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# 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

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

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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  
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8 37 period were factors associated with CBNC program utilization. Therefore, awareness creation  
9  
10 38 provision at the community level, convenient time arrangement, and increment of physical  
11  
12 39 access to a health facility are essential to improve the uptake of CBNC in the rural district.  
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15 40 **Keywords:** Utilization; community based newborn care; Geze Gofa district; Ethiopia  
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## 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 <sup>1 2</sup>. 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 <sup>3</sup>.

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 <sup>4-7</sup>. 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 <sup>8</sup>.

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 <sup>9</sup>. 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 <sup>9</sup>. Lack of postnatal health checks can delay the identification  
76 of newborn complications and the initiation of appropriate care and treatment. Thus, early



77 postpartum care is critical to ensure the proper neonatal care which includes exclusive  
78 breastfeeding, cord care and thermal care and prevention of infections <sup>10</sup>.

79 Every year nearly 45% of all under-five child deaths are among newborn infants within the first  
80 28 days, and three-quarters of all infant deaths occur in the first week of life. But two-thirds of  
81 neonatal deaths can be prevented if effective health measures are provided at birth and during the  
82 first week of life <sup>11 12</sup>.

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

## 88 **Methods**

### 89 **Study design and settings**

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

94 The district administratively divided into one urban and 29 rural kebeles with an entire residence  
95 of 87,731 population. Of these 43,690 (49.8%) are males and 44,041 (50.2%) are females. There  
96 are 20,441 (23.3%) women in the childbearing age group (15-49 years). There are also 3036

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

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

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

### 106 **Sample size and sampling techniques**

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

112 Initially using the lottery method, nine health posts (30% of the total health posts) were selected  
113 <sup>14</sup>. Then proportional allocation was applied for each health post chosen based on the number of  
114 the mother who gave birth in the last six months, and the final study participant was selected  
115 using simple random sampling techniques (lottery method) from the health post-registration to  
116 find the required sample size. Then having the name and house number visited the mother at  
117 home, and the interview was conducted. Mothers who gave birth at home and health institutions  
118 in the last six months and alive infants were included in the study.

## 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 HEWs<sup>15-20</sup>.

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 trimester<sup>21</sup>. 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 1<sup>st</sup>, 2016 to the end  
139 of February 2017.

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3 140 **Newborn:** A newborn baby in the first eight weeks after birth, which is eligible for community-  
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5 141 based newborn care program services according to the Ethiopian CBNC program  
6  
7 142 implementation guideline<sup>22</sup>.

8  
9  
10 143 Wealth index was assessed using household assets through principal component analysis adapted  
11  
12 144 from the Ethiopian demographic and health survey<sup>23</sup>.

### 15 **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<sup>13 16 19 20 22 24-31</sup>. 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.

### 34 **Data quality control**

35  
36  
37 154 Before data collection, a day training for data collectors and supervisors were given on the study  
38  
39 155 objectives, data collection instruments, techniques, and producers. Data collectors were  
40  
41 156 supervised daily, and every night the consistency and completeness of data were checked by the  
42  
43 157 principal investigator (PI). A pretest was conducted on 21 women (5% the sample size) in  
44  
45 158 Demba Gofa district (which is one of the neighbor districts and having almost similar  
46  
47 159 characteristics). Before the actual data collection, all findings from the pre-test were incorporated  
48  
49 160 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 ± 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 | Percent |
|--|--|-----------|---------|
|  |  | (n)       | (%)     |
| 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<br>(n) | Percent<br>(%) |
|---|-------------------------------|------------------|----------------|
|   | 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<br>(n) | Percent<br>(%) |
|---|-----------------------|------------------|----------------|
| 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<br>(n) | Percent<br>(%) |
|---|--|------------------|----------------|
| Postnatal visit                           | Yes  | 246              | 66.3           |
|   | No   | 125              | 33.7           |
| Postnatal care visiting time (n=246)      | <48 hours                                  | 100              | 40.7           |
|   | 3 <sup>rd</sup> day                        | 38               | 15.4           |
|   | After 3 <sup>rd</sup> 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<br>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<br>(n) | Percent<br>(%) |
|---|----------------------|------------------|----------------|
| 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<br>(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<br>n (%) | non-utilized<br>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) | <b>1.762 (1.012-3.071) *</b> |

| 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) | <b>3.705 (1.122-12.235) *</b> |
| <b>Occupational status</b>  |          |              |                     |                               |
| 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) | <b>0.350 (0.156-0.788) *</b>  |
| House wife  | 88       | 181          | 1                   | 1                             |
| <b>Ethnicity</b>  |          |              |                     |                               |
| 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)           |
| <b>Wealth status</b>  |          |              |                     |                               |
| Poorest   | 13       | 52           | 4.211 (1.984-8.937) | <b>3.756 (1.651-8.544) *</b>  |
| Poor  | 22       | 41           | 1.962 (0.992-3.881) | 1.921 (0.908-4.064)           |
| Middle  | 39       | 72           | 1.943 (1.076-3.508) | <b>1.963 (1.025-3.758) *</b>  |
| Rich  | 25       | 29           | 1.221 (0.609-2.447) | 1.258 (0.566-2.798)           |
| Richest   | 40       | 38           | 1                   | 1                             |
| <b>Time takes to reach the nearest health posts</b>                                 |          |              |                     |                               |
| < 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                             |
| <b>Place of visit, if they have faced danger sign during their recent pregnancy</b> |          |              |                     |                               |
| Hospital  | 20       | 17           | 0.298 (0.122-0.723) | <b>0.296 (0.113-0.777) *</b>  |
| 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 forth  
 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 <sup>15</sup>, 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 <sup>16</sup>, 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 <sup>20</sup>. The dissonancy 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.



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3 289 Moreover, our finding is higher than a study finding in Pakistan from the trends of a composite  
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5 290 measure of the continuum of care, including antenatal care, delivery assistance, and postpartum  
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7 291 care shows 27.4%<sup>18</sup>. This difference might be due to variation of the study period, which  
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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  
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14 294 national level that contribute for low result findings. But lower than a study done at Sohag  
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16 295 governorate, Egypt shows that 50.4% of women had achieved continuum of care measured  
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18 296 (ANC+4 visit, delivered by skilled birth attendant and had PNC)<sup>17</sup> and a study conducted in  
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20 297 Cambodia shows that 60% of women had the full range of services for the continuum of  
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22 298 maternal and newborn health care<sup>32</sup>. This discrepancy might be the study includes only ANC,  
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24 299 institutional delivery, and postnatal which does not include the newborn care in their continuum  
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26 300 of care that gives a higher result. The other possible reason might be the difference in sample  
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28 301 size and socio-cultural variations.  
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33 302 The results of this study showed that 98.1% of women received ANC services once, 76.8% four,  
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35 303 and above times, 62.8% of women were delivered at a health facility, and 60.3% of newborns'  
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37 304 health status was checked by HEWs up to two months of age. This study finding is higher than a  
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39 305 study conducted in Ratanakiri province, Cambodia shows only 32.6% of women received ANC  
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41 306 four and above visits for their recent pregnancy in the continuum of maternal, newborn, and  
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43 307 child health services<sup>33</sup>. 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  
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49 310 for their ANC follow up; our study includes services taken at the health post level, but their study  
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51 311 measures ANC services follow up only at health centers and hospitals. But lower than a study  
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3 312 conducted in at Sohag Governorate, Egypt shows 90% of women had antenatal care four and  
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5 313 above visits <sup>17</sup>. Our lower finding might be explained by the small sample size and rural  
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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  
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14  
15 317 unable to read and write. This finding is comparable with that of a study done in Xaybouathong  
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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 <sup>15</sup>. These findings  
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21 320 might be explained by as a woman education level increase her knowledge and awareness about  
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23 321 the importance of the services also increase.

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

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

334 more likely to achieve the continuum of care <sup>16</sup>, 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 <sup>34</sup>, and in Pakistan, it showed that the richest women had received 7 times more the  
337 complete continuum of care than poorest <sup>18</sup>. 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 <sup>18</sup>. 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 <sup>35</sup> 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

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

## 13 360 **Conclusions and implications**

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

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41  
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45  
46  
47 374 activities.

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49  
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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.

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11 381 **Patient consent:** obtained  
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14 382 **Ethical approval:** Ethical approval was obtained from the ethical review board of Jimma  
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16 383 University (Ref. No. IHRPGC/418/2017). The official letter of co-operation was obtained from  
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18 384 the Geze Gofa district health office.  
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22 385 **Data sharing statement:** all the relevant data are provided in the manuscript. Data can be  
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24 386 provided by the contact of the corresponding author on a reasonable request.  
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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 # |
|------------------------------|--------|--|--------------------|
| <b>Title and abstract</b>    | 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                  |
| <b>Introduction</b>          |        |  |                    |
| 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                  |
| <b>Methods</b>               |        |  |                    |
| 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/<br>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  |                    |
| <b>Results</b>               |        |  |                    |

|                          |     |   |                     |
|--------------------------|-----|---|---------------------|
| 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<br>(b) Give reasons for non-participation at each stage<br>(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<br>(b) Indicate number of participants with missing data for each variable of interest   | 10, 11<br>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<br>(b) Report category boundaries when continuous variables were categorized<br>(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | 18-20<br>18-20<br>- |
| Other analyses           | 17  | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses  | -                   |
| <b>Discussion</b>        |     |   |                     |
| 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                  |
| <b>Other information</b> |     |   |                     |
| 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](http://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

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

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## 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

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3 35 status (AOR: 1.96, 95% CI: 1.01-3.76, and those whose preference was visiting hospital they faced  
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5 36 any signs of danger (AOR: 0.29, 95% CI: 0.11-0.78).  
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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.  
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19  
20 42 **Keywords:** Utilization; community-based newborn care; Geze Gofa district; Ethiopia  
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## 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 <sup>1 2</sup>.

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 <sup>3</sup>. The majority (98%) of the neonatal deaths are  
58 from preventable causes, occurring in middle-and low-income countries, including Ethiopia <sup>1 4</sup>.  
59 Ethiopia was one of the highest contributors in Africa with 187,000 neonatal mortality in 2015 <sup>5</sup>.  
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 <sup>6</sup>.

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 <sup>7-10</sup>. 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 <sup>11</sup>. 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 <sup>12</sup>.

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 <sup>13 14</sup>. 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 <sup>15</sup>.

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3 75 Newborns in Ethiopia face multitude of barriers in accessing health care. Some of these are related  
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5 76 to culture and fatalism and others to physical access due to distance and limited communication.  
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8 77 Although nearly all the HEWs have been trained to treat severe newborn infections in the  
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10 78 Community-Based Newborn Care (CBNC) program, relatively few sick newborns have been  
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12 79 identified and treated in the country <sup>16 17</sup>.

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

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

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

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3 97 In Ethiopia, implementing the CBNC program has been taken as one of the core interventions to  
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5 98 reduce child mortality and to attain the Sustainable Development Goals (SDGs) of reducing under-  
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7 99 five mortality to less than 25 per 1000 live births and neonatal mortality to 12 or fewer per 1000  
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10 100 live births by 2030 <sup>28</sup> <sup>29</sup>. 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  
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14 102 care providers about the utilization level of the CBNC program and the extent to which its key  
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16 103 components were implemented as intended in the study area and in similar settings. Therefore, the  
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18 104 objective of this study was to assess the community-based newborn care utilization and associated  
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20 105 factors among women who delivered recently and their newborns in the Geze Gofa district,  
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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.

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

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10 121 Mothers who gave birth both at home and in health facilities in the district six months before the  
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12 122 study and live young infants were included. Mothers who delivered in another district and came  
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15 123 to the study area, lost their babies before two months of age, critically ill, and unable to respond to  
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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  
131 <sup>30</sup>. 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

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3 139 care (PNC) for mother and child within two months of the postpartum period, and identification  
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5 140 and management of sick newborns at community level up to the age of two months <sup>31-36</sup>.

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8 141 Accordingly, if the mothers received all the five components of the program, we considered them  
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10 142 as “utilized” the community-based newborn care program; otherwise as “not utilized”.

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

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

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

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

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

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

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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  
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7 163 meetings (yes, no), visited by HEWs (yes, no), time it takes to the health post (<30,30-60, 60-120,  
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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).

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

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

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

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

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41 176 Before data collection, a one day training was given to data collectors and supervisors on the  
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43 177 objectives of the study, data collection instruments, techniques and producers. The data collectors  
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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  
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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

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

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

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

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

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<br>(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<br>(n=364)                | First trimester             | 58        | 15.9    |
|   | Second trimester            | 298       | 81.9    |
|   | Third trimester             | 8         | 2.2     |
| Type of health facility for the<br>first ANC visit  | Hospital                    | 16        | 4.4     |
|   | Health center               | 56        | 15.4    |
|   | Health post                 | 292       | 80.2    |
| Knowing about danger sign<br>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<br>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 <sup>rd</sup> day       | 38        | 15.4    |
|                                      | After 3 <sup>rd</sup> 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  |

257 \*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<br>(n) | Percent<br>(%) |
|---|---------------|------------------|----------------|
| 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                   |
| <b>Educational status</b>  |           |              |                   |                     |
| 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) * |
| <b>Occupational status</b>                                       |           |              |                   |                     |
| 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                   |
| <b>Ethnicity</b>   |           |              |                   |                     |
| 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)    |
| <b>Wealth status</b>   |           |              |                   |                     |
| 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                   |
| <b>Time takes to reach the nearest health posts (in minutes)</b> |           |              |                   |                     |
| < 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)<sup>31</sup>.  
 303 A study in Ghana showed that from pregnancy to post-delivery, 7.9% of women and children  
 304 received the continuum of care<sup>32</sup>, while another study in Ghana indicated that only 8.0% of the  
 305 women completed the continuum of maternal and newborn care services<sup>36</sup>. 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%<sup>34</sup>. 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  
7 311 longer study period retrospectively to assess the utilization that included five years before the  
8  
9 312 survey, which might increased their recall bias about the services they received for the last five  
10  
11 313 years and the sociodemographic variations of study areas. Moreover, stronger and more resilient  
12  
13 314 health systems which focus on community-based service provisions like the health extension  
14  
15 315 program in Ethiopia may explain some of the discordance in the findings of the current and other  
16  
17 316 studies <sup>48-50</sup>. Results however were lower than that of a study done at Sohag Governorate, Egypt,  
18  
19 317 and showed that 50.4% of the women achieved the continuum of care as measured by ANC+4  
20  
21 318 visits, delivery by a skilled birth attendant and PNC <sup>33</sup>. In addition, a study conducted in Cambodia  
22  
23 319 showed that 60% of women had the full range of services for the continuum of maternal and  
24  
25 320 newborn healthcare <sup>51</sup>. This discrepancy might be due to the use of only maternal continuum of  
26  
27 321 care which did not include newborn care that could give a higher result. The other possible reason  
28  
29 322 might be differences in study areas. A study conducted in Cambodia used a national survey which  
30  
31 323 might have resulted in a higher findings and socio-cultural variations.

32  
33 324 Our study showed that 98.1% of the women received ANC services once, 76.8% four times and  
34  
35 325 above; 62.8% of women delivered at a health facility, and the health status of 60.3% of newborns  
36  
37 326 was checked by HEWs until two months of age. Our finding is higher than that of a study  
38  
39 327 conducted in Ratanakiri province, Cambodia, in which only 32.6% of the women made four and  
40  
41 328 above visits in the continuum of maternal, newborn, and child health services <sup>52</sup>. The possible  
42  
43 329 explanation might be the difference in the target group, which included women who gave birth  
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45 330 two years before the study which might have resulted in forgetting the services they took. The  
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47 331 other possible reason might be the difference in the service delivery pace for ANC follow ups. Our  
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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  
8 334 in Sohag Governorate, Egypt, which showed that 90% of the women had four and above antenatal  
9  
10 335 care visits <sup>33</sup>. The explanation for our low result might be the sociodemographic variation in that  
11  
12 336 we assessed the utilization for rural dwellers only. Moreover, the presence of better maternal and  
13  
14 337 child health services achievement in Egypt might be the possible explanation for this higher  
15  
16  
17 338 findings <sup>53</sup>.

18  
19  
20 339 Our study showed that women who attended elementary school, college and above had 1.7 and 3.7  
21  
22 340 times more chance of getting CBNC service utilization compared to mothers who were unable to  
23  
24 341 read and write, respectively. This finding was comparable with that of a study done in  
25  
26 342 Xaybouathong district, Lao PDR, and showed women's education was positively associated with  
27  
28 343 the continuum of maternal, newborn and child health service utilization <sup>31</sup>. These findings might  
29  
30 344 be explained by the fact a woman's education increases her knowledge and awareness about the  
31  
32 345 importance of the services and the chance of getting information.

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34  
35 346 In this study, CBNC utilization was lower by 65% among farmer women compared to housewives.  
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37 347 This result is supported by a study done in the Xaybouathong district, Lao PDR, which shows  
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39 348 farming as an occupation is negatively associated with the continuum of maternal, newborn, and  
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41 349 child health service utilization <sup>31</sup>. This result might be explained by the inconvenience of the time  
42  
43  
44 350 of service delivery for farmer women since services are provided at the community level.

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

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2  
3 354 the higher economic status utilized 1.6 times more of the continuum of maternal, newborn, and  
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5 355 child health services compared to those in the lower economic status<sup>33</sup>. A study in Ghana showed  
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7  
8 356 that women and children in the richest households were more likely to utilize the continuum of  
9  
10 357 care<sup>32</sup>. 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 poorest<sup>54</sup>. 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 poorest<sup>34</sup>. 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.

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32  
33 367 In this study, women who preferred to visit hospitals when they faced danger signs had a 70.4%  
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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 need<sup>55</sup>. 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%, respectively<sup>34</sup>. 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-

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2  
3 376 and-middle income countries <sup>56</sup> increases community-based service acceptability in rural  
4  
5 377 communities.  
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## 8 378 **Limitations of the study**

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11 379 The finding was not triangulated by qualitative methods which are also subject to social  
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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  
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17 382 experienced recall bias, particularly regarding the services they received during their previous  
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19 383 obstetrics, ANC visits, for instance. Compared to other studies however our work assessed later  
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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.  
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## 30 387 **Conclusion and implications**

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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  
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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,  
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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  
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50 396 explore the barriers for low utilization of community-based newborn care services using  
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397 qualitative methods and also better if studies assessed the effectiveness of the program on maternal  
398 and child health outcomes.

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

409 **Patient consent:** obtained

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413 **Data sharing statement:** all the relevant data are provided in the manuscript. Data can be provided  
414 by the contact of the corresponding author on a reasonable request.



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

| Section/Topic                | Item # | Recommendation   | Reported on page # |
|------------------------------|--------|--|--------------------|
| <b>Title and abstract</b>    | 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                  |
| <b>Introduction</b>          |        |  |                    |
| 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                  |
| <b>Methods</b>               |        |  |                    |
| 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/<br>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  |                    |
| <b>Results</b>               |        |  |                    |

|                          |     |   |                     |
|--------------------------|-----|---|---------------------|
| 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<br>(b) Give reasons for non-participation at each stage<br>(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<br>(b) Indicate number of participants with missing data for each variable of interest   | 12-13<br>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<br>(b) Report category boundaries when continuous variables were categorized<br>(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | 18-21<br>18-21<br>- |
| Other analyses           | 17  | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses  | -                   |
| <b>Discussion</b>        |     |   |                     |
| 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                  |
| <b>Other information</b> |     |   |                     |
| 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](http://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

|                                 |   |
|---------------------------------|---|
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| 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<br>Atnafu, Asmamaw; University of Gondar College of Medicine and Health Sciences, Health Systems and policy<br>Dellie, Endalkachew; University of Gondar College of Medicine and Health Sciences, Health Systems and policy |
| <b>Primary Subject Heading</b>: | Health services research  |
| Secondary Subject Heading:      | Obstetrics and gynaecology, Public health   |
| Keywords:                       | Community child health < PAEDIATRICS, PUBLIC HEALTH, OBSTETRICS, HEALTH SERVICES ADMINISTRATION & MANAGEMENT  |
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## 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

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3 35 status (AOR: 1.96, 95% CI: 1.01-3.76, and those whose preference was visiting hospital they faced  
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5 36 any signs of danger (AOR: 0.29, 95% CI: 0.11-0.78).  
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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,  
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12 39 we need to increase awareness at community levels, make convenient arrangements, and increase  
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14 40 the availability of services at nearby health facilities that are essential to improve the uptake of  
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16 41 CBNC in the rural district.  
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## 42 Article summary

### 43 Strengths and limitations of this study

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

## 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.<sup>1 2</sup>

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.<sup>3</sup> The majority (98%) of the neonatal deaths are from  
57 preventable causes, occurring in middle-and low-income countries, including Ethiopia.<sup>1 4</sup> Ethiopia  
58 was one of the highest contributors in Africa, with 187,000 neonatal mortality in 2015.<sup>5</sup> 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.<sup>6</sup>

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.<sup>7-10</sup> 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.<sup>11</sup> 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.<sup>12</sup>

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.<sup>13 14</sup> 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.<sup>15</sup>

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3 74 Newborns in Ethiopia face multitude of barriers in accessing health care. Some of these are related  
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5 75 to culture and fatalism and others to physical access due to distance and limited communication.  
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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.<sup>13 16</sup>

13  
14  
15 79 The utilization of available maternal and child health services is very low in Ethiopia.<sup>17-20</sup> 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.<sup>21</sup> For this low CBNC program  
22  
23 83 service utilization, socioeconomic and demographic factors are the most important contributing  
24  
25 84 variables.<sup>13 19 21</sup>

26  
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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.<sup>22-24</sup> 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.<sup>6</sup> 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.<sup>25</sup>

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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.<sup>26</sup>

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3 96 In Ethiopia, implementing the CBNC program has been taken as one of the core interventions to  
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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 99 live births by 2030.<sup>27 28</sup> However, studies that show the implementation status of these  
10  
11 100 interventions are rare. Hence, this study aimed to inform policymakers, program managers, and  
12  
13 101 care providers about the utilization level of the CBNC program and the extent to which its key  
14  
15 102 components were implemented as intended in the study area and in similar settings. Therefore, the  
16  
17 103 objective of this study was to assess the community-based newborn care utilization and associated  
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19 104 factors among women who delivered recently and their newborns in the Geze Gofa district,  
20  
21 105 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.

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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  
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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.<sup>29</sup>  
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



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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.<sup>30-35</sup>  
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.<sup>36</sup> 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

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

35  
36  
37 152 A newborn in our study was taken as a child in its first eight weeks after birth and taken as a target  
38  
39 153 for community-based newborn care services according to the Ethiopian CBNC program  
40  
41 154 implementation guidelines.<sup>37</sup> Birth weight was assessed by asking the mother and labelling as  
42  
43 155 small (<2.5 kg), average (2.5-4.0 kg) and large (>4.0 kg).

44  
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 >120 minutes), type of health facility visited for danger sign (hospital, health center, health post),  
10 163  
11 and information about CBNC (yes, no).  
12 164

15 165 Wealth index was assessed using household assets through principal component analysis adapted  
16  
17 166 from the EDHS<sup>38</sup> and ranked into five (poorest, poorer, middle, richer, and richest) levels.  
18  
19

### 20 167 **Data collection tools and procedures**

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

### 38 174 **Data quality control**

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 Gofa (one of the neighboring districts with similar characteristics). Before the actual data  
50 179  
51 collection, all findings from the pretest were incorporated into the final questionnaire and  
52 180  
53 amendments were made.  
54 181  
55

## 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

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

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

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

235 During their recent ANC visits, physical examinations and routine laboratory investigations were  
236 done for 95.6 and 56.6% of the women, respectively. Moreover, 90.7, 80.5, and 6.6% of the women  
237 received tetanus toxoid vaccination, iron folate supplementation, and deworming during ANC  
238 follow ups, respectively. Of those who had ANC follow ups, 285 (78.3%) made ANC visits four  
239 times and above. Regarding knowledge of danger signs during pregnancies, 79.2, 75.5, and 49.6%  
240 stated that their danger signs were vaginal bleeding, blurred vision, and convulsion, respectively.  
241 One-fifth of the women faced at least one danger sign, while 75.5 and 10% said that they went to  
242 health centers and hospitals when they have faced any of the danger signs, respectively. Of the  
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<br>(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<br>(n=364)                | First trimester             | 58            | 15.9        |
|   | Second trimester            | 298           | 81.9        |
|   | Third trimester             | 8             | 2.2         |
| Type of health facility for<br>the first ANC visit  | Hospital                    | 16            | 4.4         |
|   | Health center               | 56            | 15.4        |
|   | Health post                 | 292           | 80.2        |
| Knowing about danger sign<br>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<br>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 <sup>rd</sup> day       | 38            | 15.4        |
|                                      | After 3 <sup>rd</sup> 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  |
| 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 (%)        |                  |                    |
| <b>Age in years</b>       |           |              |                  |                    |
| ≤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                  |
| <b>Educational status</b> |           |              |                  |                    |
| 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) * |
| <b>Occupational status</b>                                       |            |              |                   |                     |
| 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                   |
| <b>Ethnicity</b>   |            |              |                   |                     |
| 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)    |
| <b>Wealth status</b>   |            |              |                   |                     |
| 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                   |
| <b>Time takes to reach the nearest health posts (in minutes)</b> |            |              |                   |                     |
| < 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)    |
| <b>Place of visit (if they have faced danger signs)</b>          |            |              |                   |                     |
| 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).<sup>30</sup> A study in Ghana showed that from pregnancy to post-delivery, 7.9% of women and  
 302 children received the continuum of care,<sup>31</sup> while another study in Ghana indicated that only 8.0%  
 303 of the women completed the continuum of maternal and newborn care services.<sup>35</sup> 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%.<sup>33</sup> 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  
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5 312 which focus on community-based service provisions like the health extension program in Ethiopia  
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8 313 may explain some of the discordance in the findings of the current and other studies.<sup>47-49</sup> 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.<sup>32</sup> 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.<sup>50</sup> 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.

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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.<sup>51</sup> 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.<sup>32</sup> 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

334 and child health services achievement in Egypt might be the possible explanation for this higher  
335 findings.<sup>52</sup>

336 Our study showed that women who attended elementary school, college and above had 1.7 and 3.7  
337 times more chance of getting CBNC service utilization compared to mothers who were unable to  
338 read and write, respectively. This finding was comparable with that of a study done in Nepal South  
339 Asia and sub-Sahara countries in which women's education was positively associated with the  
340 maternal and newborn health service utilization.<sup>53 54</sup> These findings might be explained by the fact  
341 that an education for a woman increases her knowledge and awareness about the importance of the  
342 services and the chance of getting information.

343 In this study, CBNC utilization was lower by 65% among farmer women compared to housewives.  
344 This result is supported by a study done in the district of Xaybouathong, Lao PDR, showing that  
345 agriculture is detrimental to the use of maternal, newborn and child health services.<sup>30</sup> This result  
346 might be explained by the difficulty of serving women farmers because services are delivered at  
347 the community level.

348 Women who are in the poorest and middle wealth quantile were 3.76 and 1.96 times more likely  
349 to use the community-based newborn care program compared to those who were in the richest.  
350 This finding is different from those studies done in the a rural community of south eastern Nigeria  
351 and western regions of china showing women with higher economic status increased maternal and  
352 child service utilization.<sup>55 56</sup> A study in Ghana showed that women and children in the richest  
353 households were more likely to utilize the continuum of care.<sup>31</sup> Another study in Africa showed  
354 that there was a three-fold disparity in the use of the continuum of care between the wealthiest  
355 20% of African women compared to the poorest.<sup>57</sup> This disagreement might be explained by the



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2  
3 356 fact that the program in our study area aimed to serve the poorest households at health post and  
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5 357 household levels to increase service access. The other possible explanation might be that wealthier  
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7 358 families can afford the direct and indirect costs of services of health centers or hospitals and seek  
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9 359 more quality care at higher facilities by well-trained providers. Additionally, the program in our  
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11 360 case is a free service that does not incur any cost on those who cannot seek other services at  
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13 361 advanced or higher facilities.  
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16  
17 362 In this study, women who preferred to visit hospitals when they faced danger signs had a 70.4%  
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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.<sup>58</sup> 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.<sup>33</sup> The other possible explanation might be  
30  
31 369 that the effectiveness of community health workers in delivering preventive maternal and child  
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33 370 health interventions in low- and middle- income countries<sup>59</sup> increases community-based service  
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35 371 acceptability in rural communities.  
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## 41 372 **Limitations of the study**

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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  
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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**

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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  
20 385 whereas farming occupation and preference of hospitals in case of danger signs affected the  
21  
22 386 utilization negatively. Therefore, awareness creation at community levels for illiterate women,  
23  
24 387 arranging convenient time for farmer women and providing full components of maternal and  
25  
26 388 newborn services in nearby community level health facilities could improve the utilization of  
27  
28 389 community-based newborn care program in rural districts. Furthermore, subsequent studies must  
29  
30 390 explore the barriers for low utilization of community-based newborn care services using  
31  
32 391 qualitative methods and also better if studies assessed the effectiveness of the program on maternal  
33  
34 392 and child health outcomes.  
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40  
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42  
43 395 appreciation goes to the data collectors for their unreserved contribution in data collection  
44  
45 396 activities.  
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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.  
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2  
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11 403 **Patient consent** Obtained  
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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.  
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22 407 **Data sharing statement** All the relevant data are provided in the manuscript. Data can be provided  
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24 408 by the contact of the corresponding author on a reasonable request.  
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**STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies***

| Section/Topic                | Item # | Recommendation   | Reported on page # |
|------------------------------|--------|--|--------------------|
| <b>Title and abstract</b>    | 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                  |
| <b>Introduction</b>          |        |  |                    |
| 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                  |
| <b>Methods</b>               |        |  |                    |
| 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/<br>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  |                    |
| <b>Results</b>               |        |  |                    |

|                          |     |   |                     |
|--------------------------|-----|---|---------------------|
| 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<br>(b) Give reasons for non-participation at each stage<br>(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<br>(b) Indicate number of participants with missing data for each variable of interest   | 12-13<br>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<br>(b) Report category boundaries when continuous variables were categorized<br>(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | 18-21<br>18-21<br>- |
| Other analyses           | 17  | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses  | -                   |
| <b>Discussion</b>        |     |   |                     |
| 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                  |
| <b>Other information</b> |     |   |                     |
| 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](http://www.strobe-statement.org).