Postnatal home visits by health extension workers in rural areas of Ethiopia: a cross-sectional study design

Yemane Berhane Tesfau

  Adigrat University College of Health Sciences

Alemayehu Bayray Kahasay

  Mekelle University College of Health Sciences

Tesfay Gebregzabher Gebrehiwot

  Mekelle University College of Health Sciences

Araya Abrha Medhanyie

  Mekelle University College of Health Sciences

Hagos Godefay

  Tigray Regional Health Bureau, Mekelle, Ethiopia

Research article

Keywords: Postnatal home visits, Health extension workers, rural districts, Northern Ethiopia

---

Abstract

Background : In low-income countries like Ethiopia, where families have poor access to or do not utilize services of formal health care systems, community health workers provide postnatal care services through home visits. However, the extent and effectiveness of home-based postnatal visits by community health workers such as the Ethiopian health extension workers (HEWs) are not well explored. This community -based study aimed to determine the coverage, contents of postnatal home visits and associated factors by health extension workers in Northern Ethiopia.

Methods : We conducted a community based cross-sectional study in the rural Districts in Northern Ethiopia from August to September 2018. A total of 705 mothers who gave a live birth in the year preceding the survey were selected using multistage random sampling. A structured questionnaire was applied to collect data by interviewing mothers. Data were analyzed using SPSS version 22 statistical software. Association of postnatal home visits with possible explanatory variables was investigated using logistic regression.

Results : One hundred two (14.5%) mothers and newborns received PNC home visit within three days after birth from HEW and 170(24.1%) reported postnatal home visits within 42 days. Among the mothers who received postnatal home visits, 6.5% measured their blood pressure, 11.2% measured their temperature, 20% counseled about family planning, 16.5% counseled on newborn danger signs, 11.2% counseled on the skin to skincare of the newborn and 14.1% of their newborns were measured their weight at home. Mothers who received at least one home visit during pregnancy (AOR, 7.58; CI 3.59-15.98), participated in pregnant women forum (AOR, 3.21; CI 1.70-6.05), notified their birth (AOR, 6.15; CI 3.50-10.80) and those member of community health insurance (AOR, 1.88; CI 1.14-3.12) were significantly associated factors with postnatal home visit by a health extension worker.

Conclusion : The coverage of postnatal home visits by health extension workers remains low in rural districts of Northern Ethiopia. Existing health systems should consider interventions that improve pregnancy and birth notification strategies and more efforts should be made at improving community-based participation and linkages with community health workers.

Background

Globally, about 4 million neonates die every year. Of these, about 71% of deaths occur within the first week of life and 1.2 million dies on the first day following birth. Furthermore, estimated 287,000 maternal deaths occur each year, mostly in low- income countries, due to obstetric complications occurring within 24 hours of birth and thereafter (1). In Ethiopia, maternal and neonatal mortality remains the highest among the world, at 412/100,000 and 29/1,000, respectively. In other words, in Ethiopia 1 in every 33 children dies within the first month, 1 in every 23 children dies before celebrating the first birthday, and 1 of every 18 children dies before reaching the fifth birthday based on recent Ethiopia Mini Demographic and Health Survey (EMDHS)(2).

Despite the fact improvements observed on antenatal care (ANC) and facility delivery, PNC utilization coverage remains low due to many reasons such as unavailability, inaccessibility, poor quality of health services, socio-cultural beliefs, awareness on danger signs of postnatal period, long waiting time and distance (3–10). Even with different multiple interventions, postnatal maternal and new-born care utilization at the facility remains low (2, 11). Studies also showed that a significant proportion of mothers prefer to return home or discharged within a few hours after delivery which makes them not receive the required care(12, 13).

Studies in low and middle -income countries with high new-born mortality demonstrated that early postnatal home visits, by community health workers help to reduce neonatal deaths and improve maternal and neonatal health. For example, studies conducted in India, Bangladesh, and Pakistan have shown that home visits can reduce deaths of newborns by 30–61% in developing countries where there is high mortality. In particular, home visits improved coverage of the key high-impact and cost-effective neonatal interventions such as early initiation of breastfeeding, skin-to-skin contact between newborns and their mothers, delayed bathing of the newborn, hygienic care of the baby's umbilical cord stump (14).

Based on the experiences and evidence from South Asian trials, in 2009, WHO and UNICEF issued a joint statement recommending PNHVs for delivery of postnatal care. Following the 2009 Joint Statement, many countries adopted policies to deliver postnatal home visits. Among the 75 countries included in the Countdown to 2015 report, 59 have policies to deliver such home visits within one week of birth(15, 16).

The health extension program, which was launched in 2003 contributed to mobilizing community members towards the utilization of antenatal care and institutional delivery. HEWs were trained to give basic maternal and child health care and improve the health of the mothers and newborns during the antenatal, delivery and postnatal period and HEWs are expected to spend 75% of their time in the community and provide essential health services through the house to house visit(17).

Postnatal home visiting by the HEWs includes assessing both mother's and neonate's general physical examination and vital signs; checking cord; checking for danger signs such as any bleeding, convulsion, breathing problems, any health problems; counseling about breastfeeding, skin to skin contacts; and providing health education based on mother's health status(18).

Studies on the coverage of postnatal visit within 48 hours showed low(19) and the coverage within three days after delivery from three Countries (Bangladesh, Nepal, and Malawi) by Community Health Workers(CHWs) showed that 57%, 50%, and 11% respectively and the pooled results of the study in these countries found that early visits were more likely if a mother had been visited by CHWs during pregnancy, birth notification by CHWs, and home deliveries(20).

In Ethiopia, since the implementation of the health extension program (HEP), few studies have published findings on the coverage of PNHVs by HEWs. In Southern Ethiopia, 12.4% of mothers and their neonates were visited by the HEWs during the first month of birth and the major factors associated with early

PNHVs were HEWs visit home during pregnancy, skilled delivery, and having HEW's cell phone and no association were observed with maternal socio-demographic characteristics and early PNHVs (21, 22)

In the northern Ethiopia, to improve the lives of mothers and newborns, different activities have conducted by HEWs in line with the government's policies and strategies and EDHS report showed the percentage of facility-based postnatal care utilization within the first two days after delivery was 45.4% (23). However, paucity exists on the evidence about the coverage of early PNHVs by HEWs. Moreover, little is known about the contents of care given during PNHVs. Therefore, the study aimed to determine the coverage and contents of PNHVs and associated factors by HEWs in rural Tigray, northern Ethiopia.

Methods

Study setting

The study was conducted in four districts of the South Eastern Zone of Tigray region, namely, Dogua Tembien, Enderta, Hintalo-Wajerat, and Seharti-Samre. This zone surrounds the capital city of Tigray region, Mekelle. The four districts had a total population of 567,735 with the total households estimated at 129,031. The zone has a total of 88 villages/kebeles (17-Enderta, 24- Dogua-Tembien, 23- Seharti-Samre and 24- Hintalo-Wajerat district). The estimated live births with children aged 11 months and below in the study area were 17,600. In 2018, there were 03 primary hospitals, 24 health centers and 75 health posts in the study zone. Concerning the number of health professionals, there were 731 health care providers in the zone out of which 183 were health extension workers (HEWs) (24).

Study design and population

We conducted a community-based cross-sectional survey among mothers who gave live birth in the past year before the survey/data collection.

Sample size and sampling technique

A single population proportion formula was used to determine the sample size. To consider the design effect of 1.7, we assumed a rate of homogeneity (Roh=0.05) and Coefficient of variance (CV=0.25) for unequal size clusters. Using a 10 % of none response rate the total sample size was 705. The study employed a multi-stage sampling at the kebele and household level. All districts in the zone were involved in the study. In the first stage, 30 clusters/kebeles were selected using simple random sampling out of 88 clusters found in the zone (6-Enderta woreda, 8- Dogua-Tembien, 8- Seharti-Samre and 8- Hintalo-Wajerat). The list of mothers with infants less than one year was registered in each cluster. A total of 138 participants from Enderta, 178 participants from Dogua Tembien, 195 participants from Seharti-Samre and 194 participants from Hintalo-Wajerat district were recruited.

Data source and measurement

Data were collected with an interviewer-administered structured questionnaire that was adapted from EDHS and the last 10 kilometers (L10K) survey (23, 25). The tool contains items regarding socio-demographic, status towards model household, community based participations like pregnant women forum, women development group (WDG), and community health insurance membership, availability of HEW's cell phone at home, time taken to visit the household, ANC attendance (both facility and home), place of delivery, birth notification, attendants at birth, postnatal visits and contents of PNC provided. It was initially prepared in English and then translated into the local language (Tigrigna) and translated back to English by different language experts. The questionnaire was pre-tested prior to the commencement of actual data collection outside the study districts. A total of 20 field workers (BSc and above in nursing, and midwifery) were recruited for the data collection and two days training was given for the data collectors. The interviewers visited each eligible woman at her home to administer the survey. Day to day supervision of the data collection was made by the principal investigator and supervisors of the study. A protocol that guides the design, implementation and management of the survey was developed and given to the data collectors. Supervisors reviewed all completed questionnaires in the field for accuracy, consistency, and completeness. Data were collected from August – September 2018. In this study, the postnatal home visit is defined at least one home visit by HEW within three days after childbirth. The coverage of postnatal home visits was defined as the percentage of women and/or newborns that were visited at home within three days after delivery. The contents of the postnatal home visits were measured by mothers/caretakers words .i.e. by mention or not mention technique (mention=1, not mention=0).

Data analysis

Data were entered and analyzed using SPSS Version 22.0 Descriptive statistics were used to summarize the data and the results were presented using texts, tables, and figures. Binary logistic regression analysis was employed. Crude and adjusted odds ratios with 95% confidence intervals corresponding to the variables included in a logistic model were calculated to assess the association between explanatory variables and postnatal home visit. Multi co-linearity was checked and model fitness using Hosmer and Lemeshow Test was conducted prior to running to multivariable analysis. A p-value of less than 0.05 was considered to be statistically significant.

Ethics approval and consent to participate

Ethical approval was obtained from the Institutional Review Board of Mekelle University (No.1437/2018). Verbal consent was also obtained from the study participants. We secured verbal consent as a significant number of the study subjects were unable to read and write. The use of verbal consent was approved by the ethics committee.

Result

Participant characteristics

We enrolled a total of 705 mothers with a 100% response rate in the study; of these, about 250(35.5%) were in the age group of 30 to 39 years with the mean age of 27.5 years (±5.77). About three-fourth, 502(71.2%) of the study participants can read and write a simple sentence, though, 284(40.3%) mothers had never attended a school. Almost all 701(99.4%) participants were Christian Orthodox. More than half 418(59.3%) of mothers were visited during pregnancy by a HEW. However, 371(88.8%) of the mothers have not received the visit during their first trimester. About 684(97%) of respondents reported making at least one antenatal care visit to a health facility, and 247(36.1%) reported 4 or more visits. Above half of the respondents, 390(57%) initiated antenatal care before 16 weeks of pregnancy. Facility deliveries were reported by 629(89.2%) of the participants, however, 591(81.8%) of them had a facility stay of less than 24 hours post-delivery. The average number of live births per mother was 3.12(±1.9). Concerning to the distance from the health post majority of the mothers, 501(71.1%) found less than 30 minutes of walking distance (**Table 1**).

Table 1 Sociodemographic characteristics of mothers and their neonates in the rural Tigray region, Northern Ethiopia, 2018

Variables	Frequency	Percentage
Current maternal age		
18-24	245	34.8
25-29	183	26
30-39	250	35.5
40-49	27	3.8
Maternal education		
No education	284	40.3
Primary education	250	35.5
Secondary education and above	171	24.3
Marital status		
Married and/ live together	647	91.8
Divorced/separated/widowed	58	8.2
Sex of newborn		
Male	357	50.6
Female	348	49.4
Children ever born		
1	163	23.1
2	167	23.7
3	113	16
+4	262	37.2
Distance to nearest health facility(one way)		
<30 min	501	71.1
30 min to <1 hrs.	160	22.7
>=1hr	44	6.20

Postnatal home visit coverage

Overall, 102(14.5%) with (95% CI= 12.0 to 17.3) of mothers and their newborns received a home visit from a HEW within three days after birth. Within the Postnatal period, about 273 PNHVs and 170 (24.1%) participants were visited by the HEWs. Out of the PNHVs performed, 67(39.4%) of mothers and their neonate received only one visit, 77 (45.3%) received two visits, 23 (13.5%) visited three times, and 03(1.8%) received four times by the HEWs (**Figure1**). Out of the total of home deliveries, only 08(10.5%) of mothers and their newborns received PNHVs within three days after delivery. **Table2** shows the timing of each visit where only 39(22.9%) mothers and their newborns received PNHV within the critical time i.e. within 24 hours. In the second visit, the majority of the participants 71(92.2%) received PNHVs after the third day of delivery. In the third visit 18(78.3%) of mothers and their neonates received PNHVs after seven days. Six out of 77 participants (7.8%) of their second visit were at 2-3 days and 5/23(21.7%) of the visit were at 4-7 days.

Table 2 Coverage of PNHVs by HEWs in rural Tigray Northern Ethiopia, 2018

Maternal and newborn postnatal home receipt coverage(N=705)	Frequency	%
Overall PNHVs within 42 days after delivery		
No	525	75.9
Yes	170	24.1
PNHV receipt within three days after delivery (n=705)		
No	603	85.5
Yes	102	14.5
Initial PNHVs (n=170)		
Within 24 hours	39	22.9
2-3 days	63	37.1
4-7 days	53	31.2
After 7 days	15	8.8
Second PNHVs (n=77)		
2-3 days	06	7.8
4-7 days	36	46.8
After 7 days	35	45.4
Third PNHVs (n=23)		
4-7 days	05	21.7
After 7 days	18	78.3
Fourth PNHVs (n=3)		
After 7 days	03	100

Out of 76 home deliveries, only 13(17.1%) 08(10.5%) of mothers and their newborn received PNHVs in the postnatal period and within three days after delivery respectively. Whereas, 472(75%) of facility deliveries did not receive PNHVs after delivery. Immediately after delivery, 55(7.8 %) and 31(4.4%) of mothers were visited by women development group (WDG) leaders and Traditional birth attendants respectively (**Figure 2).**

(**Fig3**) demonstrates that 102(60%) maternal and newborn received first/ initial PNHVs within three days; 53(31.2%) at 4-7 days, and 15(8.8%) after 7 days within the postnatal period.

Postnatal care contents provided during a home visit

Out of 170 mothers who were visited at home, 67(39.4%) of them checked for heavy bleeding, 75(44%) of mothers advised about their own postnatal danger sign, 19(11.2%) of mothers measured their temperature, 11(6.5%) of mothers measured their blood pressure at home and no mother was mentioned counseling about safe sexual practice **(Table 3).**

Table 3 Contents of maternal PNC provided by HEWs in rural Tigray, Northern Ethiopia, 2018

Postnatal contents	Frequency (N/%)
The proportion of mothers:	
Underwent body examination	37(21.8%)
Checked heavy bleeding	67(39.4%)
Measured their body Temperature	19(11.2%)
Measured their Blood pressure	11(6.5%)
Counseled about personal hygiene	48(28.2%)
Counseled about family planning	34(20%)
Checked about TT immunization	6(3.5%)
Counseled about breastfeeding	54(31.8%)
Counseled about own feeding	57(33.5%)
Checked for Iron intake	4(2.4%)

(Figure4) shows newborn contents mentioned by the mothers. A general assessment of newborns was done for 44(25.9%), newborn weighed 24(14.1%), checked their cord 70(41.2%), and 26(15.3%) newborns were measured their temperature.

Factors associated with PNHV receipt

We calculated the adjusted odds ratio of maternal characteristics associated with the PNHV receipt (Table 4). The results revealed that, mothers who received at least one home visit during pregnancy by HEWs (AOR, 7.49; CI 3.55-15.80), participated in pregnant women forum (AOR, 3.16; CI 1.67-5.99), notified their birth (AOR, 6.16; CI 3.50-10.84) and those members of community health insurance (AOR, 1.87; CI 1.13-3.10) had statistically significant positive association with postnatal home visits by health extension workers within three days after delivery. Educational status, the status of mothers on model family, time taken to travel health post, and availability of HEW's cell phone at home did not show any statistically significant association with postnatal home visits.

Table 4 Association of participants' characteristics with postnatal home visit receipt, rural Tigray, northern Ethiopia, 2018 (N=705)

Characteristics of respondents	Received PNHVs		Crude Odds Ratio		Adjusted Odds Ratio	
	Yes (%)	No (%)	Odds ratio	95% CI	Odds ratio	95% CI
Educational status of the mother						
No education	34(12.0)	250(88.0)	1.00		1.00	
Primary Education	31(12.4)	219(87.6)	1.04	0.62-1.75	0.86	0.48-1.57
Secondary education. and above	37(21.6)	134(78.4)	2.03	1.22-3.38	1.56	0.85-2.87
Model household status						
Did not hear and/not model family	59(12.7)	407(87.3)	1.00		1.00	
Yes/certified or non-certified model family	20(29.0)	49(71.0)	2.82	1.56-5.07	1.24	0.61-2.52
Working towards model family	23(13.5)	147(86.5)	1.08	0.64-1.81	0.73	0.40-1.33
ANC visit by HEW(at least1)						
No	9(3.1)	278(96.9)	1.00		1.00	
Yes	93(22.2)	325(77.8)	8.84	4.38-17.85	7.49*	3.55-15.80
HEWs cell phone available						
No	34(8.9)	346(91.1)	1.00		1.00	
Yes	68(20.9)	257(79.10	2.69	1.73-4.19	1.31	0.78-2.21
Participation in Pregnant women forum						
No	15(4.7)	306(95.3)	1.00		1.00	
Yes	87(22.7)	297(77.3)	5.98	3.38-10.58	3.16*	1.67-5.99
Community health insurance membership						
No	51(10.7)	425(89.3)	1.00		1.00	
Yes	51(22.3)	178(77.7)	2.39	1.56-3.66	1.87*	1.13-3.10
Birth notification						
No	19(4.7)	387(95.3)	1.00		1.00	
Yes	83(27.8)	216(72.2)	7.83	4.63-13.24	6.16*	3.50-10.84
Time taken to Health post						
<30 minute	81(16.2)	420(83.8)	1.00		1.00	
30-1 hour	16(10)	144(90)	0.58	0.33-1.02	0.73	0.38-1.39
>1 hour	5(11.4)	39(88.6)	0.66	0.25-1.74	0.92	0.30-2.81

Discussion

Our study showed a low coverage, 170(14.5%) mothers and newborns received PNHVs within three days after delivery. In our study, throughout the postnatal period, 170 (24.1%) mothers and their newborns received PNHVs by the HEWs. Among those who had a history of visits, 39(22.9%) received their initial PNHVs within 24 hours. Out of the total home deliveries, only 13(17.1%) and 08(10.5%) of mothers and

their newborn received PNHVs in the postnatal period and within three days after delivery respectively. The contents of PNHV provided for the mothers includes: 37(21.8%) underwent body examination, 67(39.4%) checked for heavy bleeding, 19(11.2%) measured their body temperature, 11(6.5%) measured their blood pressure, 34(20%) counseled about family planning, 54(31.8%) counseled about breastfeeding, 57(33.5%) counseled about maternal feeding and 4(2.4%) checked for Iron intake. For the newborns, the contents of the visit were as follows: 24(14.1%) of the neonates were weighed, 70(41.2%) were checked for cord care, 45(26.5%) were observed for breastfeeding, 28 (16.5%) were counseled and checked for newborn danger signs, 26(15.3%) of newborns measured their body temperature and 19(11.2%) were counseled on skin to skin contact. Home visits during pregnancy by HEWs, participated in pregnant women forum, birth notification to HEWs and being members of community health insurance had a statistically significant association with receipt of postnatal home visits.

Evidences showed that early postnatal home visits by community health workers reduce maternal and newborn morbidity and mortality, especially at higher coverage (14). However, our finding showed that the percentage of mothers and neonates who received PNHV within three days was 102(14.5%). This is consistent with the studies on the contact coverage of postnatal visits within 48 hours of birth following home births in Africa and Asia (19, 26). Previous studies also demonstrated that the coverage of PNHVs was low with only 4 countries having over 50%% (27). Our finding is higher than a study conducted on newborn care practices at home and in health facilities in Ethiopia and Malawi (28, 29). However, it is very low compared to other studies done in Uganda, Nepal, Bangladesh, and Ghana (20, 30, 31). This might be due to HEWs were engaged in different activities and loaded because of increased population and multiple other competing responsibilities(32, 33).

It is known that timely and quality delivery of maternal and newborn interventions at high coverage can reduce maternal and newborn complications. However, the contents of postnatal care provided by HEWs during PNHVs to the mother and newborn, in general, were low in this study compared to previous studies (22, 30). This could be due to little attention given towards postnatal services by HEWs, and government officials; as evidenced from our finding that showed 418(59.3%) mothers received at least one ANC visit at home.

The findings regarding the association of home visits during pregnancy and PNHVs were mixed (34). In this study, HEWs household visits during pregnancy had a significant positive association with receipt of PNHVs by the mothers and their newborns. ANC offers women the opportunity to access health information and to appreciate the importance of PNC. Similar findings were reported from different studies (22, 35–37). This might be due to frequent contact during pregnancy and forming close relationships with the mothers so that they can notify them at the delivery or in the postnatal period. Other reasons might be the HEWs were aware of the expected date of delivery (EDD) and could contact through community linkages. Thus, rigorous efforts by HEWs are necessary to visit pregnant women at home.

Early visits were also more likely if a mother had notified the HEW about the birth. Similar findings were noticed when CHWs are notified of the birth early, they are much more likely to visit home after delivery. Previous studies also have shown that mothers who have notification of their birth increase the maternal and newborn health service utilization(22, 35).

Consistent with previous studies, Participation in pregnant women forum was associated with receipt of postnatal home visits by HEWs. Thus, it is an opportunity to receive a continuum of care from pre-facility, facility and post facility (35).

Mothers that were members of community health insurance were more likely to receive PNHVs.

Even though, a paucity of information on the association of this variable with PNHVs found, findings showed that maternal postnatal visit is more likely if the mother is a member of community health insurance(8). This might also although, a postnatal home visit is for free, the need for health-seeking of the community and communication and linkage with service providers increased. Another possible reason could be mothers who received postnatal home visits might be with birth-related complications.

Therefore, in addition to pregnancy visits, efforts should make for the mothers to enroll in the community-based health insurance.

As a limitation, it is difficult to remember the accurate contents provided by health extension workers during the postnatal period because of the recall bias. In this study, though, perceived economic status was used, the household wealth status was not assessed as a factor which may affect PNHVs.

Conclusion

Our findings show that the coverage of postnatal home visits by HEWs remains low in rural districts of Northern Ethiopia. The factors associated with PNHVs include a home visit by HEWs during pregnancy, participation in pregnant women forum, birth notification and, being a member of community health insurance. Existing health systems should consider interventions that improve pregnancy and birth notification strategies and more efforts should be made at improving community-based participation and linkages with community health workers.

Abbreviations

ANC   Antenatal Care

AOR   Adjusted Odds Ratio

BSc   Bachelor of Science

CHWs   Community Health Workers

CI   Confidence Interval

CV   Coefficient of Variance

EDD   Expected Date of Delivery

EDHS   Ethiopia Demographic Health Survey

EMDHS   Ethiopia Mini Demographic Health Survey

HEWs   Health Extension Workers

IRB   Institutional Review Board

L10K   Last Ten Kilometer

OR   Odds Ratio

PNC   Postnatal Care

PNHVs   Postnatal Home Visits

Roh   Rate of Homogeneity

SD   Standard Deviation

SPSS   Statistical Packages for Social Science

UNICEF   The United Nations International Children's Emergency Fund

WDG   Women Development Groups

WHO   World Health Organization

Declarations

Ethics approval and consent to participate

This study was approved by the Institutional Review Board of Mekelle University (IRB No.1437/2018). Verbal consent was obtained from the participants. The use of verbal consent was approved by the ethics committee.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study will be available from the corresponding author on reasonable request.

Competing interests

We, the authors, declare that we don't have any competing interests.

Funding

This study was financially supported by Adigrat University and the " Tigray KMC Project" which is funded by Bill and Melinda Gates foundation and World Health Organization; Grant Number : 201526690. The funding body had no any role in the design of the study, collection, analysis, interpretation of data, and in writing the manuscript.

Authors' contributions

All authors have read and approved the final version of the manuscript. Research concept developed by YBT ABK TGG HGD AAM. Research questionnaire development by YBT ABK TGG HGD AAM. Data collection and analysis: YBT ABK TGG. Wrote the paper: YBT ABK TGG HGD AAM

Acknowledgments

The authors are grateful to the Tigray regional health bureau and the four district health offices for their facilitation and support of the fieldwork. Lastly, the authors would like to thank the data collectors and the study participants.

Author's information

Not applicable.

References

1. Sines E, Syed U, Wall S, Worley H. Postnatal care: A critical opportunity to save mothers and newborns. Policy Perspectives on Newborn Health2007:1-7.
2. Central SA. Ethiopia mini demographic and health survey 2019. Indicators. In: Program TD, ICF Rockville M, USA, editors.: Central Statistical Agency Addis Ababa, Ethiopia; 2019.
3. Kerie MW, Deressa AA. Contribution of the Health Services Extension Program to improve coverage and comprehensiveness of primary health care services in Jimma Zone, Southwest Ethiopia.
4. Workineh YG, Hailu DA. Factors affecting utilization of postnatal care service in Jabitena district, Amhara region, Ethiopia. Sci J Public Health;23:169-76.
5. Limenih MA, Endale ZM, Dachew BA. Postnatal care service utilization and associated factors among women who gave birth in the last 12 months prior to the study in Debre Markos town,

Northwestern Ethiopia: a community-based cross-sectional study. International journal of reproductive medicine;2016.

6. Akibu M, Tsegaye W, Megersa T, Nurgi S. Prevalence and Determinants of Complete Postnatal Care Service Utilization in Northern Shoa, Ethiopia. Journal of pregnancy;2018.

7. Ugboaja JO, Berthrand NO, Igwegbe AO, OBI-Nwosu AL. Barriers to postnatal care and exclusive breastfeeding among urbanwomen in southeastern Nigeria. Nigerian medical journal: journal of the Nigeria Medical Association;54(1):45.

8. DiBari JN, Yu SM, Chao SM, Lu MC. Use of postpartum care: predictors and barriers. Journal of pregnancy;2014.

9. Probandari A, Arcita A, Kothijah K, Pamungkasari EP. Barriers to utilization of postnatal care at village level in Klaten district, central Java Province, Indonesia. BMC health services research;17(1):541.

10. Tarekegn SM, Lieberman LS, Giedraitis V. Determinants of maternal health service utilization in Ethiopia: analysis of the 2011 Ethiopian Demographic and Health Survey. BMC pregnancy and childbirth;14(1):161.

11. Czuk CL. Women's Perceptions of Postpartum Appointment Keeping Barriers. 1997.

12. Sinha LN, Kaur P, Gupta R, Dalpath S, Goyal V, Murhekar M. Newborn care practices and home-based postnatal newborn care programmeâ€"Mewat, Haryana, India, 2013. Western Pacific surveillance and response journal: WPSAR;5(3):22.

13. Varma DS, Khan M, Hazra A. Increasing postnatal care of mothers and newborns including follow-up cord care and thermal care in rural Uttar Pradesh. The Journal of Family Welfare;56:31-42.

14. Gogia S, Sachdev HS. Home visits by community health workers to prevent neonatal deaths in developing countries: a systematic review. Bulletin of the World Health Organization;88:658-66.

15. Requejo J, Victora C, Bryce J. Countdown to 2015: A decade of tracking progress for maternal newborn and child survival. The 2015 Report.

16. Hodgins S, McPherson R, Kerber K. Postnatal care with a focus on home visitation: A design decision-aid for policymakers and program managers.

17. Bilal NK, Herbst CH, Zhao F, Soucat A, Lemiere C. Health extension workers in Ethiopia: improved access and coverage for the rural poor. Yes Africa Can: Success Stiroes from a Dynamic Continent:433-43.

18. Warren C, Daly P, Toure L, Mongi P. Postnatal care. Opportunities for Africa‟ s Newborns Cape Town, South Africa: Partnership for Maternal, Newborn and Child Health2006:79-90.

19. McPherson R, Hodgins S. Postnatal home visitation: lessons from country programs operating at scale. Journal of global health;8(1).

20. Sitrin D, Guenther T, Murray J, Pilgrim N, Rubayet S, Ligowe R, et al. Reaching mothers and babies with early postnatal home visits: the implementation realities of achieving high coverage in large-scale programs. PLoS One2013;8(7):e68930.

21. Gebretsadik A, Alemayehu A, Teshome M, Mekonnen M, Haji Y. Home-based neonatal care by Health Extension Worker in rural Sidama Zone southern Ethiopia: a cross-sectional study. Pediatric health, medicine and therapeutics;9:147.

22. Sitrin D, Guenther T, Murray J, Pilgrim N, Rubayet S, Ligowe R, et al. Reaching mothers and babies with early postnatal home visits: the implementation realities of achieving high coverage in large-scale programs. PLoS One;8(7):e68930.

23. EDHS ED. Health Survey. Key indicators report2016.

24. SEZAO. (South-eastern Zone Administrative Office) of Tigray regionAnnual reports. 2018, Mekelle, Ethiopia

25. Koblinsky M, Tain F, Gaym A, Karim A, Carnell M, Tesfaye S. Responding to the maternal health care challenge: The Ethiopian Health Extension Program. Ethiopian Journal of Health Development;24(1).

26. Hanson C, Manzi F, Mkumbo E, Shirima K, Penfold S, Hill Z, et al. Effectiveness of a home-based counselling strategy on neonatal care and survival: a cluster-randomised trial in six districts of rural southern Tanzania. PLoS medicine;12(9):e1001881.

27. WHO/UNICEF. Informal meeting on provision of home-based care to mother and child in the first week after birth: follow-up to the Joint WHO. Report No.: 9241504617.

28. Callaghan-Koru JA, Nonyane BA, Guenther T, Sitrin D, Ligowe R, Chimbalanga E, et al. Contribution of community-based newborn health promotion to reducing inequities in healthy newborn care practices and knowledge: evidence of improvement from a three-district pilot program in Malawi. BMC public health;13(1):1052.

29. Callaghan-Koru JA, Seifu A, Tholandi M, de Graft-Johnson J, Daniel E, Rawlins B, et al. Newborn care practices at home and in health facilities in 4 regions of Ethiopia. BMC pediatrics;13(1):198.

30. Namazzi G, Okuga M, Tetui M, Muhumuza Kananura R, Kakaire A, Namutamba S, et al. Working with community health workers to improve maternal and newborn health outcomes: implementation and scale-up lessons from eastern Uganda. Global health action;10(sup4):1345495.

31. Kirkwood BR, Manu A, ten Asbroek AH, Soremekun S, Weobong B, Gyan T, et al. Effect of the Newhints home-visits intervention on neonatal mortality rate and care practices in Ghana: a cluster randomised controlled trial. The Lancet;381(9884):2184-92.

32. Legesse H, Degefie T, Hiluf M, Sime K, Tesfaye C, Abebe H, et al. National scale-up of integrated community case management in rural Ethiopia: implementation and early lessons learned. Ethiop Med J;52(Suppl 3):15-26.

33. Mangham-Jefferies L, Mathewos B, Russell J, Bekele A. How do health extension workers in Ethiopia allocate their time? Human resources for health;12(1):61.

34. Sitrin D, Guenther T, Waiswa P, Namutamba S, Namazzi G, Sharma S, et al. Improving newborn care practices through home visits: lessons from Malawi, Nepal, Bangladesh, and Uganda. Global health action;8(1):23963.

35. Tesfaye S, Barry D, Gobezayehu AG, Frew AH, Stover KE, Tessema H, et al. Improving coverage of postnatal care in rural Ethiopia using a community‐based, collaborative quality improvement approach. Journal of midwifery & women's health;59(s1):S55-S64.

36. Edmond KM, Yousufi K, Anwari Z, Sadat SM, Staniczai SM, Higgins-Steele A, et al. Can community health worker home visiting improve care-seeking and maternal and newborn care practices in fragile states such as Afghanistan? A population-based intervention study. BMC medicine;16(1):106.

37. Sakeah E, Aborigo R, Sakeah JK, Dalaba M, Kanyomse E, Azongo D, et al. The role of community-based health services in influencing postnatal care visits in the Builsa and the West Mamprusi districts in rural Ghana. BMC pregnancy and childbirth;18(1):295.

Figures
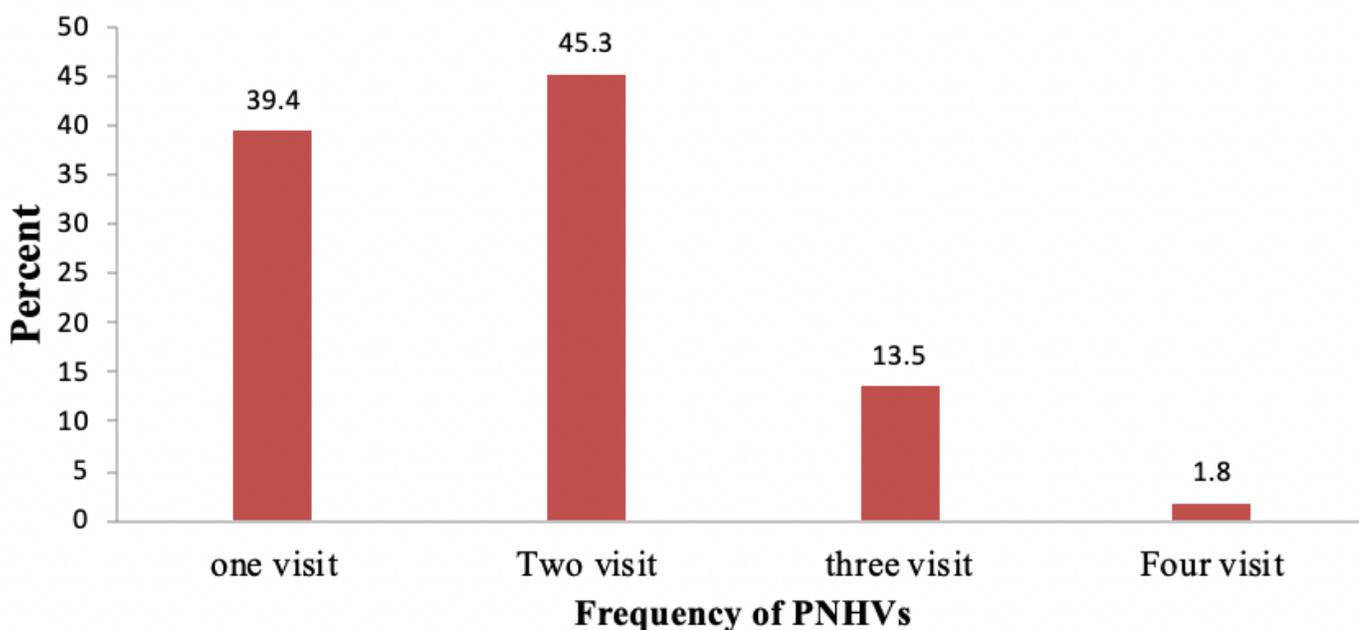
Figure 1

Proportion of mothers who gave birth by the number of visit received in Rural Tigray, northern Ethiopia
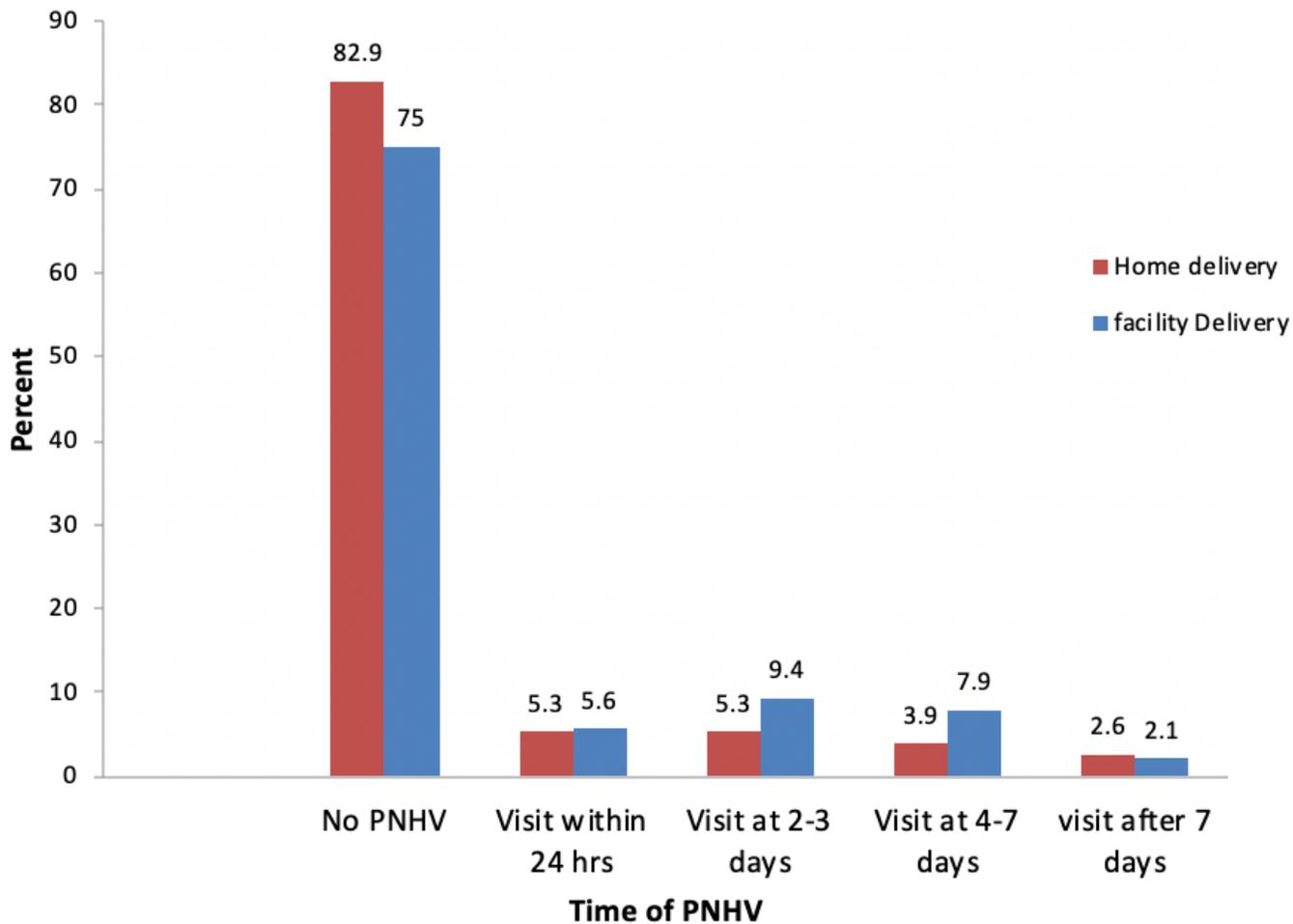
Figure 2

Percentage of mothers who received PNHVs within 42 days after birth by place of delivery
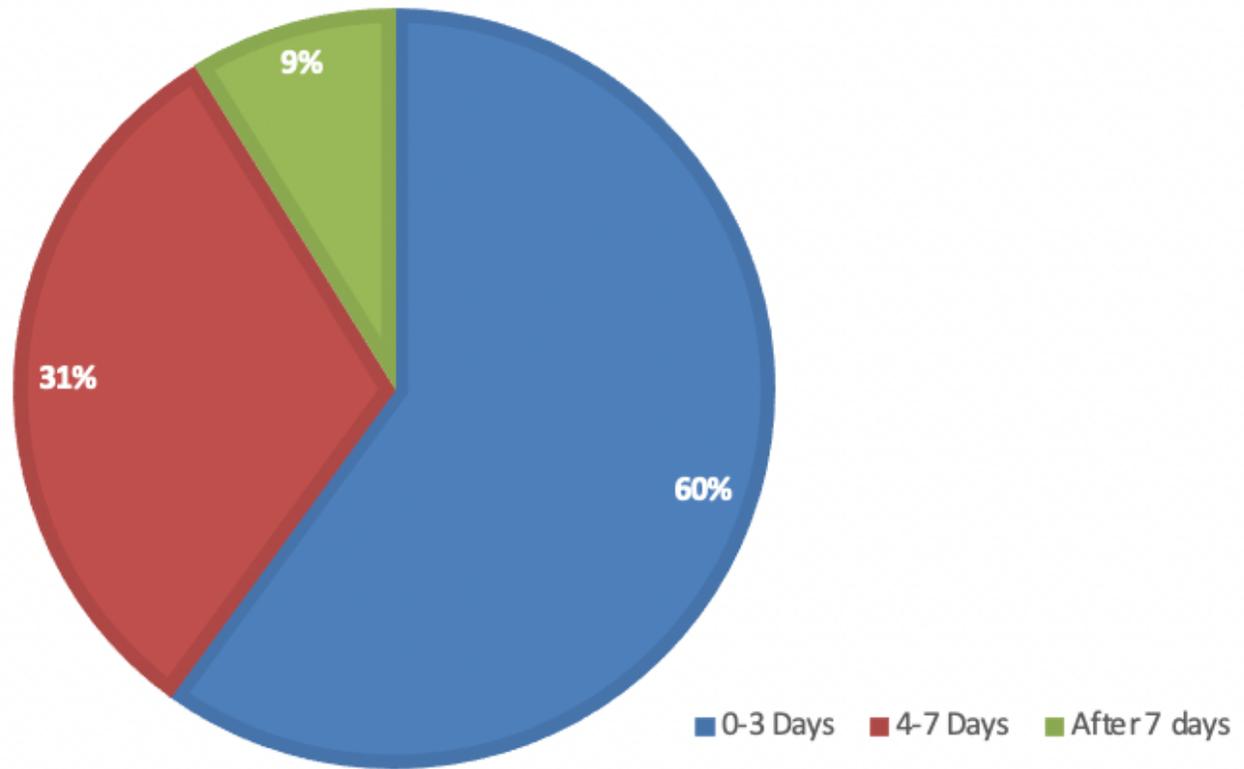
Figure 3

Percent of mothers and newborns who received PNHVs according the standard PNC schedule
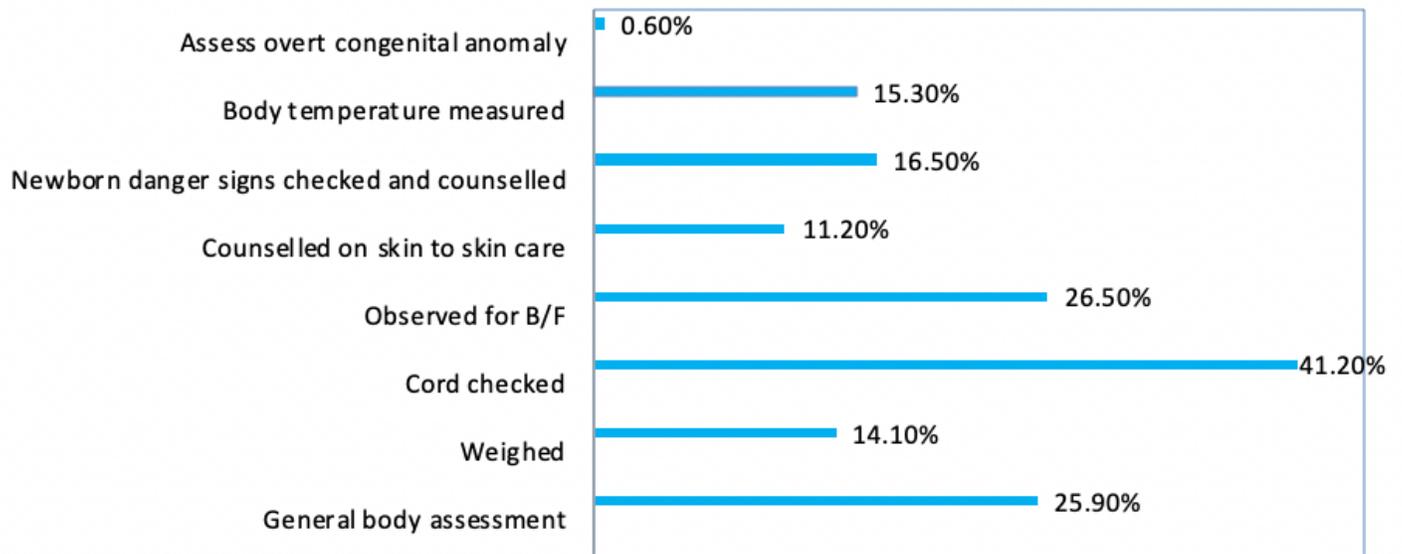
Figure 4

Type of PNHV contents delivered to newborns, in rural Tigray, Northern Ethiopia