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Original Article

What mothers know about neonatal danger signs: A Cross Sectional Study of Ethiopia

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ABSTRACT

Background: Neonatal danger signs contribute to the high mortality of neonates in developing countries. Delays in recognition of danger signs and the decision to seek care contribute to most neonatal deaths in Ethiopia. Therefore, the current study aimed to assess mothers' knowledge and associated factors on neonatal danger signs in Nekemte town, Western Ethiopia.

Methods: The current community-based cross-sectional study was conducted in Nekemte, Ethiopia, in March 2019. The sample included 727 mothers who had given birth within the past 12 months. A multistage sampling technique was utilized to recruit participants and data were collected using face-to-face interviews. The collected data were entered into EPI info (version 7.2.0.1) and analyzed using SPSS (version 23). To evaluate the knowledge of neonatal danger signs, a median score was used as the cut-off point. Mothers who spontaneously mentioned at least five danger signs were considered to have good knowledge of neonatal danger signs. Bivariable and multivariable logistic regression analyses were performed to identify factors associated with knowledge of danger signs.

Results: Of 727 participants, 707 mothers were interviewed, yielding a response rate of 98.3%. The median age of the participants was 27 years, with an interquartile range of ± 5. The result of the study indicated that 55.6% [95%CI (52.1% - 59.3%)] of mothers had good knowledge of neonatal danger signs. The adds ratio of having good knowledge of neonatal danger signs were associated with being married [AOR=2.87, 95%CI (1.27, 6.52)], mother's educational status of secondary level or higher [AOR= 1.71, 95%CI (1.03, 2.84)], antenatal care visits of four and more [AOR=1.58, 95%CI (1.09, 2.31)], and postnatal follow-up [AOR=2.13, 95%CI (1.39, 3.27)]. Furthermore, delivery at health institutions [AOR=3.11, 95%CI (1.10, 8.76)], access to TV [AOR=1.58, 95%CI (1.05, 2.37)], and Internet use [AOR=2.39, 95%CI (1.52, 3.77)] were also significantly associated with good knowledge.

Conclusion: The proportion of mothers with good knowledge of neonatal danger signs was found to be low. Therefore, it is recommended to enhance counseling services during antenatal care and strengthen community-based health information dissemination efforts related to neonatal danger signs.

Keywords: Ethiopia, Knowledge, Mothers, Neonatal danger signs, Ethiopia

Introduction

The neonatal period, which involves the first four weeks of life, represents a critical phase with a heightened vulnerability to child mortality (1). In 2017, the global average rate of neonatal deaths stood at 18 deaths per 1,000 live births, making it the period of highest risk for infant mortality. As mentioned in the study, 2.5 million infants died in the first month of life in 2017 alone, equating to approximately 7,000 neonatal deaths per day (2). Ethiopia has high neonatal mortality, with 29 deaths per 1000 live births (3). The primary causes of neonatal mortality in the country

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include birth asphyxia (31.6%), prematurity (21.8%), and sepsis (18.5 %) are the main causes of death(4).

Danger signs are signs that can be easily identified by non-clinical personnel, including the mother (5). Neonatal danger signs contribute to the high mortality of neonates in developing countries (6). Mothers' lack of knowledge of neonatal danger signs is significantly associated with a higher risk of neonatal death within the first 28 days of life (7). The World Health Organization (WHO) and UNICEF have identified a range of danger signs, including poor suckings/unable to feed, abnormal jerking movement of limbs and eyes (convulsions), trouble/difficulty of breathing, no spontaneous movement (lethargic), fever, hypothermia, umbilicus redness and discharging pus, repeated vomiting, yellowish discoloration of eyes, palms, soles at any age, and excessive crying(irritability) (8-10). Identifying neonatal danger signs allows for the early detection of neonatal illness, which is an initial step towards seeking care for sick neonates, resulting in improved newborn survival (1).

The majority of neonatal deaths in developing countries can be prevented by improving the coverage of currently available, evidence-based, and cost-effective measures (11). In its attempt to reduce the neonatal mortality rate, the Ethiopian Federal Ministry of Health (FMOH) has presently launched nationwide programs and strategies, such as community-based neonatal care (CBNC), Integrated Management of Neonatal and Child Illness (IMNCI), and Integrated Community Case Management (ICCM). These initiatives require caregivers and healthcare providers to possess proper knowledge of danger signs in a sick neonate and to seek the appropriate level of health care, which would reduce mortality (12). Early symptom recognition, identification of danger signs, and appropriate care-seeking have been identified as cornerstones in neonatal death reduction (8, 13).

Currently, the Ethiopian Ministry of Health introduced an illustrated booklet called the Family Health Card (FHC), which contains recommended action points and key health messages with illustrations of neonatal danger signs in different local languages. The FHC aims to help families recognize danger signs and improve their treatment-seeking behavior (9).

In Ethiopia, there are significant discrepancies in maternal knowledge of neonatal danger signs, ranging from 18.2% to 88.9% (14-20). According to most studies, the percentage of mothers with good knowledge of danger signs is less than 50%. However, it has been observed that urban and capital cities tend to have a higher proportion of mothers with good knowledge (15).

Mothers' knowledge of neonatal danger signs is influenced by various factors, particularly in developing countries. Several studies conducted in Bangladesh, Iraq, Ghana, Kenya, and Ethiopia, have shown that mother's use of antenatal and postnatal services (18, 20-23), along with sociodemographic factors, such as age, educational level, employment status, urban residence, and family support, are significant predictors of good knowledge. Parity, birth preparedness, media access, and husband accompaniment could positively affect mother's knowledge (17, 18, 21, 24, 25).

Maternal knowledge directly and positively impacts their health-seeking behavior and treatment-seeking intention for neonatal danger signs in many countries, including Ethiopia (26, 27). Mothers tend to seek care for their ill babies when they have adequate knowledge of neonatal danger signs (27).

Achieving the third Sustainable Development Goal, which aims to reduce neonatal mortality by eliminating preventable child deaths, happens when mothers have sufficient awareness of neonatal danger signs (18, 28). The burden of neonatal mortality in Oromia is high and has not shown any significant decline over time. Consequently, there is an urgent need to implement effective strategies to tackle the problem. Therefore, this study aimed to assess mothers' knowledge of neonatal danger signs and the possible factors affecting their knowledge in Nekemte town, Western Ethiopia, in 2019.

Methods

Study setting and Period

Nekemte town is situated 320 km west of the capital city, Addis Ababa. Nekemte town is the capital city of the East Wollega Zone of the Oromia region. According to the Central Statistical Agency population projection for Ethiopia, the total population of Nekemte town was estimated to be 127,350 in 2018, with 63,039 being women (29). Data obtained from the Nekemte town health bureau have indicated that approximately 4097 mothers had given birth within 12 months before March 2019. There are seven Kebeles in Nekemte Town. The town has one public referral hospital, one tertiary/teaching hospital, and two health centers. There is one governmental University and

two private universities in the town. The study was conducted between March 1 and March 30, 2019, targeting mothers who gave birth during the past 12 months and were residing in Nekemte town.

Study Design

The current research was a community-based cross-sectional study.

Study Subjects and Sampling Procedures

Source population

The study population included all reproductive-age mothers living in Nekemte town, East Wollega, Ethiopia. The study focused specifically on who gave birth within the 12-month period before March 2019.

Eligibility Criteria

The study included all reproductive-age mothers who gave birth within 12 months living in Nekemte town. However, three mothers who recently experienced the loss of their baby were excluded from the study due to ethical considerations. Moreover, five mothers who were severely ill during data collection were excluded.

The sample size was determined using a single population proportion calculation based on several parameters. These included a 95% confidence interval, a proportion (P) 31.32 derived from a previous study conducted in Wolkite Town[14], a precision level of 5%, and design effect 2. As a result, the total calculated sample size was determined to be 727 mothers who had given birth within the 12-month period. Then, a two-stage sampling technique was employed. Initially, four kebeles were selected randomly from a total of seven kebeles in Nekemte town. The number of mothers to be interviewed from each kebele was allocated proportionally based on the size of the respective kebeles. Finally, the mothers were chosen through a simple random sampling technique using a sampling frame obtained from the Family Index Registry maintained by health extension workers in the corresponding sub-cities.

Variables of the study

The study included outcome and explanatory variables. Knowledge of mothers towards neonatal danger signs was the outcome variable. The explanatory variables included age, marital status, educational status, income, husband's educational status, occupation, parity, antenatal care (ANC) follow-up, postnatal care (PNC) service, number/ time of ANC, number of PNC, counseling at ANC or PNC, husband involvement in postnatal care, birth preparedness, Source of information (radio/TV, magazine, internet, relatives/friends, health worker, Health extension), place of delivery, place of ANC follow up.

Operational definitions

In the current study, the knowledge level of the mothers was assessed based on their spontaneous responses to 13 items related to neonatal danger signs. The total number of correct responses determined the knowledge score, ranging from 0 to 13[30]. The median score of neonatal danger signs, which was five neonatal danger signs, was determined as the cut-off point.

Spontaneous response in the current study involves respondents naming neonatal danger signs without being offered the option/lists of the respective danger signs[18]. Mothers who were able to mention five or more danger signs were classified as having good knowledge of neonatal danger signs. On the other hand, mothers who mentioned fewer than five danger signs out of a total of 13 danger signs were categorized as having poor knowledge, indicating a knowledge score below the median threshold.

Data collection method

Data were collected by face-to-face interviews using a semi-structured questionnaire developed based on a comprehensive review of relevant literature (14, 16, 27, 30). The questionnaire consists of four parts, namely sociodemographic variables, maternal health service-related, obstetric variables, and knowledge of neonatal danger signs. To ensure linguistic consistency, the questionnaire was prepared in English, translated to local language (Afaan Oromoo), and then back-translated to English. Internal reliability was assessed using Cronbach's alpha , resulting in satisfactory values for sociodemographic section (0.703), obstetric and maternal health services (0.703), source of information (0.722), and knowledge (0.70). Four BSc nurses were employed to collect the data, and two BSc health officers served as supervisors during the data collection.

Data Quality Control

Pretest was performed on 5% of the study population in Ghimbi town 2 weeks before data collection. During the pretest, mothers were prompted to remember as many danger signs as possible to minimize recall bias for knowledge

questions. A 2-day training was provided to the supervisors and data collectors. After each day of data collection, the supervisor thoroughly checked the questionnaires for completeness and consistency. Data cleaning was performed before data entry into the software.

Data Processing and Analysis

The entered data was subjected to exploratory and cleaning processes using EPI info version 7.2.0.1. Once the data cleaning was completed, it was exported to SPSS version 23 for statistical analysis. Descriptive statistics, including frequencies, proportions, and means, were used to explain variables, such as sociodemographic characteristics of the participants, maternal knowledge, and danger signs identified by the mother. The wealth index was calculated by principal component analysis (PCA) after checking its assumptions. A binary logistic regression model was fitted. All variables with a p-value less than 0.25 in bivariable analysis were taken to multivariable logistic regression. Multivariable logistic analysis of factors was conducted. Factors that yielded a p-value of less than 0.05 and had adjusted odds ratios (AOR) with a 95% confidence interval (CI) that excluded the null value were considered statistically significant and discussed accordingly.

Ethical approval

Ethical clearance was obtained from the School of Nursing Ethical Review Committee on behalf of the Institutional Review Board of the University of Gondar (Ref. No. S/N/1602/06/2011). A permission letter was obtained from the Nekemte Town Health Bureau and all concerned bodies. The study participants were informed of the purpose of the study, the procedures, and the potential risks of the study. Verbal informed consent was taken from the study participants before starting the interview. Participants were assured that their participation was entirely voluntary and that they had the right to refuse or withdraw from the study at any time. Confidentiality of the information was guaranteed by data being assigned secret codes to ensure anonymity. The hard copy of the collected data was kept in a locked cabinet, and the soft copy of the data was secured by a password on the computer. Mothers who exhibited poor knowledge of neonatal danger signs received health education from the data collectors, focusing on the danger signs they failed to mention by data collectors. They were also advised to use their FHC. In cases where mothers reported a sick baby, appropriate referrals were made to nearby health centers for further evaluation and treatment.

Results

Sociodemographic Characteristics

Of 719 mothers expected to participate, 707 were interviewed, yielding a response rate of 98.3%. The median age of the study participants was 27.00 years with an interquartile range (IQR) of ± 5. Approximately, 490 (69.3%) of the respondents fell within the age range of 25-34 years. The majority (90%) of the respondents were married, and 417(59%) of them were protestant in religion, followed by Orthodox (19.4%). In terms of educational background, about one-third of the mothers (33.7%) had a college degree or higher (Table 1).

Maternal Health Service and Obstetric Characteristics

More than a third quarter, 623 (88.1%) of the mothers said they had visited ANC and 348 (55.9%) of the women reported attending at least four ANC appointments for the current birth. More than half 425(60.1%) of the moms did postnatal checks. Nearly a third, 125 (29.4%) of the mothers who go for postnatal checkups received advice on various subjects. (Table 2).

Knowledge of mothers about neonatal danger signs

The obtained results revealed that all participating mothers in the study mentioned at least one neonatal danger sign. Of the 13 neonatal danger signs identified by WHO/UNICEF, around 184 (26%) of the mothers mentioned only three (Table 3). The proportion of mothers who had good knowledge (mentioned at least five danger signs) was found to be 393(55.6%) with 95%CI (52.1% - 59.3%) (Figure 1).

Danger Signs Identified by Mothers

Among neonatal danger signs outlined by WHO, the most identified danger sign by the mothers was fever (69.0%) followed by vomiting (66.8%), and baby stop breastfeeding (66.1%). Yellowish discoloration of the skin 107(15.1%), baby cold to touch 113(16%), and eyes swollen, sticky, red, or draining pus 113(16%) were the least identified danger signs by the mothers (Figure 2).

Factors Associated with Knowledge of mothers about Neonatal Danger signs

Binary logistic regression was conducted to

Table 1. Sociodemographic characteristics of mothers delivered within 12 months living in Nekemte town, March 2019 (n=707)

Characteristics (Variables)		Frequency	Percentage (%)
Age of the mother	15-24	170	24%
	25-34	490	69.3%
	≥35	47	6.6%
Marital Status	Single and widowed	37	5.2%
	Married	639	90.4%
	Divorced	31	4.4%
Religion	Protestant	417	59.0%
	Muslim	104	14.7%
	Orthodox	137	19.4%
	Waaqeffataa	49	6.9%
Ethnicity	Oromo	640	90.5%
	Amhara	33	4.7%
	Gurage	30	4.2%
	Others[a]	4	0.6%
Mother's Occupation	House Wife	433	61.2%
	Merchant	129	18.2%
	Government Employee	101	14.3%
	Student	34	4.8%
	Others[b]	10	1.4%
Husband Occupation	Daily Laborer	160	23.1%
	Self-Employee	148	21.3%
	Merchant	176	25.4%
	Government Employee	204	29.4%
	Student	6	0.8%
Mother's Educational Status	No formal education	119	16.8%
	Primary (1-8)	146	20.7%
	Secondary (9-12)	204	28.9%
	College and Above	238	33.7%
Husband Educational Status	No formal education	49	7.0%
	Primary (1-8)	147	21.2%
	Secondary (9-12)	144	20.7%
	College and Above	354	51.0%
Family Size	<3	11	1.6%
	3-5	556	78.6%
	≥6	140	19.8%
Parity	1	189	26.7%
	2-4	490	69.3%
	≥5	28	4.0%
Wealth Quantile	Lowest	145	20.5%
	Second	140	19.8%
	Middle	142	20.1%
	Fourth	139	19.7%
	Highest	141	19.9%

[a]=Tigrey, Wolayita [b] = Laborer, self-employee

assess factors affecting maternal knowledge of neonatal danger signs. Initially, all variables were included in the bivariable analysis. Variables with a p-value of ≤0.2 were selected for further multivariable analysis to examine the factors and potential confounding effects. The backward Likelihood Ratio method of analysis was applied and Hosmer–Lemeshow goodness-of-fit was checked (Table 4).

Sociodemographic Factors

The multivariable logistic analysis indicated that marital status and maternal educational status were associated with mothers' knowledge.

Being married increased the odds of having good knowledge of neonatal danger signs by 2.87 times, compared to single or widowed mothers [AOR=2.87, 95%CI (1.27, 6.52)]. As can be seen in Table 4, mothers with educational achievement of

Table 2. Maternal health services and obstetric characteristics of mothers who delivered within 12 months living in Nekemte town, March 2019. (n=707)

Characteristics (variables)		Frequency	Percentage (%)
Attended ANC for current pregnancy	No	84	11.9%
	Yes	623	88.1%
Number of ANC Visits (n=623)	One Visit	48	7.7%
	Two Visit	76	12.2%
	Three Visits	151	24.2%
	Four Visits and Above	348	55.9%
Husband involved in ANC Visits (n=623)	No	126	20.2%
	Yes	498	79.8%
Attended PNC checkups (n=707)	No	282	39.9%
	Yes	425	60.1%
Frequency of PNC (n=425)	1 time	223	52.5%
	2 times	118	27.8%
	>3 times	84	19.8%
Counseled at PNC (n=425)	No	300	70.6%
	Yes	125	29.4%
Mothers counseled on topics	Advantage of breastfeeding	210	38.82%
	Cord care	62	11.46%
	Eyecare	28	5.18%
	Thermoregulation	94	17.38%
	Vaccination	129	23.8%
	Neonatal Danger Signs	18	3.32%
Husband involved in the PNC Follow-up ()n=425)	No	164	38.6%
	Yes	261	61.4%
Visited at home by HEW/HP (n=707)	No	266	37.6%
	Yes	441	62.4%
Birth Preparedness (n=707)	No	120	17.0%
	Yes	585	83.0%
Place of delivery (n=707)	At home	25	3.5%
	At hospital	316	44.75
	Health center	329	46.5%
	Private clinic	37	5.2%
Place of ANC follow up (n=707)	Health center	310	49.8%
	Private clinic	69	11.1%
	Hospital	244	39.1%
Source of information about NDS	Health Care Provider	225	30.3%
	HEW	303	40.8%
	Community Conversation	38	5.1%
	Media	176	23.72%

*HEW-Health Extension Worker, HP-Health provider, ANC-Antenatal care,

secondary school and higher were 1.71 times more likely to be knowledgeable, compared to mothers who had not received formal education [AOR= 1.71, 95%CI (1.03, 2.84)].

Maternal Obstetrics and Health Services Related Factors

Bivariable logistic analysis of maternal health services related to factors, such as ANC follow up, PNC follow up, frequency of ANC and PNC visits, counseling at ANC and PNC visits, and being visited at home by Health Extension Worker (HEW) during the postnatal period was found to be associated with maternal knowledge.

Table 3. Knowledge score of mothers of infants on neonatal danger signs who live in Nekemte town, March 2019 (n=707)

Knowledge score (out of 13)	Frequency	Percent (100%)	Knowledge category
1	15	2.1	Poor
2	64	9.1	Poor
3	95	13.4	Poor
4	140	19.8	Poor
5	184	26.0	Good
6	100	14.1	Good
7	55	7.8	Good
8	26	3.7	Good
9	11	1.6	Good
10	7	1.0	Good
11	5	0.7	Good
12	5	0.7	Good
13	0	0.0	Good
Total	707	100.0	Good

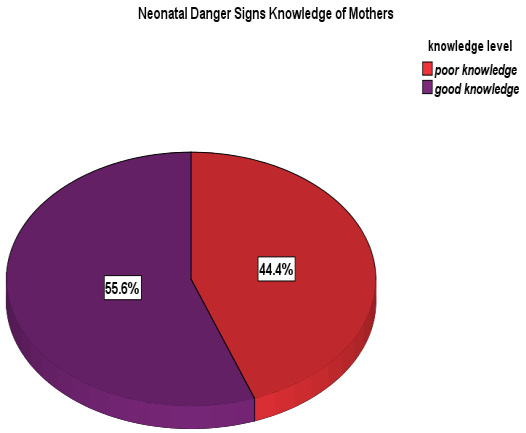

Figure 1. Knowledge of mothers towards neonatal danger signs in Nekemte town, March 2019

However, in multivariable logistic regression analysis, only the frequency of ANC follow-up, attending postnatal service, and place of delivery were found to be significantly associated with the knowledge of mothers towards neonatal danger signs.

Accordingly, the odds of having good knowledge of neonatal danger signs were associated with increased frequency of ANC follow-up. The finding showed that mothers who had four visits or more were 1.58 times more likely to have a good knowledge of neonatal danger signs, compared to those who attended less than four ANC visits [AOR= 1.58, 95%CI (1.09, 2.31)].

Moreover, mothers who followed postnatal services had higher odds of good knowledge of neonatal danger signs. The obtained results revealed that the odds of having good knowledge among mothers who attend PNC was 2.13 times more than mothers who did not attend PNC for their current delivery [AOR=2.13, 95%CI (1.39, 3.27)].

furthermore, the institutional delivery was significantly associated with maternal knowledge of neonatal danger signs. The finding of this study showed that the odds of having good knowledge among mothers who delivered at the health facility was 3.11 times higher, compared to those delivered at their home [AOR=3.11, 95%CI (1.10, 8.76)] (Table 4).

Source of Information and use of Medias

Among the five sources of information analyzed in the study (access to TV, reading a

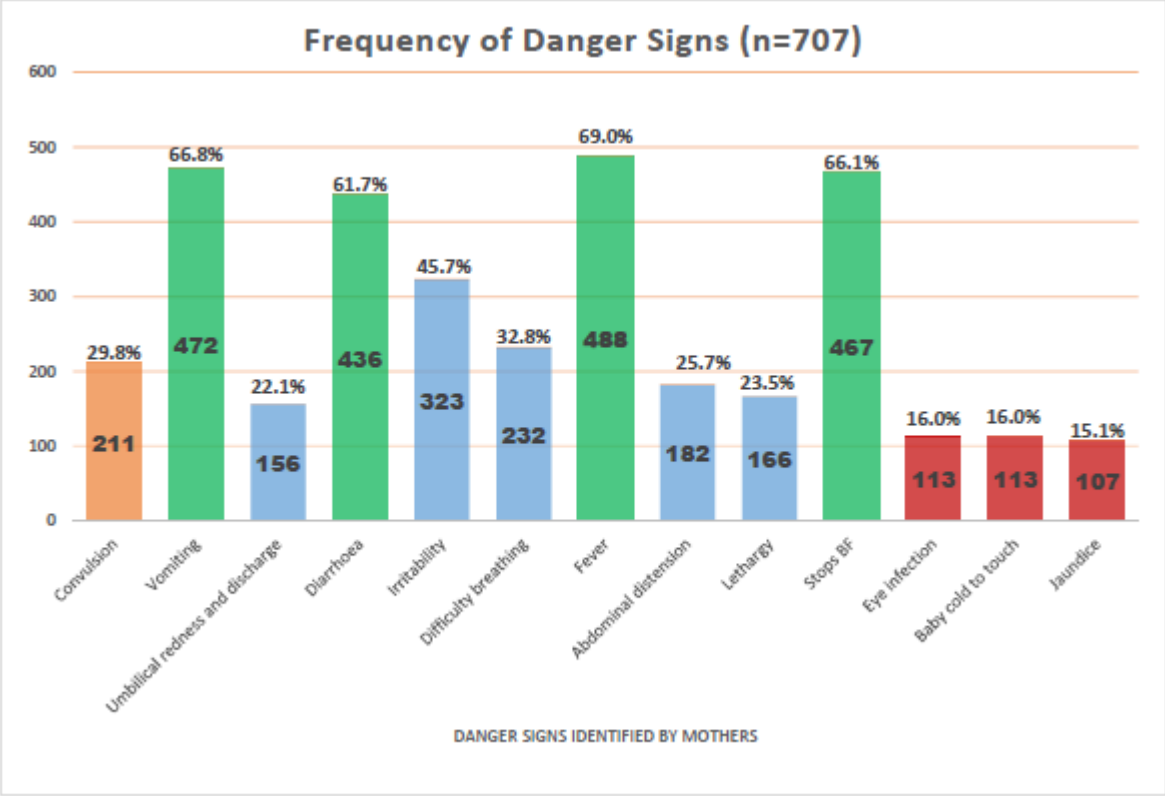

Figure 2. Neonatal danger signs identified by mothers who participated in the study, March 2019

Table 4. Bivariate and Multivariable analysis of factors associated with maternal knowledge of neonatal danger signs among mothers who delivered within 12 months living in Nekemte town, 2019 (n=707)

Factor variables		Knowledge of neonatal danger sign		Crude OR (95% CI)	Adjusted OR (95% CI)	p-value
		Poor, N	Good, N			
Marital status	Single & widowed	24	13	1	1	.012
	Married	208	431	3.83 (1.91, 7.67)	2.87 (1.27, 6.52)	.012
	Divorced	14	17	2.24 (.84, 5.96)	1.39 (0.47, 4.12)	.554
Mother's occupation	house wife	155	278	1	1	.198
	Merchant	45	84	1.04 (.69, 1.57)	1.01 (0.64, 1.59)	.978
	Gov't employee	25	76	1.70 (1.04, 2.77)	0.66 (0.35, 1.25)	.204
	student	14	20	0.80 (0.39, 1.62)	0.7 (0.32, 1.84)	.558
	Others[a]	7	3	0.24 (0.06, .94)	0.17 (0.03, .87)	.033
Husband occupation	self-employee	50	98	1	1	.563
	merchant	48	128	1.36(.85, 2.19)	1.27 (0.73, 2.19)	.393
	Gov't employee	60	144	1.22(.78, 1.93)	0.88 (0.50, 1.53)	.644
	Others[b]	80	86	0.55(.35, .87)	0.82 (0.47, 1.41)	.466
Maternal educational status	No formal education	58	61	1	1	.009
	Primary (1-8)	73	73	0.95 (0.59, 1.54)	0.89 (0.52 ,1.55)	.690
	Secondary and above	115	327	2.70 (1.78, 4.11)	1.71 (1.03, 2.84)	.037
Family support	No	101	151	1	1	
	Yes	145	310	1.43 (1.04, 1.97)	0.77(0.52, 1.14)	.192
Attended ANC	No	48	36	1	-	
	Yes	198	425	2.86 (1.80. 4.55)	-	
No of ANC visits	<4 visits	99	176	1	1	
	≥4 visits	100	248	1.40 (.99, 1.96)	1.58 (1.09, 2.31)	.017
Attended PNC	No	140	142	1	1	
	Yes	106	319	2.97 (2.15, 4.09)	2.13 (1.39, 3.27)	.010
Frequency of PNC visits	1 time	55	168	1	1	.115
	2 times	37	81	0.72(.44, 1.17)	0.995 (0.58, 1.703)	.985
	≥3 times	14	70	1.64(.86, 3.13)	2.02 (1.01, 4.06)	.047
Visited at home by HEW	No	108	158	1	1	
	Yes	138	303	1.50 (1.09, 2.06)	0.93(0.63, 1.37)	.721
Birth preparedness	No	61	59	1	1	
	Yes	185	400	2.24 (1.50, 3.33)	1.13 (0.67, 1.90)	.652
Access to TV	No	94	89	1	1	
	Yes	152	372	2.59 (1.83, 3.65)	1.58 (1.05, 2.37)	.028
Read magazines	No	223	391	1	1	
	Yes	22	70	1.82 (1.09, 3.01)	0.83(0.42, 1.63)	.586
Ever read FHC	No	216	363	1	1	
	Yes	30	98	1.94 (1.25, 3.03)	1.26 (0.73, 2.16)	.406
Internet access	No	208	284	1	1	
	Yes	38	177	3.41 (2.30, 5.06)	2.39 (1.52, 3.77)	<.001
Place of delivery	home	19	6	1	1	
	health facility	227	455	6.35 (2.50, 16.11)	3.11 (1.10, 8.76)	.032

[a] –daily laborer, self-employee [b] – daily laborer, student, and driver

magazine, access to and reading FHC, access to the internet, and use of social media), the bivariable analysis showed that access to TV, access to the internet, and sources of information from health extension workers and media were associated with maternal knowledge of mothers neonatal danger signs. However, when other factors were controlled in multivariable analysis, only access to television and access to internet were found to be significantly associated with knowledge of

mothers towards neonatal danger signs.

Accortding to Table 4, the odds of having good knowledge about neonatal danger sign among mothers with TV access was 1.58 times higher than mothers with no TV access [AOR=1.58 95%CI (1.05, 2.37]. In addition to this, mothers who had good internet access were 2.39 times more likely to have good knowledge of neonatal danger signs, compared to those with no internet access [AOR=2.39 95%CI (1.52, 3.77)].

Discussion

The knowledge of neonatal danger signs among mothers or caregivers is crucial for reducing neonatal and infant mortality rates to an acceptable level. This knowledge is fundamental for a mother's intentions to seek care, as it serves as the starting point for providing comprehensive neonatal healthcare comprehensive neonatal health care. This study aimed to assess the knowledge and the associated factors related to maternal knowledge about neonatal danger signs among mothers who had given birth in the past 12 months and were living in Nekemte town.

In this study, more than half of mothers (55.6%) had good knowledge of neonatal danger signs. However, the result of this study is lower than the level reported by governmental health centers in Addis Ababa as 88.9% of mothers had good knowledge of danger signs (15). The difference may be attributed to the educational backgrounds and relatively higher exposure to the media and other information sources. Additionally, the percentage was also lower than the findings from a study conductd in Baghdad primary health centers (21), where 81% of mothers had good knowledge of neonatal danger signs. This can be brought on by the different study environments and socioeconomic conditions of the two nations.

The prevalence of good knowledge in this study was almost twice that reported in previous studies in Wolkite town (14) and Dilla University referral hospital (16). Additionally, the prevalence rates reported from Chencha district (17) and Woldia (30) were lower than that of the current study. The higher prevalence in the current study may be due to the relatively better educational status and maternal health service utilization among the participating mothers, compared to those in previous studies. Another possible explanation for this difference could be the recent focus on newborn and maternal health by the Ethiopian Government, federal ministry of health (FMOH), NGOs, and other stakeholders. These organizations have worked to raise community awareness using various communication outlets, leading to improved awareness among the community. Increased use of media may have provided greater chances for mothers to obtain health-related information. Similarly, the finding of this study was higher than the levels reported in Kenya (15.5%) (22), Ghana (28.1%) (31), and Bangladesh (51%) (25). These differences may be due the study area and variations in triggers that helped mothers recall more danger signs.

The identification of fever as a danger sign by mothers in this study was consistent with the majority of previous studies conducted in Addis Ababa, Chencha district, Dilla University referral Hospital, and Woldia (15-17, 30). Similarly, fever was mostly identified as a danger sign among mothers in Bangladesh, Iraq, and Kenya (21, 22, 25). However, yellowish discoloration of the skin, baby cold to touch, and eye infection were the least identified danger signs by mothers in the current study, which was consistent with studies done in Woldia, Mekelle, and Wolkite towns (14, 19, 30). In contrast, jaundice was among the topmost danger signs recognized by mothers in the study conducted in Baghdad, Iraq 21, which might be due to differences in skin color.

The ANC follow-up frequency was found to be an important factor affecting mothers' knowledge of neonatal danger signs in this study. Mothers who attended four or more ANC visits were 1.58 times more likely to have good knowledge of neonatal danger signs, compared to those who attended less than four visits. This result is consistent with a study done in Baghdad (21) and a study done in Addis Ababa (15), which both showed that women who had visited ANC less than four times were more likely to have poor knowledge than those who visited four times or more. The ANC visits provide pregnant women with opportunities to learn more about maternal and newborn danger signs from healthcare professionals during ANC checkups, which could explain why increased access to ANC services leads to women having greater knowledge about neonatal danger signs.

Place of delivery was found to be significantly associated with mothers' knowledge. Mothers who delivered at a health facility were almost three times more likely to mention at least five neonatal danger signs, compared to those who delivered at home. This finding is supported by the studies conducted in Bangladesh (23) and Wolkite town (14). The possible rationale for this

may be that mothers who gave birth at health institutions will get the chance to receive postnatal care as well as counseling about maternal and neonatal illnesses. During these visits, healthcare providers provide information about the symptoms of illnesses that mothers should be vigilant about, both for themselves and their newborns. This increases the knowledge of mothers concerning neonatal danger signs.

The study confirmed that PNC follow-up practice creates a good opportunity for mothers to have good knowledge of neonatal danger signs. Postnatal care attendant mothers were around 2.13 times more likely to mention at least five neonatal danger signs, compared to their counterparts. This finding was consistent with the studies conducted in Gondar (18) and Wolkite town (14). Women would have become aware of neonatal danger signs through education received at postnatal care centers, as this issue is often among the topics discussed. Therefore, the mother's exposure to the PNC package can increase their knowledge concerning neonatal danger signs.

The educational status of mothers was found to be significantly associated with good knowledge of neonatal danger signs. This finding was supported by the studies conducted in Gondar Town (18) and Woldia, Ethiopia (30). Similarly, this was consistent with the study from Bangladesh (25), indicating that mothers' educational achievement of secondary and higher was an important determinant factor for identifying at least one danger sign. Educated mothers acquire knowledge about diseases and human health through their academic life. They also have better access to health service information and improved perception of danger signs.

Married women showed increased odds of good knowledge about neonatal danger signs, compared to single or widowed mothers. This finding was consistent with a study performed in Woldia, Northwest Ethiopia (30). Husbands play a role in discussing the baby's health concerns with their wives and can contribute to improving their knowledge of self-care and newborn care through counseling, health education, and encouraging healthcare-seeking behavior.

According to the findings of the study, increased exposure to media, especially television, is associated with a higher level of maternal knowledge regarding neonatal danger signs. Mothers with access to TV are 1.58 times more likely to have good knowledge of these danger signs, compared to those with no TV access. This finding is consistent with similar studies conducted in Ghana (32) and Gondar (18), indicating that the health-related content of television programs can improve memorability and increase awareness among communities.

The study also revealed that internet use was significantly associated with maternal knowledge. Health information and services are becoming increasingly accessible online, and this accessibility can improve the patient experience by promoting informed decision-making and enhancing health-promoting behaviors (33, 34). Internet use has also been associated with health-promoting behaviors (35). Frequent internet use enables mothers to access a wide range of health-related information about newborn illness, thereby improving their knowledge.

However, it is important to acknowledge the limitations of the study. One notable limitation is the potential for recall bias among the study population, as it comprised mothers who gave birth within the 12 months prior to March 2019. Despite efforts to minimize this bias, it is possible that participants may not accurately remember or recall specific details or events related to neonatal danger signs.

Conclusion

The study revealed that a small proportion of mothers had sufficient knowledge of neonatal danger signs, with fever being the most recognized sign and jaundice receiving the least attention. Maternal factors, such as educational and marital status, as well as increased use of maternal health services, were found to be independent predictors of good knowledge.

The study also highlighted that TV and internet use significantly impacted maternal knowledge of neonatal danger signs, indicating the missed opportunity of using social media sources to create awareness about these signs. Therefore, empowering women through quality education and promoting increased utilization of maternal health services, such as antenatal care visits, institutional delivery, and postnatal services, could improve knowledge of neonatal danger signs.

Community-based health education and interventions, such as community-based newborn care, can effectively disseminate information about neonatal danger signs and improve maternal knowledge.

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Conflicts of interest

The authors claim no competing interests.

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