

Knowledge of Neonatal Danger Signs and Associated Factors Among Mothers Who Gave Birth in the Past Six Months in Chole District, Arsi Zone, South East Ethiopia: Cross sectional Study

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Abstract

Background: Early detection of neonatal illness by mothers is an important step towards improving newborn survival. Even though mother's knowledge of neonatal danger signs plays a critical role in reducing neonatal morbidity and mortality, studies on the area are limited and most of them are institution-based study which do not include rural mothers and mothers with home delivery. Therefore, the study aimed to assess knowledge of neonatal danger signs and associated factors among mother's who gave birth in the past 6 months.

Methods: Community-based cross-sectional study was conducted on 520 postnatal mothers by using multistage sampling method from March 1-15, 2019. The data were entered into Epi data version 3.1 and then exported into SPSS version 20 for analysis. Bivariate and multivariate analysis were used by using binary logistic regression to identify factors associated with mother's knowledge of neonatal danger signs. Statistical significance was declared at p-value less than 0.05.

Results: Mother's level of knowledge on neonatal danger signs was found to be 50.2% (95%CI: 46.3%, 54.3%). Mother's and husband's secondary and above educational level [AOR= 2.15 95%CI: (1.11, 4.17)], and [AOR: 2.05, 95%CI: (1.07, 3.94) respectively, being in Urban [AOR=5.83, 95%CI: (2.77, 12.24)], had four or more antenatal visits [AOR: 2.10, 95%CI: (1.13, 3.90)], counseled during antenatal care [AOR= 4.33 95%CI: (1.88, 9.98)] and knowledge about essential newborn care [AOR=3.91 95%CI: (2.05, 7.48)] were significantly associated with mother's knowledge of neonatal danger signs.

Conclusion: The study revealed that mother's level of knowledge towards neonatal danger signs was low. Mother's educational status, husband's educational status, place of residence, number of antenatal visits, counseled during antenatal visit and knowledge about essential newborn care were significantly associated.

Introduction

Danger signs are signs that can be easily identified by non-clinical personnel including the mothers/caregivers. Neonatal danger signs are clinical signs that would indicate high risk of neonatal morbidity and mortality and are needed for early therapeutic intervention. Early detection of neonatal illness through identifying neonatal danger signs is an important step towards improving newborn survival (UNICEF, 2014; Golding ,*et al.*, 2017).

Globally, every single year about four million babies die in the first 28 days of life and in 2016 an estimated 2.6 million (19/1,000) children died in their first month of life. While 29/1000 neonatal mortality rate (120,000 babies die every year in the first 4 weeks of life) was recorded in 2016 in Ethiopia. That is 1 in every 35 neonate dies within the first month nationally and 37/1000 of neonatal mortality are in Oromia region. In Ethiopia 62% of live births have high mortality risks that are avoidable and treatable, if neonates seek health care (CSA, 2016).

Knowledge about the severity of an apparent neonatal illness (i.e., knowing when to act) and knowledge about the appropriate lifesaving action is very important to prevent or avoid baby's health problem. Thus, improving maternal knowledge towards signs of neonatal illness will significantly decrease neonatal morbidity and mortality.(Robert Kuganab-Lem and Adadow Yidana, 2014; Mekdes ,*et al.*, 2018).

Lack of specificity of the clinical manifestation of various neonatal morbidities, resulting in difficulty in making early diagnosis, and delay in seeking care and result high mortality are some of the plausible explanation for new born health problems (Ekwochi ,*et al.*, 2015).

Study conducted in Ethiopia showed that there was poor knowledge of mothers towards neonatal danger signs. Mothers practice for neonatal danger sign was unsafe; most mothers take their sick neonate to traditional healers and give home remedies. Most neonatal death take place at home, this indicating that lack of early recognition of the danger signs and low treatment seeking practice of mothers (caretaker) towards modern health care service (Walellign ,*et al.*, 2017; Melkamu ,*et al.*, 2016).

Even though, Ethiopian Government increases the provision of quality community-based newborn care services including management of newborn sepsis; and strengthens the supportive systems with a focus of woreda capacity building, the change in neonatal mortality is not as significant as the change in post-neonatal and child mortality(CSA, 2016).

Despite the fact that mother's knowledge on neonatal danger signs play a critical role in reducing neonatal morbidity and mortality, studies on the area seem to be limited, as far as researcher has investigated various sources of information. Since the available studies were conducted in the urban area or at the institution level (Awoke, 2011), they do not address the rural community in which knowledge of neonatal danger signs is relatively low and may not consider mothers with home delivery. Previous studies assess knowledge from postnatal mothers who delivered two years back (Tesfaye, 2018), this may result in recall bias and failure to differentiate between the neonatal and post neonatal period. So, the level of maternal knowledge might be miss-reported. Therefore, study aimed to assess the knowledge of neonatal danger signs and associated factors among mothers who gave birth in the past six months in Chole district South Eastern Ethiopia from March, 1–15/2019.

Methods

Study setting and period

The study was conducted from March 1–15, 2019 at Chole District, one of the districts in Arsi zone, which is found in the South Eastern part of Ethiopia. The district is about 291 km from Addis Ababa, the capital city of Ethiopia. Chole district has a total of 20 kebeles (4 urban and 16 rural kebeles). The district has a total population of 120,764 of which 61,568 are males while 59,196 of them are females and 4191 annual live births. Estimated women with child bearing age of 21,738(7386 urban and 14,352 rural). There were 2095 (712 Urban and 1383 Rural) mothers who gave live birth in the past six months at the district. The district has 4 health centers, 18 health posts, 10 private clinics and 8 drug stores. According

to 2017 report of Chole health bureau, the health coverage of the district reached 64.56% in 2016 (Chole district health office, 2017).

Study design and population

Community based cross-sectional study design using quantitative method was applied.

All mothers who gave birth within the past six months prior to the study period and resident at least for 6 months in the chole district were included in this study. All Mothers who gave birth in the past six months but unable to communicate because of serious illness or impaired cognition during data collection period were excluded from the study.

Sample size determination and Sampling procedure

The sample size was calculated by using a single population proportion formula with assumptions of confidence level at 95% = 1.96, a margin of error (d) = 0.05, Design effect = 1.5 and a reasonable proportion of mothers knowledge of neonatal danger signs (P = 0.313) from a previous study conducted at Wolkite Town, Gurage Zone, SNNPR, Ethiopia, 2017 (Walelign ,et al., 2017) and adding 5% non-response rate, the final sample size became 520.

Multi stage sampling method was employed in selecting the study subjects. Chole District has 16 Rural and 4 Urban kebeles (kebele is the smallest administrative unit in Ethiopia), 5 kebeles from the Rural and two kebeles from the urban were selected randomly. The sample size was distributed to the seven kebeles proportionate to the size of their population. Finally, the study subjects that had been included in the study from each kebele were identified by using simple random sampling technique (computer based) based on the sampling frame obtained from kebele health extension workers registration books (N = 2095). The selected households were located with the help of kebele health extension workers and administrators of the given kebeles. For household with more than one mother who gave birth in the past 6 months, one of the mothers was selected using lottery method.

Data collection methods

Data collection was undertaken using an interviewer administered structured questionnaire that was adopted from the Safe Motherhood questionnaire developed by the Maternal and Neonatal Health Program of Johns Hopkins Program for International Education in Gynecology and Obstetrics (JPHIEGO) (Del Barco, 2004). The data were collected by trained 7 diploma nurses and supervised by three BSc holder nurses who were fluent in local language "Afan Oromo and Amharic". The reason why nurses were chosen is that, at the end of data collection health education was given for the respondents with poor knowledge of neonatal danger signs. A brief introductory orientation was given for the study participants by data collectors about the purposes of study. Explanation was given on the importance of their involvement, then mothers who were volunteer were interviewing face to face using structured and pre-tested questionnaires by going into household level. Study participants were contacted at their home both at morning and afternoon.

Operational definition

Key danger signs: Are those signs which warrant survival chance of a neonate and demands immediate medical care. Thus, 1) poor/not sucking, 2), fever is high body temperature or being hot body of the selected child as perceived and reported by mothers or care givers/hyperthermia. 3) hypothermia is decreased body temperature or cold to touch of the baby 4) Convulsion(twisting of body), 5) increased respiratory rate/fast breathing (more than 60 per minute when counted for at least one minute) and, 6) Vomiting, 7) chest retractions/in drawing, 8) Jaundice (yellow soles, palms and sclera) 9) Lethargy- only moves when stimulated or not at all and 10) umbilical redness or draining pus/sign of infection.(UNICEF, 2014; WHO, 2017b)

Knowledge was measured by mother's capability of mentioning the 10 WHO listed neonatal danger signs without prompt by interviewer. Then knowledge is categorized into good knowledge and poor knowledge based on ability to mentioning three out of ten WHO listed neonatal danger signs.

Knowledge: State of awareness of mothers on WHO listed key neonatal danger signs (Solomon ,*et al.*, 2015; WHO, 2017b).

Good knowledge: Mothers who were capable of mentioning three or more key WHO identified danger signs for neonate (Lancet, 2008).

Poor knowledge- Those mothers who were able to mention two or less key WHO identified neonatal danger signs (Lancet, 2008).

Neonatal danger signs: Are symptoms that complicate the lives of the neonate and happen during the neonatal period (during the 1st 28 days) (WHO, 2017a).

Data quality control

The questionnaire was first prepared in English language then it was translated to Amharic and Afan Oromo languages, which are used for communication in the local community and back to English by different language experts to check consistency of the data. The questionnaire was pre-tested on postnatal women in the nearby district (Guna district) before the beginning of the actual data collection on 5% of total sample size. Findings and experiences from the pre-test were utilized in modifying and reshaping the research data collection tools. Training was given for data collectors and supervisors about the objective of the study, confidentiality of information, respondent's right, privacy and techniques of interview prior to data collection. Completeness of questionnaire was checked by principal investigator and supervisors on daily basis. Double data entry was done by two data clerks and consistency of entered data were cross checked by comparing two separately entered data into Epi-Data.

Data processing and analysis

The data were first coded, entered and cleaned by Epi data statistical software version 3.1 and then were exported to SPSS window version 20 for analysis. A descriptive statistical analysis was employed to

describe the characteristics of participants. For analysis of the outcome variable, good knowledge was coded as 1 and poor knowledge was coded as 0. The information was presented using frequencies, tables and figures. Multi collinearity was checked using VIF (Variance inflation factors) and standard error (SE) and variables with SE of > 2 or VIF > 10 were dropped. The goodness of fit was tested by Hosmer-Lemeshow statistic and Omnibus tests. The model was considered good fit since it is found to be insignificant for Hosmer-Lemeshow statistic ($p = 0.648$) and significant for Omnibus tests ($p = 0.000$). Bi-variate and multivariate analysis were used to observe the association between each independent variable and the outcome variable by using binary logistic regression. All variables with $P \leq 0.25$ in the bivariate analysis were included in the final model of multivariate analysis in order to control all possible confounders. In addition, variables which were significant in previous studies and from context point of view were included in the final model even if the above criteria were not met. The direction and strength of statistical association was measured by odds ratio with 95% CI. Adjusted odds ratio along with 95% CI was estimated to identify associated factors with knowledge about neonatal danger signs by using multivariate analysis in the binary logistic regression. Finally, statistical significance was declared at p -value < 0.05 .

Ethical considerations

Ethical clearance to conduct this study was obtained from Haramaya University, College of Health and Medical Sciences, Institutional Health Research Ethics Review Committee (HU-IHRERC) before starting data collection process. Official letter to make a study was also obtained from the Woreda and Kebele Government officials as needed.

Informed, voluntary, written and signed consent was obtained from each study participants prior to the interview after explaining about the purpose of the study, their right to refuse or discontinue the interview at any time if they did not want it. They were also informed as information obtained from them were treated with complete confidentiality (respondents name and other identification were not written in the questionnaire) and in case it might have minimum risk on them (may consume time).

Result

Socio-demographic Characteristics

A total of 510 out of 520 mothers of babies aged up to six months were recruited in the study yielding a response rate of 98.1%. The mean age of the participants was 28.48(SD \pm 4.68) years. Majority of the mothers were married 467(91.6%) and rural resident 333(65.3%). About 337 (72.7%) of them are Orthodox Christian followers and 255(50%) belong to Amhara ethnic group.

Table 1
Socio-demographic characteristics of study participants who delivered in the past six months in Chole District, South East Ethiopia, 2019 (n = 510).

Variables	Categories	Frequency	Percent
Sex of child (n = 510)	Male	269	52.7
	Female	241	47.3
Mother's age (n = 510)	15–24	105	20.6
	25–34	340	66.7
	35–44	65	12.7
Mother's educational level (n = 510)	Primary and below	178	34.9
	Secondary and above	332	65.1
Marital status (n = 510)	Single	9	1.8
	Married	467	91.6
	Divorce/ separated	27	5.3
	Widowed	7	1.4
Father's educational level (n = 467)	Primary and below	273	58.5
	Secondary and above	194	41.5
Religion (n = 510)	Orthodox	371	72.7
	Muslim	114	22.4
	Protestant	25	4.9
Ethnicity (n = 510)	Oromo	253	49.6
	Amhara	255	50.0
	Tigre	2	.4
Residence (n = 510)	Urban	177	34.7
	Rural	333	65.3
Occupation (n = 510)	Governmental employee	22	4.3
	Private employee	28	5.5
	Housewife	353	69.2
	Merchant	29	5.7
*Other- student and daily laborer			

Variables	Categories	Frequency	Percent
	Farmer	67	13.1
	Other*	11	2.2
*Other- student and daily laborer			

Maternal health services and Obstetric conditions

Out of the total respondents 363(71.2%) of mothers were multipara and 63(87.6%) of them had at least one history of abortion. Among 483 mothers who had ANC 237(49.1%) of them had four and more visits. Majority of respondents 392(76.9%) were seen by Midwife/Nurse. But only 364(75.4%) respondents attended regular ANC counselling while counseling on neonatal danger signs was the least covered 21(5.8%) area of all counseling during ANC.

Table 2

Maternal health related factors among mothers who gave birth in the past six months in Chole District, Arsi zone, South Eastern Ethiopia, 2019 (n = 510).

Variable	Categories	frequency	Percent
Para (n = 510)	1	112	22.0
	2-4	363	71.2
	>=5	35	6.9
Abortion (n = 510)	have abortion History	63	12.4
	No history of abortion	447	87.6
ANC (n = 510)	Yes	483	94.7
	No	27	5.3
No. of ANC visit (n = 483)	<=3 visits	246	50.9
	>=4 visits	237	49.1
ANC provider (n = 483)	Doctor/Health officer	7	6.7
	Midwife/Nurse	392	76.9
	HEWs	84	16.4
Counseled during ANC (n = 483)	Yes	364	75.4
	No	119	24.6
Counseled during ANC on (n = 483)	Family planning	170	46.7
	Maternal nutrition	143	39.3
	Breastfeeding	136	37.4
	Hygiene	106	29.1
	Immunization	98	26.9
	HIV awareness	90	24.7
	Neonatal danger signs	21	5.8

Obstetrics Conditions

Majority of mothers 376(73.7%) delivered at health institutions. On the other hand, 381(74.7%) of respondents had immediate post-natal care (PNC) visit and majority 325(85.3%) of them were assisted by Midwife/nurse. But only 138(36.2%) of respondents had been counseled on neonatal danger signs during PNC.

Table 3

Obstetric conditions among mothers who gave birth in the past six months in Chole District, Arsi zone, South Eastern Ethiopia, 2019 (n = 510).

Variable	Categories	frequency	percent
Place of delivery (n = 510)	Health institution	376	73.7
	Home	134	26.3
Delivery Assistant (n = 510)	Health professional	376	73.7
	TBA	54	10.6
	TTBA	68	13.3
	Relative(friend)	12	2.4
Mode of delivery (n = 510)	SVD	487	95.5
	Instrumental delivery	15	2.9
	Cesarean section	8	1.6
Immediate PNC (n = 510)	Yes	381	74.7
	No	129	25.3
Care-giver during PNC (n = 381)	Midwife/nurse	325	85.3
	HEWs	47	12.3
	Other*	9	2.4
Counseled during PNC (n = 381)	Yes	138	36.2
	No	243	63.8
*Other- physician and health officer TBA- traditional birth attendant, TTBA- trained traditional birth attendant			

Source of information about neonatal danger signs

Out of total respondent's 438(85.9%) of them ever heard about neonatal danger signs, while 72(14.1%) not heard about it. The most common 349(68.4%) source of information about neonatal danger signs was health professionals. Out of mothers heard from media 38(52.1%) and 35(47.9%) of them get the information from television and radio respectively.

Knowledge about Essential Newborn Care (ENC)

From a total of 510 respondents, 291(57.1%) of study participants had good responded equal to and above median score (five and above) whereas 219(42.9%) had poor knowledge responded below median

score (below five) about ENC. Study participants were interviewed about knowledge of cord care, material to tie the cord, material applied on the cord, breastfeeding initiation time, exclusive breast-feeding, bathing time and immediate immunization. Two hundred fifty of respondents stated cord tie to tie the cord, 298(58.4%) stated as nothing was applied on the cord, 386(75.7%) stated that breastfeeding initiation time was within one hour, 350(68.6%) stated as they exclusively feed their newborn until now and 301(59%) bath the newborn after 24 hours.

Table 4
Knowledge about essential newborn care among mothers delivered in the past six months in Chole District, South Eastern Ethiopia, 2019 (n = 510)

Variable	Categories	Frequency	Percent
Aware about cord care (n = 510)	Yes	378	74.1
	No	132	25.9
Material to tie cord (n = 378)	Cord tie	250	49.0
	Unsterile material	80	15.7
	I don't know	48	9.8
Material applied on cord (n = 510)	Nothing	298	58.4
	Anti-septic	34	6.7
	Butter	178	34.9
Breast feeding initiation time (n = 510)	Within one hour	386	75.7
	After one hour	124	24.3
Exclusive breast feeding until now (n = 510)	Yes	350	68.6
	No	160	31.4
Bathing time (n = 510)	Within 24 hours	209	41.0
	After 24 hours	301	59.0
Immediate immunization (n = 510)	Yes	27	5.3
	No	483	94.7

Mother's knowledge of neonatal danger signs

The majority (93.5%) of the participants were knowledgeable about at least one of ten WHO recognized neonatal danger signs, but only 50.2% (95%CI: 46.3%, 54.3%) of interviewed mothers were able to mention at least three neonatal danger signs (had a good knowledge). Figure 2 Total knowledge of

neonatal danger signs among mothers who gave birth in the past six months at Chole District, Arsi Zone, South East Ethiopia, 2019 (n = 510)

The most frequently recognized neonatal danger sign by 423(82.9%) mothers was hotness of the body (fever) followed by vomiting 306 (60%) and lethargy 260 (51%). Fig. 3 Maternal knowledge on specific neonatal danger signs among mothers who gave birth in the past six months at Chole District, Arsi Zone, South East Ethiopia, 2019 (n = 510)

From the total (477) mothers who know at least 1 neonatal danger sign, 292(61.2%) of them perceived as severe (the neonate may die from sign/signs they had recognized if not treated early) while 185(38.8%) of them perceived as not severe (those signs do not kill the neonate).

Factors associated with knowledge of neonatal danger signs

Mother's age, mother's educational level, husband's educational level, residence, source of information, parity, number of ANC, counseling during ANC, place of delivery, counseling during PNC and mother's knowledge about essential newborn care were selected for the final model. After controlling for cofounders in multivariate model mother's educational level, Husband's educational level, place of residence, number ANC visits, counseling during ANC and knowledge about essential newborn care were significantly associated with knowledge about neonatal danger signs. Mothers who attain secondary and above educational level were 2.15 times [AOR = 2.15 95%CI: (1.11, 4.17)] higher to have knowledge about neonatal danger signs as compared to mothers who attain primary and lower educational level. Similarly, mothers whose husbands attain secondary and above educational level [AOR: 2.05, 95%CI: (1.07, 3.94)] were nearly two times to mention at least three neonatal danger signs as compared to husbands with primary and below educational level. Mothers who live in urban were 5.83 times more likely to be knowledgeable as compared to mothers who live in rural area [AOR = 5.83, 95%CI: (2.77, 12.24)].

Table 5

Factors associated with mothers' knowledge about neonatal danger signs in Chole District, South Eastern Ethiopia, 2019 (n = 510).

Variables	Knowledge about Neonatal Danger Signs			
	Poor	Good	COR (95%CI)	AOR (95%CI)
Age group				
15–24	48(45.7%)	57(54.3%)	2.32(1.22, 4.41)*	1.01(0.28, 3.64)
25–34	163(47.9%)	177(52.1%)	2.12(1.22, 3.70)*	1.30(0.46, 3.64)
35–44	43(66.2%)	22(33.8%)	1	1
Maternal education level				
Primary and below	135 (75.8%)	43 (24.2%)	1	1
Secondary and above	119 (35.8%)	213 (64.2%)	5.62(3.73, 8.47) **	2.15 (1.11, 4.17)*
Husband's education level				
Primary and below	163(59.7%)	110(40.3%)	1	1
Secondary and above	60(30.9%)	134(69.1%)	3.31(2.24, 4.88)*	2.05(1.07, 3.94)*
Residence				
Rural	229(68.8%)	104(31.2%)	1	1
Urban	25(14.1%)	152(85.9%)	13.39(8.27, 21.69)**	5.83(2.77, 12.24)**
Source of information				
Family and Friends	12(75%)	4(25%)	1	1
Media	23(31.5%)	50(68.5%)	6.52(3.89, 16.03)**	0.60(0.17, 2.17)
Health professionals	162(46.4%)	187(53.6%)	3.46(2.42, 7.26)**	0.78(0.18, 3.48)
Parity				
1	49(43.8%)	63(56.2%)	2.18(0.99, 4.75)	0.51(0.10, 2.51)
2–4	183(50.4%)	180(49.6%)	1.67(0.81, 3.41)	0.61(0.15, 2.44)
>=5	22(62.9%)	13(37.1%)	1	1

*Significant with $P < 0.05$ and ** Significant with $P < 0.001$

CI = Confidence Interval, COR = Crude Odds Ratio, AOR = Adjusted Odds ratio

Variables	Knowledge about Neonatal Danger Signs			
	Poor	Good	COR (95%CI)	AOR (95%CI)
Number of ANC				
1–3	170(69.1%)	76(30.9%)	1	1
4 and above	59(24.9%)	178(75.1%)	6.75(4.53, 10.07)**	2.10(1.13, 3.90)*
ANC Counseling				
No	94(79.0%)	25(21.0%)	1	1
Yes	135(37.1%)	229(62.9%)	6.38(3.91, 10.41)**	4.33(1.88, 9.98)**
Delivery place				
Home	105(78.4%)	29(21.6%)	1	1
Health institution	149(39.6%)	227(60.4%)	5.52(3.48, 8.74)**	2.73(0.49, 15.34)
PNC Counseling				
No	118(49.0%)	123(51%)	1	1
Yes	36(26.1%)	102(73.9%)	2.72(1.72, 4.29)**	0.74(0.38, 1.45)
ENC knowledge				
Poor	175(79.9%)	44(20.1%)	1	1
Good	79(27.1%)	212(72.9%)	10.67(7.02, 16.24)**	3.91(2.05, 7.48)**
*Significant with P < 0.05 and ** Significant with P < 0.001				
CI = Confidence Interval, COR = Crude Odds Ratio, AOR = Adjusted Odds ratio				

The odds of knowledge were 2.1 among mothers who had four or more ANC visits [AOR: 2.10, 95%CI: (1.13, 3.90)] as compared to mothers who had three or less ANC visits. Utilization of counseling to mothers during ANC visit was significantly associated with knowledge about neonatal danger signs [AOR = 4.33 95%CI: (1.88, 9.98)]. Mothers who had knowledge about essential newborn care were 3.91 times [AOR = 3.91 95%CI: (2.05, 7.48)] more likely knowledgeable about neonatal danger signs.

Discussion

The knowledge of mothers on neonatal danger signs was found to be 50.2% (95%CI: 46.3, 54.3) (able to mention three or more WHO identified neonatal danger signs). Factors that significantly associated to women knowledge of neonatal danger signs were mother's educational level, husband's educational level,

place of residence, number ANC visits, counseling during ANC and knowledge about essential newborn care.

The knowledge of neonatal danger signs in this study was consistent with studies done in Southern Ethiopia (Abera ,*et al.*, 2017) which was 50.3% and Tigray region, Ethiopia (Nuredin ,*et al.*, 2017) which was 50.6%. But higher than studies conducted in Kenya (Kibaru and Otara, 2016), Eastern Ethiopia(Tesfaye, 2018) and Gondar, Ethiopia(Solomon ,*et al.*, 2015) which was (15.5%), (9.38%) and (18.2%) respectively. This difference might be due to study period difference, a slight difference in the data collection tools, number of neonatal danger signs included in this study were higher than those studies and in this study exposure to ANC and percentage of institutional delivery (mothers who delivered at health institutions had better exposure to post- natal counseling) were found to be higher. In another ways, previous studies included mothers who gave birth two years back which might lead to mothers fail to recall and loose caring responsibility. Meanwhile, this study is lower than studies conducted in Baghdad (Abdulrida ,*et al.*, 2018) (81%), Sri Lanka (Senarath ,*et al.*, 2011), (80%), Nigeria (Ekwochi ,*et al.*, 2015) (78.7%), and Wolkite, Ethiopia (Walellign ,*et al.*, 2017) (68.68%). This might be due to involvement of rural women in this study and study area difference that, this study was community-based study. In this study, a low level of mothers' knowledge of the neonatal danger signs was observed even though the majority of the women had attended more than 3 visits of antenatal care; this led to an idea that the antenatal care providers may not have proper resources and facilities to educate mothers about the neonatal danger signs. Poor knowledge of mothers on neonatal danger signs will have negative impact on Integrated Management of Childhood Illnesses (IMCI) Program in Ethiopia, because the program is based on early identification of newborn danger Signs by caregivers and appropriate referral aiming at reduction in neonatal mortality.

The most frequently mentioned danger signs were fever, vomiting and lethargy which is consistent with study conducted in Kenya (Kibaru and Otara, 2016) and Ethiopia (Abera ,*et al.*, 2017). This might be due to these signs were commonly affect the health of neonates and were relatively easily detected by caregivers. And incongruent with studies conducted in Nigeria (Ekwochi ,*et al.*, 2015) and Ethiopia (Mekdes ,*et al.*, 2018; Solomon ,*et al.*, 2015). This might be due to the difference in extensive HEWs counseling in the community and socio-cultural variation between the study participants. Overall, this implies Poor recognition of danger signs is the main barrier in order not to seek care even if they are manifesting those signs and also caregivers do not seek medical care if they do not recognize it as severe (because only 61.2% of mothers in this study perceived the recognized signs as severe).

In this study, mothers having secondary and above educational level were about two times more likely to know about neonatal danger signs as compared to those mothers with primary or below educational level. This is nearly consistent with study conducted in Gondar town (Solomon ,*et al.*, 2015). The possible justification could be educated mothers acquire knowledge about disease and human health through their academic life and education increase to get health service and increase tendency to read and understand materials related to newborn health.

Similarly, husband educational level was significantly associated with mothers' good knowledge about neonatal danger signs. The odds of being having knowledge about neonatal danger signs was two times among mothers whose husbands achieved secondary and above educational level. This is consistent with the study conducted in Wolkite and Gondar, Ethiopia (Walelign ,*et al.*, 2017; Solomon ,*et al.*, 2015). This could be explained as educated husbands are more informed and help the mother in recognition of neonatal danger signs and this might positively affect the knowledge of the mothers.

The study showed that mothers who live in urban were 5.83 times more likely knowledgeable as compared to mothers who lived in rural area. This is congruent with the study conducted in Southern Ethiopia (Abera ,*et al.*, 2017) and Woldia, Ethiopia (Mekdes ,*et al.*, 2018) where living in rural increase the odds of good knowledge of neonatal danger signs. This might be due to mothers who live in urban were more likely to seek health care and health information from different sources as compared to mothers who living in rural parts. This study showed that 82% of home delivery was conducted at rural area and this leads to less chance to contact with health professionals. This leads to an idea that, mothers who live in rural area had tendency to deliver at home and had less chance to get immediate PNC counseling on neonatal danger signs and remain uninformed.

ANC visit was significantly associated with mother's knowledge about neonatal danger signs. In line with that, mother who got counseling during ANC follow up were 5.71 times more knowledgeable as compared to mothers who did not get counseled during ANC. This is consistent with study conducted in Ghana (Okawa ,*et al.*, 2015), Eastern Ethiopia (Tsfaye, 2018), Jimma, Ethiopia (Melkamu ,*et al.*, 2016) and in Gondar (Solomon ,*et al.*, 2015). This might be due to exposure to ANC follow up repeatedly might increase the chance to get more information related to neonatal danger signs from health professionals. These might indicate the need to improve the counseling given to mothers during ANC and PNC giving due emphasis to these signs and symptoms of serious newborn illness, given the fact that the majority of the mothers were having ANC/PNC follow-up and delivered at health facilities.

Mothers who had knowledge about essential newborn care had significant association with knowledge about neonatal danger signs. This is consistent with study conducted in Ethiopia (Abera ,*et al.*, 2017). This might be due to the case that recognition of neonatal danger signs is one of the components of essential newborn care. So, those mothers who have knowledge on essential newborn care practices are more likely knowledgeable about neonatal signs of illness. Meanwhile, there was high institutional delivery in this study (73.7%), which probably allow the chance to get contact with health professionals at health facility and get counseled on neonatal danger signs on appropriate time.

The study might not show cause and effect relationship because of the nature of the study design (cross-sectional). It might be affected by recall bias because it allowed mothers who gave birth in the past 6 months, while neonatal danger signs occurred during the first one month of life.

Conclusion And Recommendations

The study revealed that the overall level of mother's knowledge about neonatal danger signs was low. Only half of mothers achieved the criteria of WHO and lancet regarding good knowledge of neonatal danger signs. In general, this study identified that mother's educational level, husband's educational level, place of residence, number of ANC visits, counseling during ANC and knowledge about ENC were the independent factors associated with mother's good knowledge of neonatal danger signs. Intervention modalities focusing on maternal/parental counseling on the commonest symptoms of illness in the neonate particularly during the ANC/PNC follow-up as well as during institutional delivery is very important in order to increase mothers' knowledge in recognition of illness

Abbreviations

ANC: Antenatal Care; AOR: Adjusted Odd Ratio; COR: Crude odd Ratio; CSA: Central Statistics Agency; DHS: Ethiopian Demographic Health Survey; ENC: Essential new born care; EPI-INFO Epidemiological Information software; HEWs: Health Extension Workers; IHRERC: Institutional Health Research Ethics Review Committee; IMNCI: Integrated Management of Newborn and Child Illnesses; IMR: Infant mortality rate; JPHIEGO: Johns Hopkins Program for International Education in Gynecology and Obstetrics; MCH: Maternal and Child Health; SDGs: Sustainable Development Goals; SPSS: Statistical Package for Social Sciences; UNICEF: United Nations Children's Fund; WHO: World Health Organization

Declarations

Ethics approval and consent to participate

Ethical clearance was secured from Haramaya University, College of Health and Medical Sciences, Institutional Health Research Ethics Review Committee (IHRERC). Informed, voluntary, written and signed consent was obtained from each study participants prior to the interview after explaining about the purpose of the study, their right to refuse or discontinue the interview at any time if they did not want it. They were also informed as information obtained from them were treated with complete confidentiality

Consent to publication

Non applicable

Availability of data and materials

Pertinent data were presented in this manuscript. Additional data can be requested from the corresponding author upon reasonable request.

Conflict of interest

There is no conflict of interest

Funding

Authors' contributions

TG, the corresponding author, worked on designing the study, trained, and supervised the data collectors, checked the completeness of collected data, entered, analyzed, and interpreted the result, and prepared the manuscript. The co-authors namely TA, MD, AE, and TG played their role in re-analyzing and writing the final draft of the results. Moreover, the co-authors wrote the manuscript. All authors were involved in reading and approving the final manuscript.

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References

1. Abdulrida HN, Hassan RJ and 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 Medical Journal* 17: 29.
2. Abera M, Nega A, Kedir T, Agegnehu B and Shitaye S. (2017) *Mother's Level of Knowledge on Neonatal Danger Signs and Its Predictors in Chench District, Southern Ethiopia*.
3. Awoke W. (2011) Prevalence of childhood illness and mothers'/caregivers' care seeking behavior in Bahir Dar, Ethiopia: A descriptive community based cross sectional study. 155-159.
4. Chole District Health Office Annual Report. (2017).
5. CSA I. (2016) Ethiopia demographic and health survey *Addis Ababa, Ethiopia and Calverton, Maryland, USA: Central Statistical Agency and ICF International* 430.
6. Del Barco R. (2004) Monitoring birth preparedness and complication readiness. Tools and indicators for maternal and newborn health.
7. Ekwochi U, Ndu IK, Osuorah CDI, Amadi OF, Okeke IB, Obuoha E, *et al.* (2015) Knowledge of danger signs in newborns and health seeking practices of mothers and care givers in Enugu state, South-East Nigeria. *Italian Journal of Pediatrics* 41: 1-7.
8. Golding N, Burstein R, Longbottom J, Browne AJ, Fullman N, Osgood-Zimmerman A, *et al.* (2017) Mapping under-5 and neonatal mortality in Africa, 2000-15: a baseline analysis for the Sustainable Development Goals. *Lancet* 390: 2171-2182.
9. Kibaru EG and 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* 9: 481.
10. Mekdes MJ, Elsa TB, Hawi BM, Destaw MG, Abera ET and Melese AR. (2018) Low level of knowledge about neonatal danger signs and its associated factors among postnatal mothers attending at

- Woldia general hospital, Ethiopia. *Matern Health Neonatol Perinatol* 4: 5.
11. Melkamu B, Hadiya Y, Nega J and Mesfin Z. (2016) 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 Health* 28: 473.
 12. Nuredin A, Berhe KK and Yohannes T. (2017) Awareness and Associated Factors towards Neonatal Danger Signs among Mothers Attending Public Health Institutions of Mekelle City, Tigray, Ethiopia, 2015. *Journal of Child and Adolescent Behavior* 05.
 13. Okawa S, Ansah EK, Nanishi K, Enuameh Y, Shibamura A, Kikuchi K, *et al.* (2015) High Incidence of Neonatal Danger Signs and Its Implications for Postnatal Care in Ghana: A Cross-Sectional Study. *PLoS One* 10: e0130712.
 14. Robert Kuganab-Lem and Adadow Yidana. (2014) Exploring Women Knowledge of Newborn Danger Signs: A Case of Mothers with under Five Children. 4: 5.
 15. Senarath U, Fernando DN, Vimpani G and Rodrigo I. (2011) Factors associated with maternal knowledge of newborn care among hospital-delivered mothers in Sri Lanka. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 101: 823-830.
 16. Solomon NG, Worku AG and 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 research notes* 8: 309.
 17. Tesfaye AY. (2018) Antenatal care utilization increase the odds of women knowledge on neonatal danger sign: a community-based study, eastern Ethiopia. *BMC research notes* 11: 845.
 18. UNICEF. (2014) The Health Extension Programme.
https://www.unicef.org/publications/index_71829.html
 19. Walelign A, Bekana F and Tigist D. (2017) Mother's knowledge and Practice about Neonatal Danger Signs and Associated Factors in Wolkite Town, Gurage Zone, SNNPR, Ethiopia, 2017. *Journal of Biomedical Sciences* 06.
 20. WHO. (2017a) Caring for the newborn at home; a training course for community health workers; community health workers manual. Geneva.
www.who.int/maternal_child_adolescent/news/events/2012/CHW_Manual.pdf
 21. WHO. (2017b) United Nations Inter-agency Group for Child Mortality Estimation New York.
https://apps.who.int/iris/bitstream/handle/10665/97603/9789241506649_eng.pdf;sequence=1

Figures

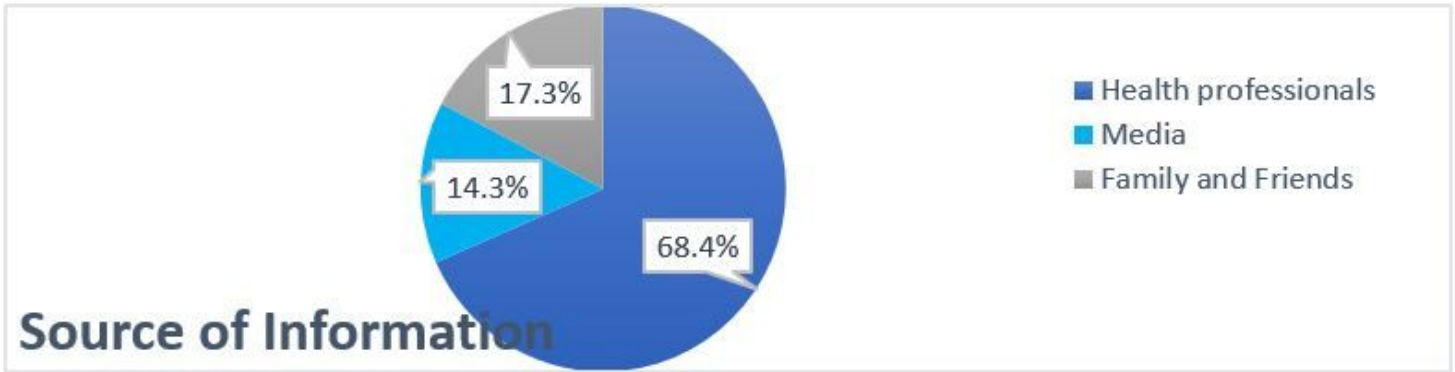


Figure 1

Source of information about neonatal danger signs among mothers who gave birth in the past six months at Chole District, Arsi Zone, South East Ethiopia, 2019. (n=438)

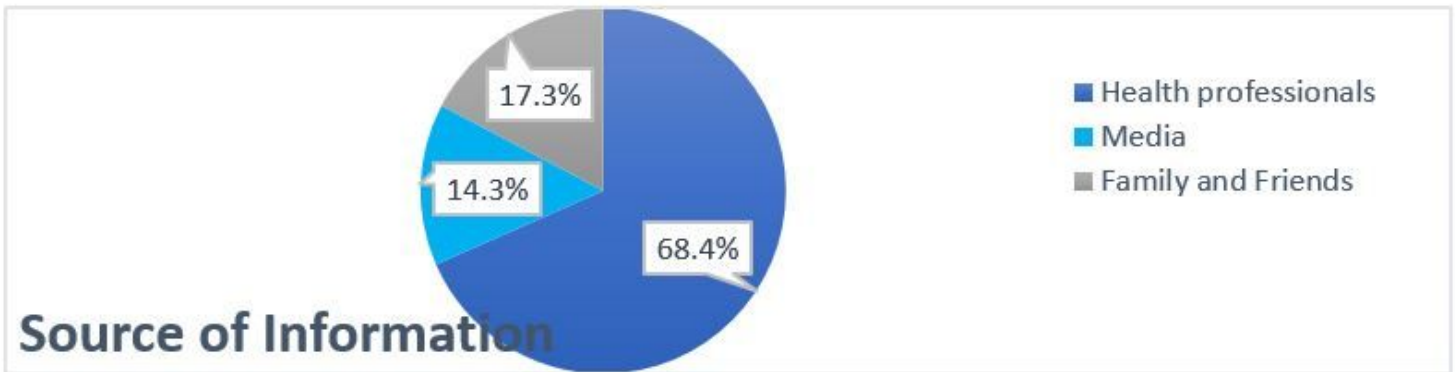


Figure 1

Source of information about neonatal danger signs among mothers who gave birth in the past six months at Chole District, Arsi Zone, South East Ethiopia, 2019. (n=438)

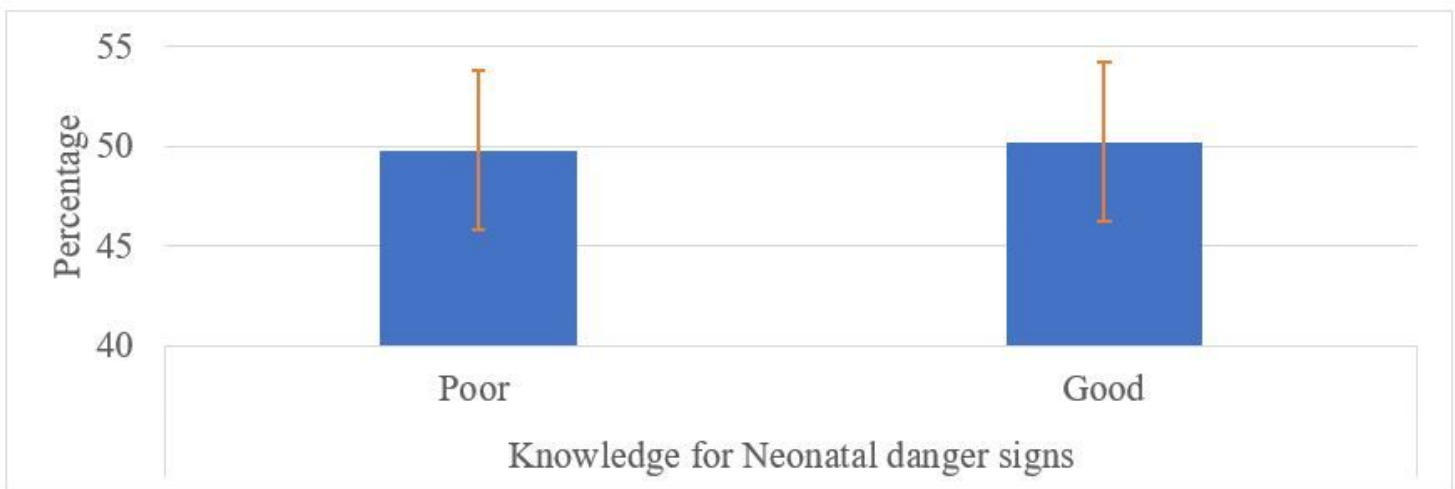


Figure 2

Total knowledge of neonatal danger signs among mothers who gave birth in the past six months at Chole District, Arsi Zone, South East Ethiopia, 2019 (n=510)

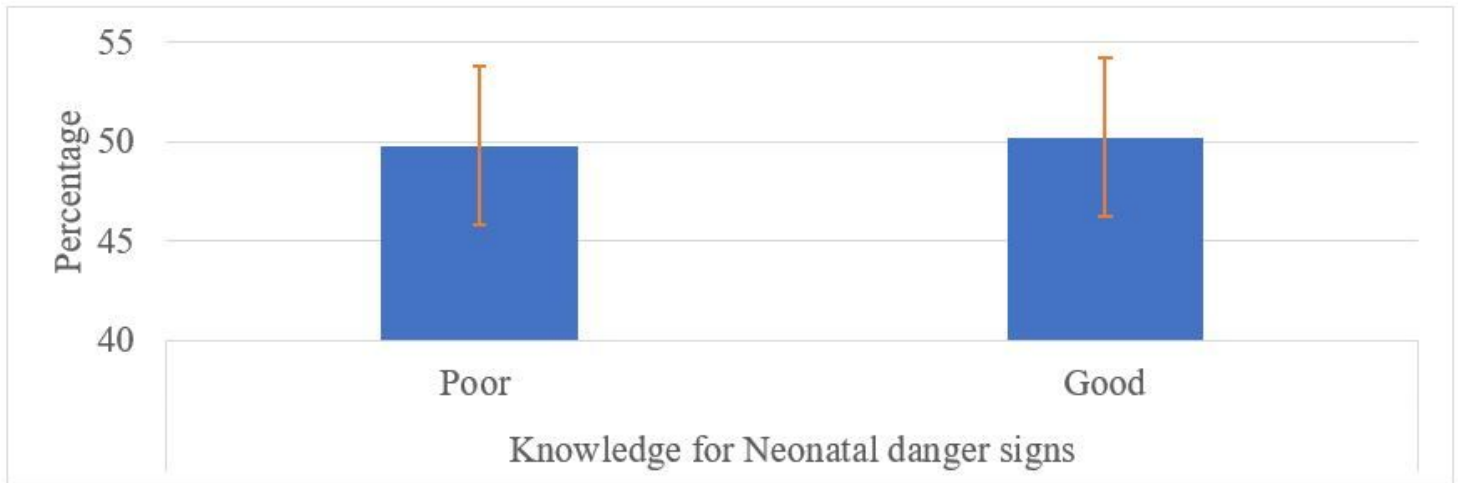


Figure 2

Total knowledge of neonatal danger signs among mothers who gave birth in the past six months at Chole District, Arsi Zone, South East Ethiopia, 2019 (n=510)

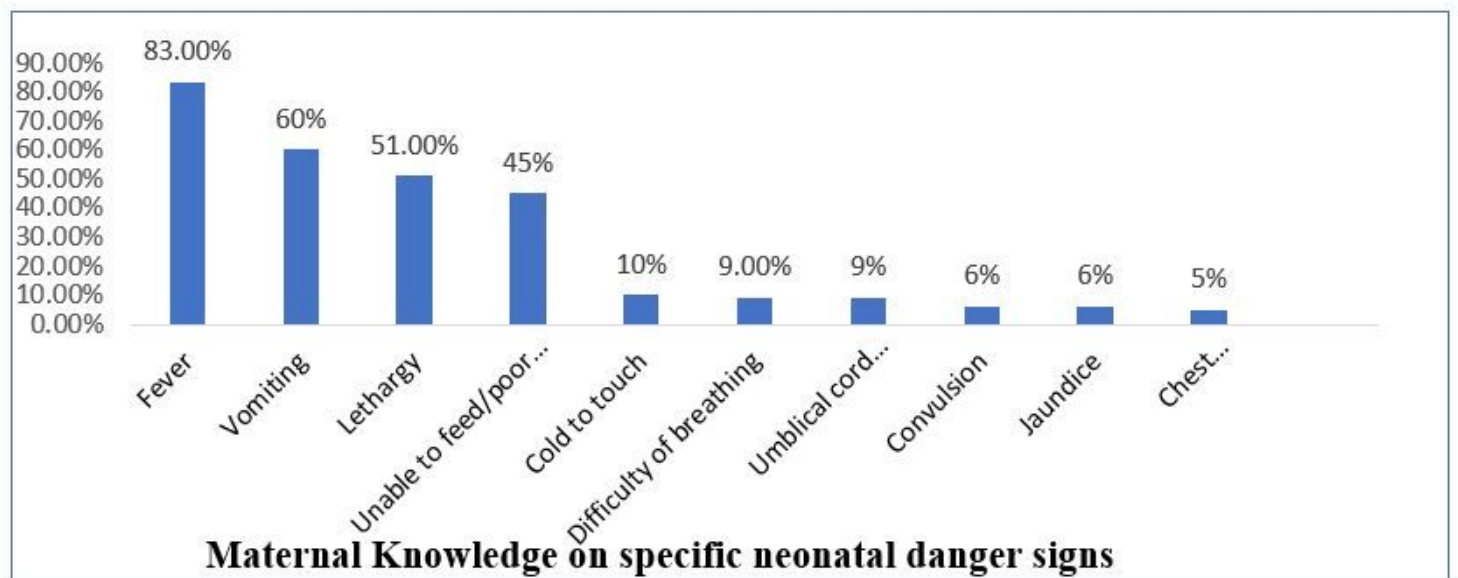


Figure 3

Maternal knowledge on specific neonatal danger signs among mothers who gave birth in the past six months at Chole District, Arsi Zone, South East Ethiopia, 2019 (n=510)

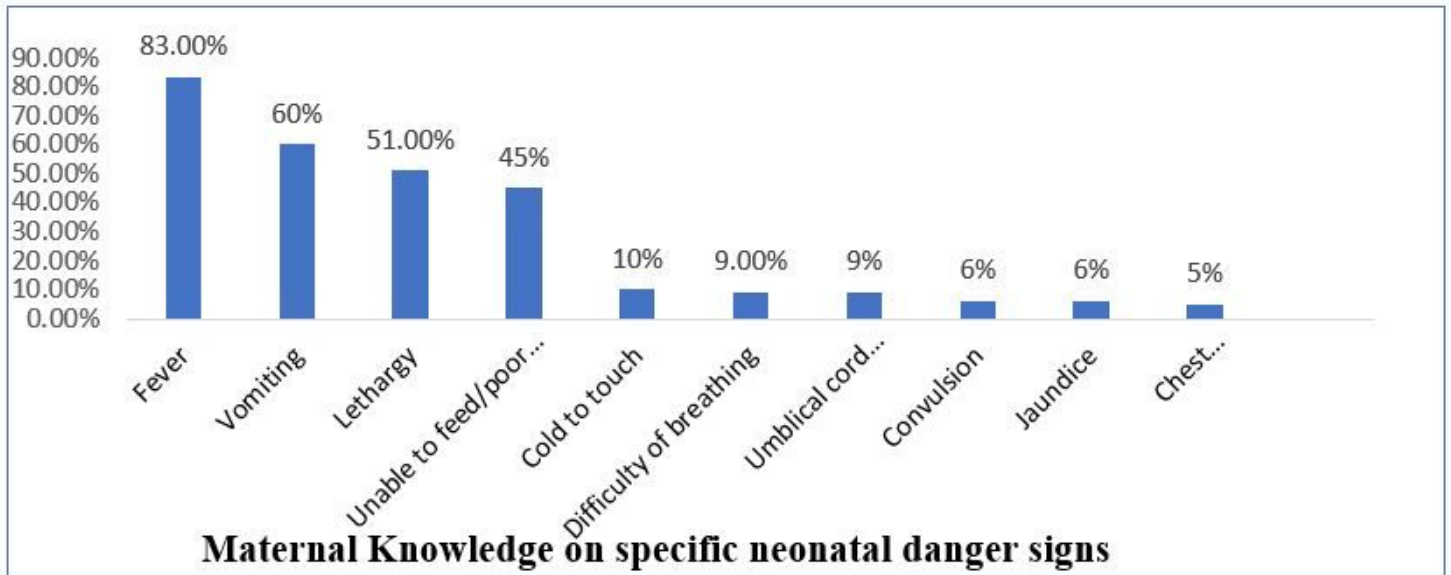


Figure 3

Maternal knowledge on specific neonatal danger signs among mothers who gave birth in the past six months at Chole District, Arsi Zone, South East Ethiopia, 2019 (n=510)