC public health* 2013;13(1):847.
45
46
47
48 563

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

| Section/Topic | Item # | Recommendation | Reported on page # |
|------------------------------|--------|--|--------------------|
| Title and abstract | 1 | (a) Indicate the study’s design with a commonly used term in the title or the abstract | 1 |
| | | (b) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| Introduction | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 5-7 |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | 7 |
| Methods | | | |
| Study design | 4 | Present key elements of study design early in the paper | 7 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 7-8 |
| Participants | 6 | (a) Give the eligibility criteria, and the sources and methods of selection of participants | 8 |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 8-10 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 9-10 |
| Bias | 9 | Describe any efforts to address potential sources of bias | 10 |
| Study size | 10 | Explain how the study size was arrived at | 8 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 11 |
| Statistical methods | 12 | (a) Describe all statistical methods, including those used to control for confounding | 11 |
| | | (b) Describe any methods used to examine subgroups and interactions | 11 |
| | | (c) Explain how missing data were addressed | |
| | | (d) If applicable, describe analytical methods taking account of sampling strategy | 11 |
| | | (e) Describe any sensitivity analyses | |
| Results | | | |

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

| | | | |
|--------------------------|-----|---|---------------------|
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram | 12 |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest | 12-13 13-18 |
| Outcome data | 15* | Report numbers of outcome events or summary measures | 18 |
| Main results | 16 | (a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | 18-21 18-21 - |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | - |
| Discussion | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 21 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 25 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 21-25 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 25 |
| Other information | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 26 |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.