

Neonatal Danger Signs knowledge and Associated Factors in Sodo District: Perspectives of Mothers in Southern Ethiopia

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Citation: Habtamu Girma, Sahilu Assegid, Muktar Beshir (2021) Neonatal Danger Signs knowledge and Associated Factors in Sodo District: Perspectives of Mothers in Southern Ethiopia. *J Public Health Dis Prev* 4: 108

Abstract

Background: Improving knowledge of mothers on neonatal danger signs and identification of neonates who requires a referral for severe illness has major public health importance to reduce mortality in this vulnerable population. However, data are scarce on mothers' knowledge on neonatal danger signs and associated factors in the context of Sodo district. Therefore, this study aimed to measure mothers' knowledge of neonatal dangers signs with its factors associated to provide valuable information for program improvement.

Methods: A facility based cross-sectional study was conducted in Sodo district, Gurage zone, Southern Ethiopia from March 1- April 27, 2019. A total of 397 mothers with a young infant were interviewed using a questionnaire adapted from literature. Cleaned data were coded and entered using open source software Epi data version 3.1 and the analysis was done using SPSS version 24. Descriptive statistics were employed to compute summary statistics and proportions. Bivariate and multivariable logistic regression analyses were applied to check and test the association between mothers' knowledge of neonatal danger signs and explanatory variables.

Results: More than half of mothers 55.7% (95% CI:50.6%,61.2%) had good knowledge of neonatal danger signs. Postnatal care follow-up (AOR:3.58,95%CI:1.96,6.53) and routine home visit (AOR:1.9,95%CI:1.21,2.99) were significantly associated with good knowledge of mothers on neonatal danger signs.

Conclusions: Post-natal care follow-up and routine home visit were found to be significantly associated with mother knowledge on danger signs and consistent with other studies in the literature. Therefore, intervention to improve mother's knowledge on neonatal danger signs should be considered as part of program improvement.

Keywords: Associated Factors; Danger Signs of Illness; Mothers' knowledge; Neonatal; Infant; Sodo District; Southern Ethiopia

List of abbreviations:

ANC:Antenatal care; CBNC:Community-Based New-born Care; EDHS:Ethiopia Demographic and Health Survey; HC:Health Center; HEW:Health Extension Worker; ICCM:Integrated Community Case Management; IMNCI:Integrated Management of New-born and Childhood illness; Km:Kilometer; PH:Primary Hospital; PHCU:Primary Health Care Unit; PNC:Postnatal Care

Background

The neonatal period is the primary 28 days of life. It is also divided into the early neonatal period (first 7 days) and late neonatal period (days 8-28). It is the most vulnerable time for a child's survival. Globally, the main causes of neonatal deaths are preterm birth complications, complications during labor and delivery (intrapartum-related complications), and sepsis. Together, these three causes account for almost three-quarters of all neonatal deaths [1,2].

Danger signs within the neonatal period are nonspecific and can be manifestation of almost all newborn disease. Neonates are more prone to show subtle signs of illness. The World Health Organization (WHO) strongly recommended specific danger signs that should be assessed during each postnatal care contact and the newborn should be referred for further evaluation, if any of the signs are present. Families should also be encouraged to seek health care early in the event that they identify any danger signs in between postnatal care visits. The danger signs are as follows; stopped feeding well, history of convulsions, fast breathing (breathing rate >60/min), severe chest in-drawing, no spontaneous movement, fever (temperature >37.5 °C), low body temperature (temperature <35.5 °C), and any jaundice in first 24 hr. of life, or yellow palms and soles at any age [3,4].

To improve the survival of newborns, Community Based Newborn Care (CBNC) has been incorporated with the Integrated Community Case Management (ICCM) platform of the Ethiopian Health Extension Program. This includes incorporating a newborn care package along with the continuum of care from pregnancy to childbirth and postnatal which will be carried out by community health workers. In addition, creating awareness and improving the knowledge of mothers about neonatal danger signs at each time and place of care is a critical issue to improve care-seeking behavior and to speed up the early referral of ill neonates that need urgent treatment and follow up [5-7].

Newborn mortality and stillbirths require greater visibility in the emerging post-2015 sustainable development agenda if the overall under 5 deaths is to be reduced. Sustainable Development Goals (SDG) goal 3 calls for an end to preventable deaths of newborns and children under 5 years of age and specifies that all countries should aim to reduce neonatal mortality to at least as low as 12 deaths per 1,000 live births and under-five mortality to at least as low as 25 deaths per 1,000 live births by 2030 [8,9].

In 2017 alone, 5.4 million children died before reaching their fifth birthday, 2.5 million of those children died in the first month of life. The burden of neonatal deaths is also unevenly distributed across regions and countries. Two regions account for almost 80 percent of the newborn deaths in 2017; sub-Saharan Africa accounted for 39 percent of all such deaths and Southern Asia accounted for 38 percent [9]. The recent report of 2016 Ethiopia Demographic and Health Survey (EDHS) findings indicate that all childhood mortality rates have declined over time. The under-5 mortality rate has declined from 116 deaths per 1,000 live births 10-14 years prior to the survey (2002-2006) to 67 deaths per 1,000 live births in the 0-4 years prior to the survey (2012-2016). The report of EDHS also indicates that the neonatal mortality rate was reduced from 49 to 29 deaths per 1,000 live births. Yet during the entire human lifespan, the day of birth is the day of greatest risk of death [10-13].

Among identified determinants of neonatal deaths, the presence of neonatal danger signs and maternal knowledge on neonatal danger signs was identified in previous studies [14-16]. Lack of maternal knowledge on danger signs and response to health problems noted by parents in the first month were found to be associated with a higher risk of neonatal death. And it is listed as one significant barrier to early identification and adequate treatment for a newborn with severe illness [15,17-23].

A newborn baby who is small or has a potentially life-threatening problem is in an emergency situation requiring immediate diagnosis and management. Delay in the identification of the problem or in providing the correct management may be fatal [24]. Therefore, improving maternal knowledge concerning neonatal danger sign is a key entry point and mothers need to know the danger signs of a sick newborn. They can explain these signs to others or family member in a simple language so as to enable them to identify the danger signs and to seek early and prompt medical care. Without measuring the status of mothers' knowledge on neonatal danger signs with its associated factors, the burden of neonatal mortality will keep increased posing challenges to the community and to the

healthcare. Nevertheless, there is a paucity of information on the status of mothers' knowledge and related factors in the southern Ethiopia, particularly in Sodo district.

Hence, this study aimed to assess the status of mothers' knowledge on neonatal danger signs and associated factors considering the implication on reducing neonatal mortality

Objectives

General Objective:

To assess the status of knowledge on neonatal danger signs and associated factors among mothers in Sodo district, Southern Ethiopia, 2019

Specific Objectives:

To assess the status of knowledge on neonatal danger signs among mothers in Sodo district, Southern Ethiopia, 2019

To identify factors associated with good knowledge of mothers on neonatal danger signs in Sodo district, Southern Ethiopia, 2019

Methods

Study setting, designs and period

A facility based cross-sectional study was conducted in Sodo district from March 1- April 27/2019. All mothers who were visiting health facilities of Sodo district with the young infant during the study period were included and mothers who were unable to communicate because of serious illness were excluded. Sodo District is one of the districts in Gurage Zone, South Nations, Nationalities and Peoples' Region (SNNPR) of Ethiopia and it is located 105 Km from the capital Addis Ababa. It is bordered on the south by Meskan district, Gurage zone and by Oromia regional state government districts on the other direction. Sodo district has 59 kebeles (5 urban and 54 rural) and total population of 192,096 (male 94,127 and female 97,969), household of 39,203, estimated live birth of 6,646, surviving infants of 6, 128, <5 years of 29,967, estimated women with childbearing age of 44,758, and estimated pregnancy/delivery of 6,646 in 2018/19. There are 8 governmental health centers (HC), one primary hospital (PH) and 54 health posts [25]

Sample size determination and sampling procedure

The sample size for this particular study is calculated using single population proportion formula considering the following parameters. A 95% confidence level, the margin of error (0.05), the proportion of good knowledge of mother on neonatal danger signs from the previous study as 50.6% [26], population correction since the target population is less than 10,000 in the area (target populations mean that mothers with young infants) and taking 10% of non-response rate.

$$n = \frac{(Z_{\alpha/2})^2 p(1-p)}{d^2}$$

Where n= minimum sample size required for the study

Z= standard normal distribution (Z=1.96) with confidence interval of 95% and $\alpha=0.05$

P=prevalence/ population proportion (p= 0.506)

d=is a tolerable margin of error (d=0.05)

$$n = (1.96)^2 * 0.506(1-0.506) / (0.05)^2 = 384.$$

Using correction formula since the target population is less than 10,000 in the area (target populations mean that mothers with young infants)

Where $n=384$

$N =$ target population $=6,128$ Then the sample size $nf=361$

Taking 10% nonresponse rate, the sample size was 397.

All nine health facilities were included in the study. A stratified sampling technique was employed, and the desired number of participants were determined based on the amount of average client flow of each health facility (strata) using proportional allocation. Every 2nd mother was interviewed in the strata by using a systematic sampling technique until the required sample size was obtained during the actual data collection period. The first respondent was selected by lottery method in each stratum.

Data collection Instrument and Process

A structured interviewer-administered English version questionnaire was adapted from the Safe motherhood questionnaire developed by the John Hopkins Program for International Education in Gynecology and Obstetrics (JHPIEGO) [27]. And it was translated into the Amharic language and then to local language “*Gurage-Kistanigna*” by a person assigned from woreda culture and tourism office. To check for its consistency, it was back translated to English by the language expert before data collection. The instrument has four main parts that includes mothers’ socio-demographic characteristics, maternal healthcare-related factors, healthcare delivery system factors and covariates to measure mothers’ knowledge on neonatal danger signs.

Diploma graduated nurses were recruited as data collectors and BSc graduate nurses were recruited as supervisors. Data collectors and supervisors took two days long training about the aim of the study, content of the instrument and how to collect data and a pre-test was conducted on 5% of the sample size in another similar setting at Meskan woreda Shershera Bido health center. Face to face interview was held privately after verbal consent was obtained from each client by using *Gurage-Kistanigna* translated structured questionnaire. Clients were interviewed after they got the service. Medical registration number of participants were written and documented by data collectors to prevent double interviewing of the same mother at different time.

Measurement

A total of 10 main danger signs were used to measure the knowledge of mothers on neonatal danger signs. Accordingly, the two categories poor and good knowledge on neonatal danger signs were developed. Mothers who were able to identify three and more danger signs were categorized as mothers with good knowledge on neonatal danger signs. Their response was recorded by asking them to mention neonatal danger signs without giving them option of respected danger signs. The list of neonatal danger signs and categorization was based on the recommendation of WHO and the young infant’s clinical signs study group by making in line with Ethiopian CBNC manual [4,5,28-31].

Data Analysis

Data for cleaning were coded and entered using EpiData software package version 3.1 and then exported to SPSS for windows version 24 for statistical analysis. Descriptive statistics were applied to describe the study participants in summary measures and logistic regression was used to identify variables significantly associated with the out-come variable. Primarily, to select candidate variables for multivariable logistic regression at a p-value of less than 0.25 bivariate logistic analysis was performed between the outcome variable and each of the independent variables. After that multivariable logistic regression was performed to handle confounding variables and to identify independent factors that are significantly associated with good knowledge of mothers on neonatal danger signs. Backward stepwise regression was used to create the model. P-value<0.05, Adjusted Odds ratio at 95% CI was used to identify significant factors.

Multicollinearity was checked using variance inflation factors (VIF>10). Hosmer and Lemeshow goodness of fit test was applied to assess final model fitness.

Results

Socio-demographic characteristics

A total of 397 mothers were included in this study making a response rate of 100%. The mean age of the respondents was 28.5(SD \pm 5.3). About 225 (57.2%) were in the age range of 25-34 years. Mothers who live in rural accounts 308 (77.6%). Gurage was the predominant ethnic group 343(86.4%) and Orthodox Christianity reported by majority of participants 358(90.2%). Majority, 395(99.5%) were in marital union and 180 (45.3%) mothers were unable to read and write, while 80(20.2%) of their husbands were illiterate. A large proportion, 333(83.9%) of the mothers were housewife in their occupation. Around 180(45.7%) had an average monthly income in the range of 500-1500. Regarding family size, 231(58.5%) had a family size of in the interval of 3-5 (Table 1).

Variable	Categories	Frequency	Percent
Age of the mothers' (years)	15-24	91	22.9
	25-34	227	57.2
	\geq 35	79	19.9
Residence	Rural	308	77.6
	Urban	89	22.4
Ethnicity	Gurage	343	86.4
	Oromo	46	11.6
	Amhara	4	1
	Others	4	1
Religion	Orthodox	358	90.2
	Muslim	16	4
	Protestant	23	5.8
Marital status	In marital union	395	99.5
	Not in marital union	2	0.5
Mother educational level	Unable to read and write	180	45.3
	Able to read and write only	63	15.9
	Primary school	101	25.4
	Secondary school	38	9.6
	College and higher	15	3.8
Mothers' Occupation	Housewife	334	84.1
	Employed	60	15.1
	Other	3	0.8
Husbands' educational level	Unable to read and write	80	20.2
	Able to read and write only	116	29.3
	Primary school	115	29
	Secondary school	59	14.9
	College and higher	26	6.6
Monthly income (ETB)*	<500	147	37.3
	500-1500	180	45.7
	>1500	67	17
Family size	\leq 5	233	58.5
	>5	162	41

ETB (Ethiopian Birr)

Table 1: Socio-demographic characteristics of participants at Sodo district, Southern Ethiopia, 2019 (n=397)

Maternal health care factors

Among the respondents, 380(95.7%) attended ANC service for their last pregnancy. Of whom, 247(65%) visits four and more times. Three hundred-fourteen (79.1%) were prepared for birth preparedness and complication readiness plan. A majority of mothers, 373(93.9%) were given their last birth at a health institution. Three hundred- thirty (83.1%) attended PNC service. Out of them, 324(98.2%) attended PNC less than three and three times (Table 2).

Variable	Categories	Frequency	Percent
History of ANC	Yes	380	95.7
	No	17	4.3
Frequency of ANC visits	≤3	133	35
	4+	247	65
Birth preparedness/complication readiness plan during pregnancy	Yes	314	79.1
	No	83	20.9
Types of preparedness	Place of delivery	213	67.8
	Defining skilled birth attendant	27	8.6
	Transportation	61	19.4
	Saving money	233	74.2
	Buying materials	199	63.4
	A person protecting the remaining family	29	9.2
	A person in case of emergency	38	12.1
Others	2	0.6	
Place of delivery	Institutional	373	93.9
	Not institutional	24	6.1
History of PNC	Yes	330	83.1
	No	67	16.9
Frequency of PNC visit	≤3	324	98.2
	4+	6	1.8

Table 2: Maternal healthcare factors at Sodo district, Southern Ethiopia, 2019 (n=397)

Health care delivery system factors

From all respondents, 224(61.6%) mothers were traveled less than five kilometers (Km) to reach nearby health institution from their home. Majority of the participants,358(90.2%) respond the presence of community health workers (HEW) in their kebele and 270(68%) participants report there was a routine home visit by community health workers (Table 3).

Variable	Categories	Frequency	Percent
Distance from a health facility (in Km)	<5	244	61.6
	≥5	152	38.4
Availability of community health workers (HEW)*	Yes	358	90.2
	No	26	6.5
	Don't know	13	3.3
Routine home visit	Yes	270	68
	No	127	32

*HEW (Health Extension Workers)

Table 3: Health care delivery related factors at Sodo district, Southern Ethiopia, 2019 (n=397)

Status of knowledge of mothers on neonatal danger signs

This study found that 221(55.7%) (95% CI:50.6%,61.2%) of the mothers had good knowledge on neonatal danger signs who had mentioned three and more danger signs out of ten listed neonatal danger signs. Out of 397 participants, 387(97.5%) mentioned at least one danger sign, two participants mentioned all listed danger signs and ten participants had no knowledge of any of the danger signs and listed none (Table 4).

Number of neonatal danger signs listed by mothers	Frequency	Percent
None	10	2.5
One	60	15.1
Two	106	26.7
Three	97	24.4
Four	71	17.9
Five	26	6.5
Six	18	4.5
Seven	5	1.3
Eight	1	0.3
Nine	1	0.3
Ten	2	0.5

Table 4: Neonatal danger signs frequency by mothers at Sodo district, Southern Ethiopia, 201(n=397)

The most frequently mentioned danger signs in this study was fever and it accounts 304(76.6%), followed by not feeding well 230(57.9%) and fast or difficulty of breathing 167(42.1%). The least mentioned danger signs were yellow palms/soles/eyes and not move at all when stimulated, which were reported by 24(6%) and 25(6.3%) of the mothers respectively (Figure 1).

This study revealed that the most common source of information about neonatal danger signs was health professionals and it is reported by 329(85%) respondents, followed by health development army (HDA) leaders, 53(13.7%) (Figure 2).

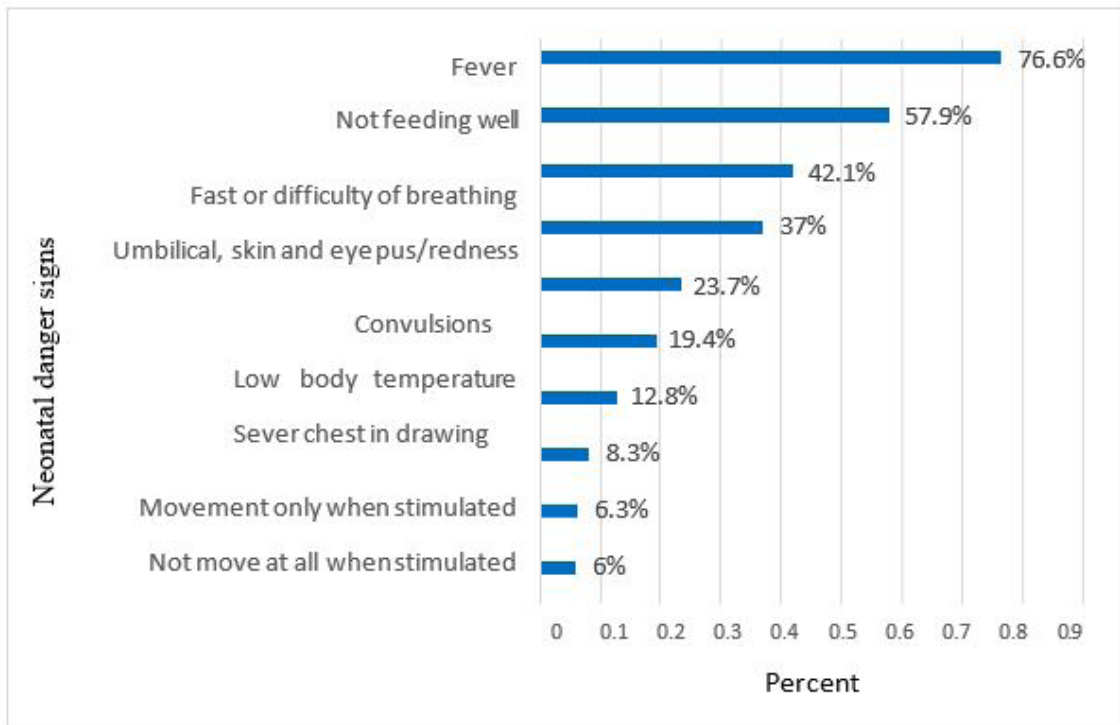


Figure 1: Danger signs mentioned by mothers attending health facilities of Sodo district, Southern Ethiopia, 2019

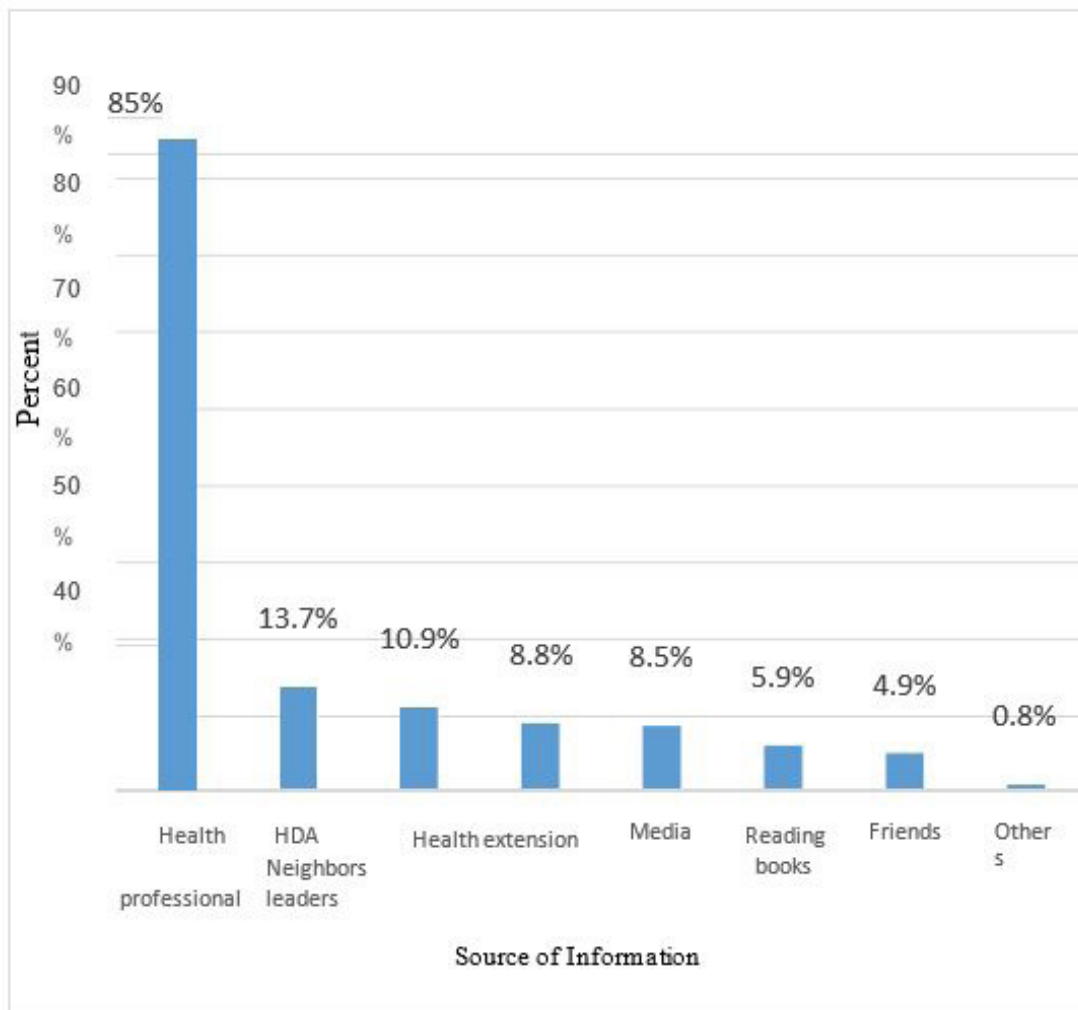


Figure 2: Neonatal danger signs information source for mothers at Sodo district health facility, Southern Ethiopia, 2019

Factors associated with a good knowledge of mothers on neonatal danger signs

On bivariate logistic regression analysis age, husband education level, ANC follow up, birth preparedness and complication readiness plan, place of delivery, PNC follow up, distance, availability of community health workers and routine home visit were candidate variables with p- value <0.25 for multivariable logistic regression analysis. On multivariable logistic regression analysis, PNC follow up and routine home visit were significantly associated with good knowledge of mothers on neonatal danger signs. The odds of good knowledge on neonatal danger signs were 3.58 times higher among mothers who had a history of PNC follow up as compared to mothers who had no history PNC follow up (AOR: 3.58,95%CI:1.96,6.53). And the odds of good knowledge on neonatal danger signs were 1.9 times higher in mothers who reported there is a routine home visit by community health workers (HEW) as compared to their counterparts (AOR:1.9,95%CI:1.21,2.99) (Table 5).

Variables	Knowledge of mothers on neonatal danger signs		Crude OR (95%CI)	Adjusted OR (95%CI)
	Poor	Good		
Age				
15-24	42(46.2%)	49(53.8%)	1	
25-34	90(39.6)	137(60.4%)	1.31(0.79,2.13)	
≥35	44(55.7%)	35(44.3%)	0.68(0.37,1.25)*	
Husband educational level				
Unable to read and write	37(46.3)	43(53.7%)	1	
Able to read and write only	50(43.1%)	66(56.9%)	1.14(0.64,2.01)	
Primary school	39(33.9%)	76(66.1%)	1.68(0.93,3.01) *	
Secondary school	37(62.7%)	22(37.3%)	0.51(0.25,1.02) *	
College and higher	12(46.2%)	14(53.8%)	1.00(0.41,2.44)	
ANC follow up				
No	12(70.6)	5(29.4%)	1	
Yes	164(43.2%)	216(56.8%)	3.16(1.09,9.15) *	
Birth preparedness and Complication readiness plan				
No	47(56.6%)	36(43.4%)	1	
Yes	129(41.1%)	185(58.9%)	1.87(1.15,3.05) *	
Place of delivery				
Not institutional	16(66.7%)	8(33.3%)	1	
Institutional	160(42.9%)	213(57.1%)	2.66(1.11,6.37) *	
PNC follow up				
No	49(73.1%)	18(26.9%)	1	
Yes	127(38.5%)	203(61.5%)	4.35(2.43,7.80) *	1 3.58(1.96,6.53)**
Distance				
<5 Km	102(41.8%)	142(58.2%)	1	
≥5 Km	73(48%)	79(52%)	0.78(0.52,1.17)*	

Availability of community health worker (HEW)				
No	11(42.3%)	15(57.7%)	1	
Yes	155(43.3%)	203(56.7%)	0.96(0.43,2.15)	
I don't know	10(76.9%)	3(23.1%)	0.22(0.05,0.99)*	
Routine home visit				
No	75(59.1%)	52(40.9%)	1	1
Yes	101(37.4%)	169(62.6%)	2.41(1.57,3.71)*	1.90(1.21,2.99)**

*significant with P-value <0.25

**significant with P-value <0.05

1=reference category

Table 5: Factors associated with good knowledge on neonatal danger signs at Sodo district, Southern Ethiopia, 2019

Discussion

Sufficient knowledge on neonatal danger signs is important for early recognition and identification of severe illness of neonates. Furthermore, it is one part of a solution to reduce neonatal morbidity and mortality. The purpose of this study is to give valuable information by measuring the status of knowledge on neonatal danger signs among mothers and factors contributing to good knowledge in the study area. The major findings of the study were 55.7% of mothers had good knowledge on neonatal danger signs. Then again, History of PNC follow up and a routine home visit by health extension workers were factors significantly associated with good knowledge of mothers on neonatal danger signs.

The status of knowledge revealed by this study is lower than the status reported in Bagdad-Alkarkh district (32). The possible explanations for this discrepancy may be socio-demographic characteristic difference between study participants and methodological difference in the selection of study respondents. On the other hand, the status is higher than the status reported from studies done in other African countries, Nakuru-district of Kenya and East Mamprusi district of Ghana [33,34]. And also, higher than studies done previously in Ethiopia. Such as Woldia, Northwest Ethiopia, four regions of Ethiopia, and Tiro Afeta district [28,35-37]. The reason for this difference may be accountable to the study design and the study period difference. The status revealed by the current study is comparable with the findings of previous studies done in Mekele and Chenchä [26,38]. The reason might be the current study was comparable with the study done in Mekele in terms of participant's exposure to maternal health care services. In this study the proportion mothers utilized ANC service and give birth in health facilities were 95.7% and 93.9% respectively. In Mekele study also 96.9% and 98.6% of the mothers utilize the same services respectively. And also, the study participants socio-demographic characteristics were comparable with the participants of the study done in Chenchä. For instance, in the current study majority of mothers (77.6%) were rural residents and also in chenchä (63.5%). In addition, majority (99.5%) of mothers were currently in marital union and also in Chenchä (92.7%).

The current studies showed that the most frequently mentioned danger sign was a fever. This figure is comparable with the majority of studies done previously in Wardha India, rural Bangladesh, sub-district hospitals in Bangladesh, Nakuru district of Kenya, Mekele, Woldia and chenchä [26,33,38-41]. On the other hand, a study conducted in Bangladesh-Alkarkh revealed that the most frequently mentioned danger sign was feeding difficulty and in East Mamprusi district of Ghana and southwestern rural Uganda fast or difficulty of breathing was the most commonly mentioned danger sign [32,34,42]. These danger signs were also mentioned at the second and third level in the current study respectively. This consistency showed that these three danger signs are relatively more known by mothers. This indicates that to increase the overall knowledge status of mothers on neonatal danger signs requires assessing gaps on counseling and communication skills of health workers, designing and implementing different methods and approaches to discuss on each items of recommended neonatal danger signs in a variety of situations with women, their partners and families in an effective and appropriate way [43].

Regarding factors associated, history of PNC follow-up was significantly associated with good knowledge of mothers on neonatal danger signs. This finding was supported by a study done in Mekele and Northwest Ethiopia [28]. The reason might be mothers who had a history of PNC follow up have a chance to get advice about neonatal danger signs with other services. Therefore, this indicates that initiating PNC as early as possible improved knowledge of mothers on neonatal danger signs [44,45].

A routine home visit by health extension workers also showed a significant association, a routine home visit was not tested in previous studies and this makes the finding new. The possible justification for this might be mothers who had lived in routinely visited households have the opportunity to discuss face to face at their home with health extension workers on neonatal danger signs. This implies, conducting home visit regularly in Ethiopian health extension program at house hold level and discussing health-related issues with the mother and family member's increases knowledge of mothers on neonatal danger signs [46,47].

The study may have its own limitation in that all findings were self-reported by mothers, which may introduce recall bias. Therefore, interpretation of the findings of the study needs to consider this point.

Conclusion

This study revealed that slightly more than half of the mothers had good knowledge on neonatal danger signs. This figure indicates still there is a need to improve knowledge of mothers regarding neonatal danger signs. So as to enhance the decision of mothers on care seeking and to facilitate early referral of severely ill neonates. Besides this study identified a history of PNC follow up and a routine home visit by health extension worker were factors significantly associated with good knowledge of mothers on neonatal danger sign. Therefore, health education about neonatal danger signs by using different channels, utilization of PNC services, and a routine home visit by health extension workers should be improved.

Declarations

Ethics approval and consent to participate: This study was commenced after obtaining ethical clearance from Jimma University Institute of health ethical review committee. Support letter was obtained from Jimma University Institute of health, faculty of public health, Department of Epidemiology for Sodo district health office and from district health office for respective health institutions. In addition, written informed consent was obtained from mothers in the district to confirm their willingness to be part of the study. The respondents were notified that they have the right to refuse or terminate at any point of the interview. The information provided by each respondent was kept confidential. Beneficence and respect to the respondents were maintained throughout the study.

Consent for publication: Not applicable as the study does not have individual level personal data.

Availability of data and materials – the data sets generated or analyzed for this study are available and can be obtained from the corresponding author up on request.

Competing interests: All the authors declare no competing interests.

Funding: The data collection process is funded by Sodo Woreda health office. The funder of the study did not have a role in the design, data collection, analysis, and interpretation of data or in writing the manuscript.

Authors Contributions: HG conceptualized the study, developed the data collection instrument. HG, SA and MB implemented the study, participated in data collection, analyzed the data and written the manuscript. All authors critically reviewed the manuscript to fully approve it for publication.

Acknowledgment: We would like to acknowledge Jimma University, Institute of health, faculty of public health, Department of Epidemiology for facilitating this study. We are also indebted for Sodo Woreda health office for funding the data collection process. We also appreciate the efforts and sincere response of all study participants. Our last words of appreciation go to data collectors, and supervisors who were actively participated in this study and all health facilities in the district and Gurage zone health department for their support in providing relevant information.

References

1. United Nations Children's Fund (2014) *Committing to Child Survival: A Promise Renewed Progress Report 2014*. New York; 2014.
2. World Health Organization (2005) *New born health Part I: Overview for policy-makers*. Geneva: WHO 1-16 p.
3. World Health Organization (2013) *Hospital care for children Second edition*. Geneva: WHO 438p.
4. World Health Organization (2013) *Postnatal care of the mother and newborn 2013*. Geneva: WHO 72 p.
5. World Health Organization (2015) *Caring for newborns and children in the community*. Switzerland: WHO 272 p.
6. JSI, L 10 K Health P, Unit C (2014) *Newborn care. Last ten kilometers*.2-5.
7. Berhanu D ABI community Ethiopia (2017) *Quality of CBNC programme assessment*. London School of Hygiene & Tropical Medicine. London.
8. World Health Organization (2014) *Every newborn an action plan to end preventable deaths*. Geneva: WHO 58 p.
9. United Nations Children's Fund (2018) *Levels and trends in Child Mortality 2018*. New York.
10. The Federal Democratic Republic of Ethiopia Ministry of health /MCH directorate (2015) *National Newborn and Child Survival Strategy Document 2015/16-2019/20*. Addis Ababa: Ministry of Health 16 p.
11. Ethiopian Public Health Institute (EPHI)/Federal Ministry of Health (2016) *Countdown to a healthier Ethiopia: Building on Successes to Accelerate Newborn Survival* p12.
12. Central Statistical Agency (2016) *Federal democratic republic of Ethiopia Demographic and Health Survey 2016 key indicator report*. Addis Ababa.
13. Lawn JE, Kerber K, Enweronu-laryea C, Masee O (2009) *Newborn survival in low resource settings — are we delivering?* BJOG An Int J Obstet Gynaecol 49-59.
14. Salih FA, Eltyeb EE (2017) *Neonatal mortality contributors using the three delays audit : a study from Albuluk paediatrics teaching hospital in Sudan*. Int J Res Med Sci 5: 5139-44.
15. Abdullah A, Hort K, Butu Y, Simpson L (2016) *Risk factors associated with neonatal deaths: a matched case control study in Indonesia*. Glob Health Action 1: 1-12.
16. Kananura RM, Tetui M, Mutebi A, Bua JN, Waiswa P, et al. (2016) *The neonatal mortality and its determinants in rural communities of Eastern Uganda*. Reprod Health 13.
17. USAID, CHIP S (2015) *The children. cause of new born death* p2.
18. Latha MP, Lanmelli V (2015) *Effectiveness of STP on Newborn Care among Primi Mothers at Govt* 1-4.
19. UNICEF and PATH (2016) *Literature Review on Barriers to Utilization of Health Extension Services: Draft Report*. Addis Ababa.

20. Ekwochi U, Ndu IK, Osuorah CDI, Onah KS, Obuoha E, et al. (2015) Delays in healthcare delivery to sick neonates in Enugu South-East Nigeria: an analysis of causes and effects. *J Public Health (Bangkok)* 38: 171-7.
21. Kruse AY, Phuong CN, Ho BTT, Stensballe LG, Pedersen FK, et al. (2014) Identification of important and potentially avoidable risk factors in a prospective audit study of neonatal deaths in a paediatric hospital in Vietnam. *Acta Paediatr* 139-44.
22. Upadhyay RP, Krishnan A, Rai SK, Chinnakali P (2014) Need to Focus Beyond the Medical Causes: A Systematic Review of the Social Factors Affecting Neonatal Deaths. *pediatric Perinat Epidemiol.* 127-37.
23. Waiswa P, Kallander K, Peterson S, Tomson G, Pariyo GW (2010) Using the three delays model to understand why newborn babies die in eastern Uganda. *Trop Med Int Heal* 15: 964-72.
24. World Health Organization (2003) *Managing new born problem: guide for doctors, nurses and midwives.* Geneva: WHO 338 p.
25. Sodo woreda BoFED (2018) *Sodo woreda Socio-Economic information 2011E.* Buee.
26. Adem N, Kk B, Tesfay Y (2017) Awareness and Associated Factors towards Neonatal Danger Signs among Mothers Attending Public Health Institutions of Mekelle City, Tigray, *J child Adolesc Behav.* 5: 9.
27. JHPIEGO (2004) *Tools and indicators for maternal and newborn health.* Baltimore, Maryland: JHPIEGO 338p.
28. Nigatu SG, Worku AG, Dadi AF (2015) Level of mother's knowledge about neonatal danger signs and associated factors in North West of Ethiopia: A community based study. *BMC Res Notes* 4-9.
29. Federal Ministry of health E (2016) *Integrated Management of Newborn and Childhood Illness (module 2).* Addis Ababa, Ethiopia: Ministry of Health 57p.
30. World Health Organization (2014) *Integrated Management of Childhood Illness.* Switzerland: WHO 80 p.
31. Young T, Clinical I, Study S. Clinical signs that predict severe illness in children under age 2 months: A multicenter study. *Lancet* 371: 135-42.
32. Abdulrida HN, Hassan RJ, Sabri MM (2018) Knowledge and Health - Seeking Practices of Mothers Attending Primary Health - Care Centers in Baghdad Al - Karkh Sector about Danger Signs in Newborns. *Mustansiriya Med J* 17: 29-35.
33. Kibaru EG, Otara AM (2016) Knowledge of neonatal danger signs among mothers attending well baby clinic in Nakuru Central District, Kenya: cross sectional descriptive study. *BMC Res Notes.* 1-8.
34. Kuganab-lem R, Yidana A (2014) Exploring Women Knowledge of Newborn Danger Signs: A Case of Mothers with under Five Children. *Public Heal Res* 4: 195-202.
35. Jemberia MM, Berhe ET, Mirkena HB, Gishen DM, Tegegne AE, et al. (2018) Low level of knowledge about neonatal danger signs and its associated factors among postnatal mothers attending at Woldia general hospital, Ethiopia. *Matern Heal Perinatol* 1-8.
36. Melkamu B, Berhane M, Yimam H, Jibat N, Zewdu M (2018) Parents' Knowledge of Danger Signs and Health Seeking Behavior in Newborn and Young Infant Illness in Tiro Afeta District, Southwest Ethiopia: A Community-based Study. *Ethiop J Heal Sci* 28: 10.

-
37. Callaghan-koru JA, Seifu A, Tholandi M, Graft-johnson J De, Daniel E, et al. (2013) Newborn care practices at home and in health facilities in 4 regions of Ethiopia. *BMC pediatrics* 11.
38. Mersha A, Assefa N, Teji K, Bante A, Shibiru S (2017) Mother' s Level of Knowledge on Neonatal Danger Signs and Its Predictors in Chench District, Southern Ethiopia. *Am J Nurs Sci* 6: 426-32.
39. Dongre AR, Deshmukh PR, Garg BS (2009) Awareness and Health Care Seeking for Newborn Danger Signs Among Mothers in Peri-Urban Wardha. *Indian J pediatrics* 76: 2008-9.
40. Zaman S Bin, Gupta R Das, Muhammed G, Kibria A, Hossain N (2018) Husband' s involvement with mother' s awareness and knowledge of newborn danger signs in facility- based childbirth settings: a cross - sectional study from rural Bangladesh. *BMC Res Notes* 4-9.
41. Zaman S Bin, Hossain N, Hussain MA, Abimanue V (2017) Factors Related to Knowledge on Newborn Danger Signs Among The Recently Delivered Women in Sub - district hospitals of Bangladesh. *Public Heal Indones* 3: 50-60.
42. Sandberg J, Pettersson KO, Asp G, Kabakyenga J, Agardh A (2014) Inadequate Knowledge of Neonatal Danger Signs among Recently Delivered Women in Southwestern Rural Uganda: A Community Survey. *PLoS One* 9: 9.
43. World Health Organization (2014) A handbook for building skills Counselling for Maternal and Newborn Health Adaptation Guide Updated Geneva: WHO 54 p.
44. World Health Organization (2015) Postnatal Care for Mothers and Newborns Highlights from the World Health Organization 2013 Guidelines 1-8 p.
45. Warren CE (2015) Exploring the quality and effect of comprehensive postnatal care models in East and Southern Africa. ICRH monographs. Ghent University.
46. WHO/UNICEF (2009) Joint Statement Home visits for the newborn child: a strategy to improve survival. Geneva: WHO 8 p.
47. Perry H (2012) How effective are community health workers? Baltimore, Maryland.