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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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Abstract

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

Design: cross-sectional study

Setting: A community-based

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

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

Outcomes: community-based newborn care program utilization.

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

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

the poorest and middle quantile, and preference of visiting the hospital if they had faced danger signs among themselves and their newborns in the antepartum, intrapartum, and postpartum period were factors associated with CBNC program utilization. Therefore, awareness creation provision at the community level, convenient time arrangement, and increment of physical access to a health facility are essential to improve the uptake of CBNC in the rural district.

Keywords: Utilization; community based newborn care; Geze Gofa district; Ethiopia

Article summary

Strengths and limitations of this study

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

Introduction

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

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

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

postpartum care is critical to ensure the proper neonatal care which includes exclusive breastfeeding, cord care and thermal care and prevention of infections [10].

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

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

Methods

Study design and settings

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

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

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

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

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

Sample size and sampling techniques

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

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

Variables and measurements

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

Community-based newborn care program utilization was measured when a pregnant mother and newborn received the following services during pregnancy, delivery and postnatal period up to two months (identified early in the community and received focused antenatal care, institutional childbirth and a newborn recognized for asphyxia and resuscitated, prevented and managed for hypothermia, for pre-term and low birth weight, and managed for neonatal sepsis and very severe diseases at community level by HEWs [15-20].

Antenatal care service utilization: According to WHO for healthy pregnancies, antenatal care (ANC) should have at least four visits during the pregnancy in which the first within the first trimester [21]. If the pregnancy is not healthy, the visit might be more than four times as per the healthcare provider's decision.

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

Newborn: A newborn baby in the first eight weeks after birth, which is eligible for community-based newborn care program services according to the Ethiopian CBNC program implementation guideline [22].

Wealth index was assessed using household assets through principal component analysis adapted from the Ethiopian demographic and health survey [23].

Data collection tools and procedures

An interviewer-administered standardized structured questionnaire was used after reviewing different studies and guidelines [13 16 19 20 22 24-31]. The tool was initially developed in English and then translated into the local language (Amharic) and finally back to English to ensure its consistency. Four trained Bachelor of Sciences in Nurse's data collectors and two trained Bachelor of Sciences in Public Health Officer supervisors were recruited from Sawla health center, which is located nearby district. During the data collection process, supervisors have checked the data accuracy, consistency, and completeness daily.

Data quality control

Before data collection, a day training for data collectors and supervisors were given on the study objectives, data collection instruments, techniques, and producers. Data collectors were supervised daily, and every night the consistency and completeness of data were checked by the principal investigator (PI). A pretest was conducted on 21 women (5% the sample size) in Demba Gofa district (which is one of the neighbor districts and having almost similar characteristics). Before the actual data collection, all findings from the pre-test were incorporated into the final questionnaire, and necessary amendments were done.

Data processing and analysis

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

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

Results

Socio-demographic and economic characteristics of participants

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

Table 1: Socio-demographic and economic characteristics of study participants in Geze Gofa 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

* Amhara, Guraghe, Kembata

Antenatal care and institutional delivery services

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

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

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

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

Variables	Responses	Frequency (n)	Percent (%)
	Advice on HIV/AIDS and others STI prevention and control	275	74.1
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 (n)	Percent (%)
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

Postpartum and immediate newborn care services

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

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

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

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

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

Newborn care services during the first two months of age

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

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

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

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

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

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

Overall community based newborn care program utilization

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

Factors associated with community based newborn care program utilization

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

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

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

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

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

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

Variables	CBNC utilized n (%)	CNBC non-utilized n (%)	COR (95% CI)	AOR (95% CI)
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)

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

Discussion

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

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

Moreover, our finding is higher than a study finding in Pakistan from the trends of a composite measure of the continuum of care, including antenatal care, delivery assistance, and postpartum care shows 27.4% [18]. This difference might be due to variation of the study period, which includes those women who gave birth five years before the survey, which might increase their bias to remember the services received before five years and the study area, which covers at the national level that contribute for low result findings. But lower than a study done at Sohag governorate, Egypt shows that 50.4% of women had achieved continuum of care measured (ANC+4 visit, delivered by skilled birth attendant and had PNC) [17] and a study conducted in Cambodia shows that 60% of women had the full range of services for the continuum of maternal and newborn health care [32]. This discrepancy might be the study includes only ANC, institutional delivery, and postnatal which does not include the newborn care in their continuum of care that gives a higher result. The other possible reason might be the difference in sample size and socio-cultural variations.

The results of this study showed that 98.1% of women received ANC services once, 76.8% four, and above times, 62.8% of women were delivered at a health facility, and 60.3% of newborns' health status was checked by HEWs up to two months of age. This study finding is higher than a study conducted in Ratanakiri province, Cambodia shows only 32.6% of women received ANC four and above visits for their recent pregnancy in the continuum of maternal, newborn, and child health services [33]. The possible explanation might be due to the difference in target group, which includes those women who gave birth two years before the study might forget the services they have taken. The other possible reason might be the difference in the service delivery pace for their ANC follow up; our study includes services taken at the health post level, but their study measures ANC services follow up only at health centers and hospitals. But lower than a study

conducted in at Sohag Governorate, Egypt shows 90% of women had antenatal care four and above visits [17]. Our lower finding might be explained by the small sample size and rural residence of the study participants.

The study revealed that women who attended elementary school and college and above were 1.7 and 3.7 times more chance of utilization of the program, respectively, than those who were unable to read and write. This finding is comparable with that of a study done in Xaybouathong district in Khammouane province, Lao PDR shows women's education was positively associated with the continuum of maternal, newborn and child health services utilization [15]. These findings might be explained by as a woman education level increase her knowledge and awareness about the importance of the services also increase.

Community based newborn care program utilization was lower by 65% among farmer women compared to those housewife women. This result is supported by a study done in the Xaybouathong district in Khammouane province, Lao PDR, which shows being farmers as occupations negatively associated with the continuum of maternal, newborn, and child health services utilization [15]. This result might be explained by the inconvenience of service delivery time for those farmer women.

Those women who are in the poorest and middle quantiles of wealth status were 3.76 and 1.96 times more likely to utilize the community based newborn care program compared to women who are in the richest quantile. This finding is in disagreement with studies in Sohag Governorate, Egypt that shows women in the higher economic status were 1.6 times more utilized the continuum of maternal, newborn, and child health services compared to those women in the lower economic status [17], in Ghana women and children from richest households were

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

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

Limitation of the study

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

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

Conclusions and implications

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

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

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

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

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

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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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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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Abstract

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

Design: Cross-sectional study

Setting: Community-based

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

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

Outcomes: Community-based newborn care utilization

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

status (AOR: 1.96, 95% CI: 1.01-3.76, and those whose preference was visiting hospital they faced any signs of danger (AOR: 0.29, 95% CI: 0.11-0.78).

Conclusions: The use of the community-based newborn care program in the study area was surprisingly low. To increase utilization and potentially improve the outcomes of these neonates, we need to increase awareness at community levels, make convenient arrangements, and increase the availability of services at nearby health facilities that are essential to improve the uptake of CBNC in the rural district.

Keywords: Utilization; community-based newborn care; Geze Gofa district; Ethiopia

Article summary

Strengths and limitations of this study

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

Introduction

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

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

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

In Ethiopia, a community-based newborn care (CBNC) program is an initiative that includes a newborn care package along the maternal and newborn health continuum of care [13 14]. It is carried out by Health Extension Workers (HEWs) at community levels and aims at improving maternal and newborn health through the four Cs, prenatal and postnatal **c**ontact, **c**ase-identification of newborns with signs of bacterial infections, **c**are or treatment as early as possible, and the **c**ompletion of a full seven-day course of appropriate antibiotics at the community level [15].

Newborns in Ethiopia face multitude of barriers in accessing health care. Some of these are related to culture and fatalism and others to physical access due to distance and limited communication. Although nearly all the HEWs have been trained to treat severe newborn infections in the Community-Based Newborn Care (CBNC) program, relatively few sick newborns have been identified and treated in the country [16 17].

The utilization of available maternal and child health services is very low in Ethiopia [18-21]. A community-based child care household survey in 194 clusters in 46 woredas across four regions on newborn and child health service utilization showed that only 4.0% of the newborns had a postnatal check within the recommended first two days of life [22]. For this low CBNC program service utilization, socioeconomic and demographic factors are the most important contributing variables [16 20 22].

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

Moreover, home care visits are not delivered on the standard days (1 and 3) of a newborn's life, and for the majority of mothers a third visit does not occur before the end of the first week of life (day 7) in developing countries [27].

In Ethiopia, implementing the CBNC program has been taken as one of the core interventions to reduce child mortality and to attain the Sustainable Development Goals (SDGs) of reducing under-five mortality to less than 25 per 1000 live births and neonatal mortality to 12 or fewer per 1000 live births by 2030 [28] [29]. However, studies that show the implementation status of these interventions are rare. Hence, this study aimed to inform policymakers, program managers, and care providers about the utilization level of the CBNC program and the extent to which its key components were implemented as intended in the study area and in similar settings. Therefore, the objective of this study was to assess the community-based newborn care utilization and associated factors among women who delivered recently and their newborns in the Geze Gofa district, southern Ethiopia.

Methods

Study design and settings

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

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

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

Mothers who gave birth both at home and in health facilities in the district six months before the study and live young infants were included. Mothers who delivered in another district and came to the study area, lost their babies before two months of age, critically ill, and unable to respond to interviews were excluded.

Sample size and sampling techniques

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

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

Variables and measurements

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

care (PNC) for mother and child within two months of the postpartum period, and identification and management of sick newborns at community level up to the age of two months [31-36]. Accordingly, if the mothers received all the five components of the program, we considered them as "utilized" the community-based newborn care program; otherwise as "not utilized".

Antenatal care service utilization was measured according to WHO guidelines for healthy pregnancies the mother should make at least four visits during the pregnancy the first of which must be within the first trimester [37]. If the pregnancy is unhealthy, the visit might be more than four times as per the healthcare provider's decision.

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

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

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

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

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

merchant, daily labor, farmer, housewife), household wealth status (poorest, poorer, middle, richer, richest), parity (primipara, multipara), participation in the women health development team meetings (yes, no), visited by HEWs (yes, no), time it takes to the health post (<30,30-60, 60-120, >120 minutes), type of health facility visited for danger sign (hospital, health center, health post), and information about CBNC (yes, no).

Wealth index was assessed using household assets through principal component analysis adapted from the EDHS [39] and ranked into five (poorest, poorer, middle, richer, and richest) levels.

Data collection tools and procedures

An interviewer-administered standardized structured questionnaire was used after reviewing different studies and guidelines [27 32 35 36 38 40-47]. The tool was initially developed in English and translated into the local language (Amharic) and finally back to English to ensure consistency. Four trained BSc. degree graduate nurses and two public health officers of the same qualification from the nearby Sawla district were recruited as data collectors and supervisors, respectively. The supervisors checked data accuracy, consistency and completeness daily.

Data quality control

Before data collection, a one day training was given to data collectors and supervisors on the objectives of the study, data collection instruments, techniques and producers. The data collectors were supervised daily, and the consistency and completeness of data were checked by the principal investigator every night. A pretest was conducted on 21 women (5% of the sample size) of Demba Gofa (one of the neighboring districts with similar characteristics). Before the actual data collection, all findings from the pretest were incorporated into the final questionnaire and amendments were made.

Data processing and analysis

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

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

Patient and public involvement

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

Ethical considerations

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

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

Results

Sociodemographic and economic characteristics of participants

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

Table 1 Sociodemographic and economic characteristics of study participants in Geze Gofa 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

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

Health extension program services and other related characteristics

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

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

Obstetric history and maternal health services

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

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

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

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

Variables	Responses	Frequency (n)	Percent (%)
	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

Postpartum and immediate newborn care services

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

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

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

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

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

Newborn care services during the first two months of age

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

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

Variables	Responses	Frequency (n)	Percent (%)
Having information about the CBNC program	Yes	256	69.0
	No	115	30.9
Newborn received 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

Community-based newborn care utilization

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

Factors associated with community-based newborn care utilization

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

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

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

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

Variables	CBNC utilized	CNBC not utilized	COR (95% CI)	AOR (95% CI)
	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)

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

Discussion

Overall, 37.5% of the women who delivered recently and their newborns received the full components of the community-based newborn care program. This finding is higher than that of a study conducted at Xaybouathong district, Lao PDR. In this study, only 6.8% the women received all the modified composite coverage index components of maternal and child health services (ANC 4 or more, neonatal tetanus protection, facility-based delivery, delivery assisted by skilled birth attendant (SBA), PNC for mother and newborn, BCG, Penta, Polio, and family planning) [31]. A study in Ghana showed that from pregnancy to post-delivery, 7.9% of women and children received the continuum of care [32], while another study in Ghana indicated that only 8.0% of the women completed the continuum of maternal and newborn care services [36]. Our finding is higher than that of a study conducted in Pakistan and showed that the continuum of maternal care was 27.4% [34]. The possible justification for the discrepancy could be the inclusion of the continuum of care as measured by ANC, institutional delivery, immediate postnatal care, and newborn care

services up to two months of age, whereas in others studies the continuum of care included a child health services until the age of one year. The other possible explanation might be the use of a longer study period retrospectively to assess the utilization that included five years before the survey, which might increased their recall bias about the services they received for the last five years and the sociodemographic variations of study areas. Moreover, stronger and more resilient health systems which focus on community-based service provisions like the health extension program in Ethiopia may explain some of the discordance in the findings of the current and other studies [48-50]. Results however were lower than that of a study done at Sohag Governorate, Egypt, and showed that 50.4% of the women achieved the continuum of care as measured by ANC+4 visits, delivery by a skilled birth attendant and PNC [33]. In addition, a study conducted in Cambodia showed that 60% of women had the full range of services for the continuum of maternal and newborn healthcare [51]. This discrepancy might be due to the use of only maternal continuum of care which did not include newborn care that could give a higher result. The other possible reason might be differences in study areas. A study conducted in Cambodia used a national survey which might have resulted in a higher findings and socio-cultural variations.

Our study showed that 98.1% of the women received ANC services once, 76.8% four times and above; 62.8% of women delivered at a health facility, and the health status of 60.3% of newborns was checked by HEWs until two months of age. Our finding is higher than that of a study conducted in Ratanakiri province, Cambodia, in which only 32.6% of the women made four and above visits in the continuum of maternal, newborn, and child health services [52]. The possible explanation might be the difference in the target group, which included women who gave birth two years before the study which might have resulted in forgetting the services they took. The other possible reason might be the difference in the service delivery pace for ANC follow ups. Our

study included services taken at the health post level, while their study measured ANC service follow ups at health centers and hospitals only. Our findings is lower than that of a study conducted in Sohag Governorate, Egypt, which showed that 90% of the women had four and above antenatal care visits [33]. The explanation for our low result might be the sociodemographic variation in that we assessed the utilization for rural dwellers only. Moreover, the presence of better maternal and child health services achievement in Egypt might be the possible explanation for this higher findings [53].

Our study showed that women who attended elementary school, college and above had 1.7 and 3.7 times more chance of getting CBNC service utilization compared to mothers who were unable to read and write, respectively. This finding was comparable with that of a study done in Xaybouathong district, Lao PDR, and showed women's education was positively associated with the continuum of maternal, newborn and child health service utilization [31]. These findings might be explained by the fact a woman's education increases her knowledge and awareness about the importance of the services and the chance of getting information.

In this study, CBNC utilization was lower by 65% among farmer women compared to housewives. This result is supported by a study done in the Xaybouathong district, Lao PDR, which shows farming as an occupation is negatively associated with the continuum of maternal, newborn, and child health service utilization [31]. This result might be explained by the inconvenience of the time of service delivery for farmer women since services are provided at the community level.

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

the higher economic status utilized 1.6 times more of the continuum of maternal, newborn, and child health services compared to those in the lower economic status [33]. A study in Ghana showed that women and children in the richest households were more likely to utilize the continuum of care [32]. Another study in Africa showed that there was a three-fold disparity in the use of the continuum of care between the wealthiest 20% of African women compared to the poorest [54]. In Pakistan, a study showed that the richest women were seven times more likely to utilize the continuum of care than the poorest [34]. This disagreement might be explained by the fact that the program in our study area aimed to serve the poorest households at health post and household levels to increase service access. The other possible explanation might be that wealthier families can afford the direct and indirect costs of services of health centers or hospitals and seek more quality care at higher facilities by well-trained providers. Additionally, the program in our case is a free service that does not incur any cost on those who cannot seek other services at advanced or higher facilities.

In this study, women who preferred to visit hospitals when they faced danger signs had a 70.4% lower chance of utilization of the community-based newborn care services compared to those who preferred health posts. According to the Ethiopian health tier system, health posts are more accessible than hospitals; so, those who want to visit hospitals might not get the services as easily as they need [55]. This result is in line with that of a study in Pakistan and showed that the absence of problems relating to distance and travel arrangements to access health facilities increases the utilization of the continuum of maternal, newborn, and child healthcare services by 76.1% and 72.9%, respectively [34]. The other possible explanation might be that the effectiveness of community health workers in delivering preventive maternal and child health interventions in low-

and-middle income countries [56] increases community-based service acceptability in rural communities.

Limitations of the study

The finding was not triangulated by qualitative methods which are also subject to social desirability bias owing to our use of an interviewer-administered questionnaire. To minimize the impact, data collectors were recruited from other districts. Moreover, the women might have experienced recall bias, particularly regarding the services they received during their previous obstetrics, ANC visits, for instance. Compared to other studies however our work assessed later events that preceded the study by only six months. On top of that, the data collectors were highly experienced and well-trained on the tools to explain the questions and extend the time for respondents so they recall events later.

Conclusion and implications

The study showed that community-based newborn care utilization in the study area was low compared to the current national recommendations. Elementary school, college and above education as well as the poorest and middle wealth status affected the utilization positively, whereas farming occupation and preference of hospitals in case of danger signs affected the utilization negatively. Therefore, awareness creation at community levels for illiterate women, arranging convenient time for farmer women and providing full components of maternal and newborn services in nearby community level health facilities could improve the utilization of community-based newborn care program in rural districts. Furthermore, subsequent studies must explore the barriers for low utilization of community-based newborn care services using

qualitative methods and also better if studies assessed the effectiveness of the program on maternal and child health outcomes.

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Patient consent: obtained

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

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

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

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

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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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ABSTRACT

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

Design Cross-sectional study

Setting Community-based

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

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

Outcomes Community-based newborn care utilization

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

status (AOR: 1.96, 95% CI: 1.01-3.76, and those whose preference was visiting hospital they faced any signs of danger (AOR: 0.29, 95% CI: 0.11-0.78).

Conclusions The use of the community-based newborn care program in the study area was surprisingly low. To increase utilization and potentially improve the outcomes of these neonates, we need to increase awareness at community levels, make convenient arrangements, and increase the availability of services at nearby health facilities that are essential to improve the uptake of CBNC in the rural district.

Article summary

Strengths and limitations of this study

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

INTRODUCTION

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

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

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

In Ethiopia, a community-based newborn care (CBNC) program is an initiative that includes a newborn care package along the maternal and newborn health continuum of care.[13 14] It is carried out by Health Extension Workers (HEWs) at community levels and aims at improving maternal and newborn health through the four Cs, prenatal and postnatal **c**ontact, **c**ase-identification of newborns with signs of bacterial infections, **c**are or treatment as early as possible, and the **c**ompletion of a full seven-day course of appropriate antibiotics at the community level.[15]

Newborns in Ethiopia face multitude of barriers in accessing health care. Some of these are related to culture and fatalism and others to physical access due to distance and limited communication. Although nearly all the HEWs have been trained to treat severe newborn infections in the Community-Based Newborn Care (CBNC) program, relatively few sick newborns have been identified and treated in the country.[13 16]

The utilization of available maternal and child health services is very low in Ethiopia.[17-20] A community-based child care household survey in 194 clusters in 46 woredas across four regions on newborn and child health service utilization showed that only 4.0% of the newborns had a postnatal check within the recommended first two days of life.[21] For this low CBNC program service utilization, socioeconomic and demographic factors are the most important contributing variables.[13 19 21]

Despite the increasing availability of key maternal and newborn health services, low utilization and lack of quality services continue to be a challenge in Ethiopia.[22-24] Of the total 72% of women who delivered at home without skilled assistance, 80% were from rural residents. Besides, only thirteen percent of the newborns had a postnatal check within the critical first two days after birth, while 86% did not receive postpartum.[6] Lack of postnatal health checks can delay the identification of newborn complications and initiate appropriate care and treatment. Thus, early postpartum service is critical to ensure proper neonatal care which includes exclusive breastfeeding, cord and thermal care and the prevention of infections.[25]

Moreover, home care visits are not delivered on the standard days (1 and 3) of a newborn's life, and for the majority of mothers, a third visit does not occur before the end of the first week of life (day 7) in developing countries.[26]

In Ethiopia, implementing the CBNC program has been taken as one of the core interventions to reduce child mortality and to attain the Sustainable Development Goals (SDGs) of reducing under-five mortality to less than 25 per 1000 live births and neonatal mortality to 12 or fewer per 1000 live births by 2030.[27] [28] However, studies that show the implementation status of these interventions are rare. Hence, this study aimed to inform policymakers, program managers, and care providers about the utilization level of the CBNC program and the extent to which its key components were implemented as intended in the study area and in similar settings. Therefore, the objective of this study was to assess the community-based newborn care utilization and associated factors among women who delivered recently and their newborns in the Geze Gofa district, southern Ethiopia.

METHODS

Study design and settings

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

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

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

Mothers who gave birth both at home and in health facilities in the district six months before the study and live young infants were included. Mothers who delivered in another district and came to the study area, lost their babies before two months of age, critically ill, and unable to respond to interviews were excluded.

Sample size and sampling techniques

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

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

Variables and measurements

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

care (PNC) for mother and child within two months of the postpartum period, and identification and management of sick newborns at community level up to the age of two months.[30-35] Accordingly, if the mothers received all the five components of the program, we considered them as "utilized" the community-based newborn care program; otherwise as "not utilized".

Antenatal care service utilization was measured according to WHO guidelines for healthy pregnancies the mother should make at least four visits during the pregnancy, the first of which must be within the first trimester.[36] If the pregnancy is unhealthy, the visit might be more than four times as per the healthcare provider's decision.

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

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

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

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

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

merchant, daily labor, farmer, housewife), household wealth status (poorest, poorer, middle, richer, richest), parity (primipara, multipara), participation in the women health development team meetings (yes, no), visited by HEWs (yes, no), time it takes to the health post (<30,30-60, 60-120, >120 minutes), type of health facility visited for danger sign (hospital, health center, health post), and information about CBNC (yes, no).

Wealth index was assessed using household assets through principal component analysis adapted from the EDHS[38] and ranked into five (poorest, poorer, middle, richer, and richest) levels.

Data collection tools and procedures

An interviewer-administered standardized structured questionnaire was used after reviewing different studies and guidelines.[26 31 34 35 37 39-46] The tool was initially developed in English and translated into the local language (Amharic) and finally back to English to ensure consistency. Four trained BSc. degree graduate nurses and two public health officers of the same qualification from the nearby Sawla district were recruited as data collectors and supervisors, respectively. The supervisors checked data accuracy, consistency and completeness daily.

Data quality control

Before data collection, a one day training was given to data collectors and supervisors on the objectives of the study, data collection instruments, techniques and producers. The data collectors were supervised daily, and the consistency and completeness of data were checked by the principal investigator every night. A pretest was conducted on 21 women (5% of the sample size) of Demba Gofa (one of the neighboring districts with similar characteristics). Before the actual data collection, all findings from the pretest were incorporated into the final questionnaire and amendments were made.

Data processing and analysis

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

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

Patient and public involvement

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

Ethical considerations

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

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

RESULTS

Sociodemographic and economic characteristics of participants

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

Table 1 Sociodemographic and economic characteristics of study participants in Geze Gofa 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 (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

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

Health extension program services and other related characteristics

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

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

Obstetric history and maternal health services

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

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

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

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

Postpartum and immediate newborn care services

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

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

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

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

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

Newborn care services during the first two months of age

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

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

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

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

Community-based newborn care utilization

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

Factors associated with community-based newborn care utilization

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

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

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

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

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

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

Variables	CBNC utilized	CNBC not utilized	COR (95% CI)	AOR (95% CI)
	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)

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

DISCUSSION

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

sociodemographic variations of study areas. Moreover, stronger and more resilient health systems which focus on community-based service provisions like the health extension program in Ethiopia may explain some of the discordance in the findings of the current and other studies.[47-49] Results however were lower than that of a study done at Sohag Governorate, Egypt, and showed that 50.4% of the women achieved the continuum of care.[32] In addition, a study conducted in Cambodia showed that 60% of women had the full range of services for the continuum of maternal and newborn healthcare.[50] This discrepancy might be due to the use of only maternal continuum of care which did not include newborn care that could give a higher result. A study conducted in Cambodia used a national survey which might have resulted in a higher findings and the study area and socio-cultural variations might be other possible reasons.

Our study showed that 98.1% of the women received ANC services once, 76.8% four times and above; 62.8% of women delivered at a health facility, and the health status of 60.3% of newborns was checked by HEWs until two months of age. Our finding is higher than that of a study conducted in Ratanakiri province, Cambodia, in which only 32.6% of the women made four and above visits in the continuum of maternal, newborn, and child health services.[51] The possible explanation might be the difference in the target group, which included women who gave birth two years before the study which might have resulted in forgetting the services they took. The other possible reason might be the difference in the service delivery pace for ANC follow ups. Our study included services taken at the health post level, while their study measured ANC service follow ups at health centers and hospitals only. Our findings is lower than that of a study conducted in Sohag Governorate, Egypt, which showed that 90% of the women visited four and above antenatal care.[32] The reason for our low results may be the sociodemographic variability, as we have only assessed the utilization for rural residents. Moreover, the presence of better maternal

and child health services achievement in Egypt might be the possible explanation for this higher findings.[52]

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

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

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

fact that the program in our study area aimed to serve the poorest households at health post and household levels to increase service access. The other possible explanation might be that wealthier families can afford the direct and indirect costs of services of health centers or hospitals and seek more quality care at higher facilities by well-trained providers. Additionally, the program in our case is a free service that does not incur any cost on those who cannot seek other services at advanced or higher facilities.

In this study, women who preferred to visit hospitals when they faced danger signs had a 70.4% lower chance of utilization of the community-based newborn care services compared to those who preferred health posts. According to the Ethiopian health tier system, health posts are more accessible than hospitals; so, those who want to visit hospitals might not get the services as easily as they need.[58] This result is in line with that of a study in Pakistan and showed that the absence of difficulties for access to health facilities increases the use of maternal, newborn, and child healthcare continuum by 76.1 and 72.9%, respectively.[33] The other possible explanation might be that the effectiveness of community health workers in delivering preventive maternal and child health interventions in low- and middle- income countries[59] increases community-based service acceptability in rural communities.

Limitations of the study

The finding was not triangulated by qualitative methods which are also subject to social desirability bias owing to our use of an interviewer-administered questionnaire. To minimize the impact, data collectors were recruited from other districts. Moreover, the women might have experienced recall bias, particularly regarding the services they received during their previous obstetrics, ANC visits, for instance. Compared to other studies however our work assessed later

events that preceded the study by only six months. On top of that, the data collectors were highly experienced and well-trained on the tools to explain the questions and extend the time for respondents so they recall events later.

CONCLUSIONS

The study showed that community-based newborn care utilization in the study area was low compared to the current national recommendations. Elementary school, college and above education as well as the poorest and middle wealth status affected the utilization positively, whereas farming occupation and preference of hospitals in case of danger signs affected the utilization negatively. Therefore, awareness creation at community levels for illiterate women, arranging convenient time for farmer women and providing full components of maternal and newborn services in nearby community level health facilities could improve the utilization of community-based newborn care program in rural districts. Furthermore, subsequent studies must explore the barriers for low utilization of community-based newborn care services using qualitative methods and also better if studies assessed the effectiveness of the program on maternal and child health outcomes.

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Patient consent Obtained

Ethical approval Ethical approval was obtained from the ethical review board of Jimma University (Ref. No. IHRPGC/418/2017). The official letter of co-operation was obtained from the Geze Gofa district health office.

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

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

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

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