



Research article

Knowledge of neonatal danger signs and associated factors among mothers attending pediatric immunization clinics in Gidan District Health Centers, North Wollo, Ethiopia



Yibeltal Asmamaw Yitayew^{a,*}, Anteneh Shumet Tadele^b, Zemen Mengesha Yalew^c, Shiferaw Abeway Mamuye^a, Desalegn Abebaw Jember^d

^a Department of Pediatrics and Child Health Nursing, College of Medicine and Health Science, Wollo University, Dessie, Ethiopia

^b Muja Health Center, Gidan District, North Wollo, Ethiopia

^c Department of Comprehensive Nursing, College of Medicine and Health Science, Wollo University, Dessie, Ethiopia

^d Department of Pediatric Nursing, St. Paul Hospital Millennium Medical College, Addis Ababa, Ethiopia

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ABSTRACT

Background: The majority of neonatal deaths in developing countries occurred at home due to late recognition of the signs of serious illness by parents or caregivers. In Ethiopia, besides the attempts made to scale-up the maternal and child health services, maternal knowledge of neonatal danger signs is low. Therefore, this study aimed to assess the knowledge of neonatal danger signs and associated factors among mothers attending pediatric immunization clinics in Gidan district health centers, North Wollo, Ethiopia.

Method: An institution-based cross-sectional study was conducted from September 1–30, 2020, among 399 mothers attending pediatric immunization clinics in Gidan district health centers. The data were collected using a pretested, structured, and interviewer-administered questionnaire. Epidata version 4.4.2.0 was used for data entry, and Statistical Package for Social Sciences version 22 was used for analysis. Descriptive statistics, bivariate and multivariate logistic regression were computed. Finally, an adjusted odds ratio along with 95% CI was calculated, and variables that had a P-value <0.05 were declared statistically significant.

Result: The level of good maternal knowledge of neonatal danger signs in the study area was 48.1% (95% CI, 43.6%–52.9%). Maternal education level (AOR: 3.58, 95% CI, 1.22–10.55), parity (AOR: 2.10, 95% CI 1.18–3.71), having postnatal care follow-up (AOR: 2.05, 95% CI, 1.21–3.49), receiving health education about neonatal danger signs (AOR: 4.87, 95% CI, 2.73–8.68), and previous experience of neonatal danger signs (AOR: 2.35, 95% CI, 1.33–4.15) were significantly associated variables with the maternal knowledge of neonatal danger signs.

Conclusion: This study revealed that maternal knowledge of neonatal danger signs was low. Maternal educational level, parity, postnatal care follow-up, health education about neonatal danger signs, and previous experience of neonatal danger signs were significantly associated variables. Therefore, maternal knowledge of neonatal danger signs needs to be enhanced through improving postnatal care services utilization and providing adequate health education about newborn health problems.

1. Introduction

The neonatal period (the first 28 days of life) is the most vulnerable time for the child's survival. Globally, 2.4 million children died in the first month of life in 2019 (17 deaths per 1,000 live births). Sub-Saharan Africa had the highest neonatal mortality rate in 2019 (27 deaths per 1,000 live births), followed by Central and Southern Asia

(24 deaths per 1,000 live births). A child born in sub-Saharan Africa was ten times more likely to die in the first month than a child born in a high-income country. Likewise, Ethiopia is among the top four countries with the highest burden of newborn deaths (99,000 deaths in 2019). According to the 2019 Ethiopian mini demographic and health survey key indicators, the neonatal mortality in Ethiopia was 30 deaths per 1000 live births [1, 2, 3].

* Corresponding author.

E-mail address: yibie.asmamaw21@gmail.com (Y.A. Yitayew).

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Neonates and young infants often present with nonspecific symptoms and signs of severe illness [4]. Neonatal danger signs are clinical signs that indicate a high risk of neonatal morbidity and mortality and require immediate therapeutic intervention [2, 5]. The World Health Organization (WHO) described nine neonatal danger signs, which includes; not able to feed or stopped feeding well, convulsions, fast breathing, severe chest indrawing, fever ($\geq 37.5^{\circ}\text{C}$), hypothermia ($\leq 35.4^{\circ}\text{C}$), yellow soles, movement only when stimulated or no

movement, and signs of local infection (umbilicus red or draining pus, skin boils, or eyes draining pus) [6].

The majority of neonatal deaths in developing countries occur at home due to late recognition of the signs of serious illness by parents or caregivers [7]. As a result, enhancing maternal knowledge of newborn danger signs has a significant impact on newborn health [8]. Studies conducted in this regard in Ethiopia showed that the maternal knowledge of neonatal danger signs ranges from 18.2%-64.1% [9, 10]. Additionally,

Table 1. Socio-demographic characteristic of the participants visiting pediatric immunization clinics in Gidan District Health Centers, North Wollo, Ethiopia (n = 399).

Variable	Category	Frequency	
		Number	Percentage
Age of the respondents	15–24	116	29.1
	25–34	222	55.6
	≥ 35	61	15.3
Marital status	Married	346	86.7
	Single	25	6.3
	Divorced	16	4.0
	Widowed	4	1.0
	Separated	8	2.0
Religion	Orthodox	373	93.4
	Muslim	23	5.8
	Protestant	3	0.8
Educational level of the woman	Unable to read and write	70	17.5
	Able to read and write	79	19.8
	Primary education	45	11.3
	Secondary education	60	15.0
	College or above	145	36.3
Educational level of the husband	Unable to read and write	42	10.5
	Able to read and write	70	17.5
	Primary education	49	12.3
	Secondary education	50	12.5
	College or above	188	47.1
Occupation of the women	Housewife	227	56.9
	Merchant	40	10.0
	Farmer	8	2.0
	Employee	117	29.3
	Student	7	1.8
Occupation of the husband	Farmer	112	28.1
	Merchant	95	23.8
	Employee	186	46.6
	Student	6	1.5
Age of the infants	<2 months	165	41.3
	2–5 months	124	31.1
	≥ 6 months	110	27.6
Sex of the infant	Male	201	50.4
	Female	198	49.6
Residence	Urban	287	71.9
	Rural	112	28.1
Family size	1–3	215	53.9
	4–6	152	38.1
	≥ 7	32	8.0
Average monthly income	<1000	101	25.3
	1000–1999	46	11.5
	2000–4999	159	39.8
	≥ 5000	93	23.3
Average distance to HC	<1 Hour	311	77.9
	1–2 Hours	84	21.1
	≥ 2 Hours	4	1.0
Availability of radio/television	Yes	302	75.7
	No	97	24.3

various factors that had a significant association with maternal knowledge of neonatal danger signs were also identified. Of these, age, occupation, maternal level of education, fathers' educational level, residence, availability of Radio or Television (TV), antenatal care (ANC) follow-up, spousal involvement during ANC, place of delivery, postnatal care (PNC) follow-up, higher decision-making ability, birth preparedness, information about neonatal danger signs, gravidity, previous experience of neonatal danger signs (NDSs), and counseling on newborn care are among them [9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21].

Early identification of neonatal danger signs is an important step toward improving newborn survival [15]. Furthermore, various studies indicated that knowledge of neonatal danger signs had a significant association with the treatment-seeking behavior of the mothers [18, 22]. However, in Ethiopia, besides the attempts made to scale-up the maternal and child health services, maternal knowledge of neonatal danger signs remains low [10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 23]. Therefore, this study aimed to assess the knowledge of neonatal danger signs and associated factors among mothers attending pediatric immunization clinics in Gidan district health centers, North Wollo, Ethiopia.

2. Methods

2.1. Study setting, design and period

An institution-based cross-sectional study design was conducted in Gidan district health centers from September 1–28, 2020. Gidan district is located 340 km away from Bahir Dar, the capital city of the Amhara region, and 625 km away from Addis Ababa, the capital city of Ethiopia. According to Gidan district administrative office, the estimated total population of the district was 42,232, and the total estimated number of infants in the study period was 4,605. Gidan district has six health centers that provide various health care services, including immunization.

2.2. Source and study population

2.2.1. Source population

All mothers attending pediatric immunization clinics in Gidan district health centers.

2.2.2. Study population

Randomly selected mothers attending pediatric immunization clinics in Gidan district health centers.

2.3. Sample size determination and procedure

The sample size was determined using a single population proportion formula by considering a 39% proportion of good maternal knowledge of neonatal danger signs in Sheko District, Southwest Ethiopia, with a 95% CI and 5% marginal error [15].

The sample size was calculated by using the following formula:

$$n = \frac{(Z_{\alpha/2})^2 \times p(1-p)}{w^2} = n = \frac{(1.96)^2 \times 0.39(1-0.39)}{(0.05)^2} = 365$$

Where:

n = is the required sample size

$Z_{\alpha/2}$ = the standardized normal distribution at 95% CI

P = the proportion of good maternal knowledge of neonatal danger signs

W = margin of error at 5%

By considering a 10% non-response rate, the final sample size was 402. Gidan district had six health centers, and out of these, three health centers (Muja, Ayela, and Densa health centers) were randomly selected. The respondents were allocated proportionally to each health center

based on the estimated clients visiting the immunization clinics during the study period. Finally, systematic random sampling ($k \approx 2$) was used to select the participants based on their sequence of immunization.

2.4. Operational definitions

Neonatal period: The first 28 days of life.

Neonatal danger signs: Clinical indicators for the presence of severe illness in the new-born. According to the WHO, new-born danger signs include; not able to feed/stopped feeding, convulsions, fast breathing, severe chest indrawing, fever (≥ 37.5 °C), hypothermia (≤ 35.4 °C), yellow soles, movement only when stimulated/no movement, and signs of local infection (red/pus draining umbilicus, skin boils, or pus draining eyes) [6].

Good and poor knowledge of NDSs: The mother who could mention at least three WHO-listed new-born danger signs were categorized as having good knowledge of NDSs, while the mother who mentioned less than three WHO-listed new-born danger signs were categorized as having poor knowledge of NDSs [11, 15, 18, 21, 24, 25].

2.5. Data collection tool and procedures

The data were collected using a pretested, structured, and interviewer administered Amharic version questionnaire which was adapted and modified from previous studies and WHO guidelines [6, 11, 15, 18, 21, 24, 25, 26, 27]. The questionnaire comprises three sections (I) socio-demographic characteristics of the respondents (II) maternal reproductive health characteristics, and (III) neonatal danger signs related items. Six data collectors (nurses) and one supervisor were involved in the data collection process. Mothers were asked to list the neonatal danger signs that they knew, and every correct response was marked.

2.6. Data quality assurance

The questionnaire was first prepared in English and translated to Amharic, then back-translated to English to ensure consistency. One day training was given to data collectors and supervisors, and pretesting of the questionnaire was conducted on 5 % of the total sample size in Woldia general hospital. Moreover, the principal investigators also conducted regular supervision, immediate feedback, and daily checking of the completed data.

2.7. Data processing and analysis

The data were checked for completeness, consistency, accuracy, and entered into Epidata version 4.4.2.0, then exported to SPSS version 22 for analysis. Frequency, proportion and summary statistics were computed to describe the study population. Bivariate logistic regression was employed to assess the association of independent variables with the maternal knowledge of NDSs, and variables that had a p-value < 0.2 were further analyzed using multivariate logistic regression. Finally, adjusted odds ratios (AORs) with 95% CIs were computed, and variables that had a p-value < 0.05 were considered as significantly associated. Additionally, the model fitness was checked using the Hosmer and Lemeshow goodness-of-fit test, which was $p = 0.31$.

2.8. Ethical consideration

Ethical clearance was obtained from the Institutional Research Ethical Review Committee of Wollo University, College of Medicine and Health Sciences, and official letters were submitted to each respective health center. Informed written consent was obtained from all mothers after explaining the objectives of the study in detail, and anonymity and confidentiality of the data were kept. Respondents have the right not to participate or withdraw from the study at any stage, and all study methods were performed in accordance with the 1964 declaration of Helsinki and its later amendments.

Table 2. Reproductive health characteristics of the respondent visiting pediatric immunization clinics in Gidan District Health Centers, North Wollo, Ethiopia (n = 399).

Variable	Category	Frequency	
		Number	Percentage
Parity	1	166	41.6
	2–4	207	51.9
	≥5	26	6.5
Attended ANC	Yes	376	94.2
	No	23	5.8
Number of ANC visit	1	25	6.6
	2	70	18.6
	3	103	27.4
	≥4	178	47.3
Preparedness for the delivery	Yes	366	91.7
	No	33	8.3
Place of delivery	Home	51	12.8
	Health facility	348	87.2
Attendant of the current delivery	Health professionals	349	87.5
	Family	19	4.8
	Traditional birth attendant	31	7.8
Type of delivery	Spontaneous vaginal delivery	333	83.5
	Cesarean section	15	3.8
	Instrumental	51	12.8
Obstetric complication	Yes	62	15.5
	No	337	84.5
Type of the obstetric complications	APH/PPH	12	19.4
	Prolonged labor	39	62.9
	Retained placenta	7	11.3
	Asphyxia	2	3.2
	Previous CS	1	1.6
	Eclampsia	1	1.6
PNC attendance for the current baby	Yes	213	53.4
	No	186	46.6
Number of PNC visit	1	170	79.8
	2	24	11.3
	3	10	4.7
	≥4	9	4.2

3. Result

3.1. Socio-demographic characteristics of the respondents

A total of 399 mothers were enrolled in the study, giving a response rate of 99.3%. Nearly 56% of mothers aged 25–34 years, 86.7 % were married, and 93.4% were Orthodox in religion. Over half of the respondents (56.9%) were housewives in occupation, 17.5% unable to read and write, and 47.1% of husbands had attended college or above

education. Half of the infants (50.4%) were male, and 41.3% were aged below 2 months (Table 1).

3.2. Reproductive health characteristics of the respondents

Nearly half of the respondents (51.9%) had 2-4 children, and 94.2% of the mothers attended antenatal care follow-up. The majority (87.2%) of respondents gave birth at a health facility, and 87.5% were assisted by a health professional, 91.7% of mothers were prepared for the delivery,

Table 3. Health deucalion, source of information and pervious experience with neonatal danger signs of mothers visiting pediatric immunization clinics in Gidan District Health Centers, North Wollo, Ethiopia (n = 399).

Variables	Category	Frequency	
		Number	Percentage
Get education about NDSs	Yes	246	61.7
	No	153	38.3
Source of information about NDSs	Health Professionals	164	66.7
	Health Extension workers	32	13
	Community/family	9	3.7
	Media (TV, Radio)	41	16.7
Previous NDSs experience	Yes	120	30.1
	No	279	69.9

and 83.5% delivered in spontaneous vaginal delivery. Nearly half of the mothers (53.4%) had PNC follow-up, and 15.5% of the respondents had obstetric complications (Table 2).

3.3. Mother's knowledge of neonatal danger signs

The majority of respondents (61.7%) had received education about NDSs, and 30.1% had previously experienced neonatal danger signs (Table 3). The vast majority (96.2%) of respondents listed at least one and 48.1% listed ≥ 3 NDSs. Furthermore, fever was the most (80.5%), while yellow palm/sole was the least (9.8%) mentioned NDSs (Figures 1 and 2).

3.4. Factors associated with maternal knowledge of neonatal danger signs

In the bivariate analysis, age of the mother, educational level of the mother and the father, occupation of the father, residence, average

family monthly income, availability of TV/Radio, parity, ANC follow-up, obstetric complications, place of delivery, PNC follow-up, obtain education about NDSs, and previous experience of NDSs were variables that had a p-value < 0.2 (Table 4). From the above-listed variables, residence, as well as the father's educational level and occupation were excluded from further multivariate analysis due to multicollinearity ($r \geq 0.7$). The multivariate logistic regression analysis showed that maternal education level, parity, PNC follow-up, obtain education about NDSs, and previous experience of NDSs were significantly associated (p-value < 0.05) variables with the maternal knowledge of NDSs.

Mothers who had college or above education were 3.58 times more likely to have a good knowledge of NDSs than those who can't read and write (AOR: 3.58, 95% CI, 1.22–10.55). Likewise, mothers who had 2-4 children had a 2.10 times higher odds of good knowledge of NDSs than those who had 1 child (AOR: 2.10, 95% CI 1.18–3.71). Additionally, mothers who attended PNC follow-up were 2.05 more likely to have good knowledge of NDSs than those who didn't attend (AOR: 2.05, 95% CI,

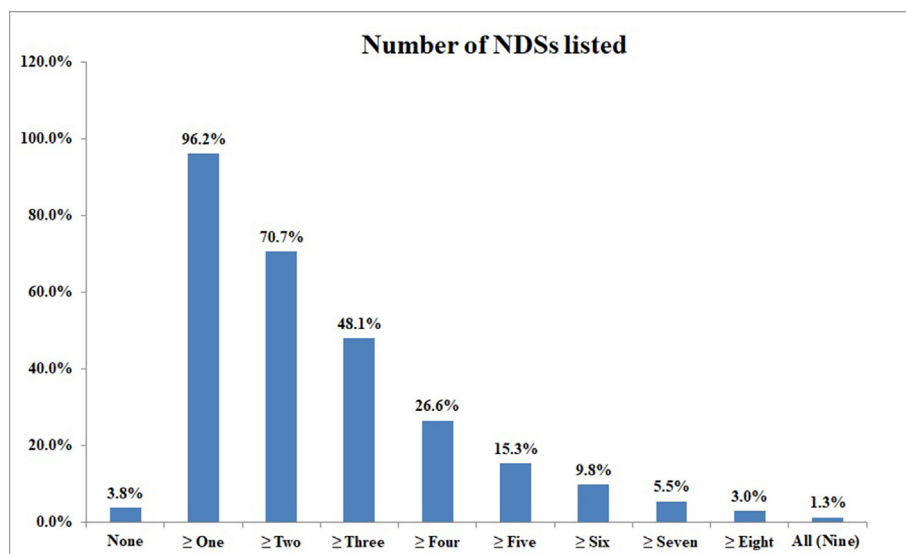


Figure 1. The number of neonatal danger signs listed by mothers visiting pediatric immunization clinics in Gidan District Health Centers, North Wollo, Ethiopia (n = 399).

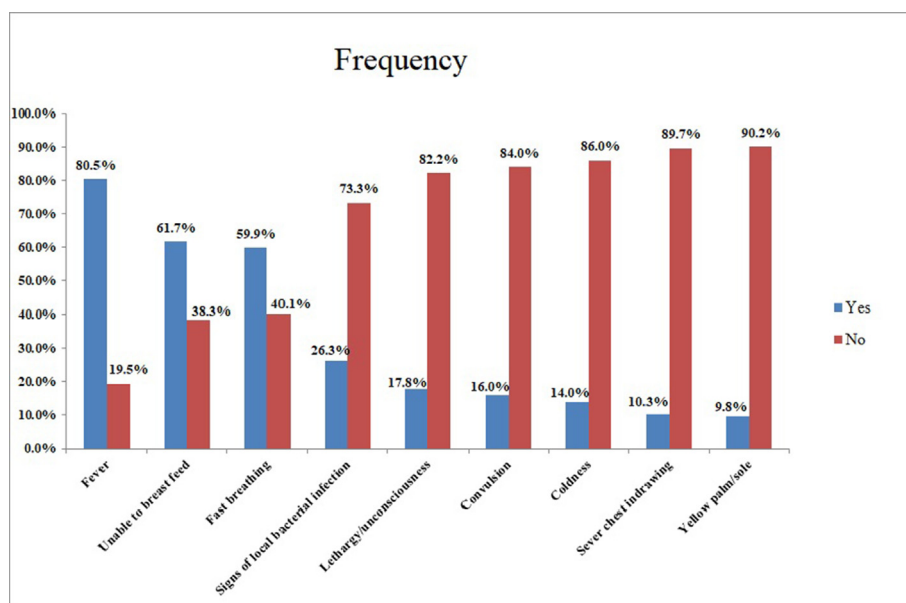


Figure 2. The awareness of specific neonatal danger signs among mothers visiting pediatric immunization clinics in Gidan District Health Centers, North Wollo, Ethiopia (n = 399).

Table 4. Bivariate analysis of factors associated with maternal knowledge of neonatal danger signs visiting pediatric immunization clinics in Gidan District Health Centers, North Wollo, Ethiopia (n = 399).

Variable	Category	Knowledge of NDSs		COR [95 % CI]	P-value
		Good	Poor		
Age of the mother	15–24	54	62	1	
	25–34	118	104	1.3 (0.83–2.04)	0.25
	≥35	20	41	0.56 (0.29–1.07)	0.079
Educational level of the mother	Unable to read and write	17	53	1	
	Able to read and write	21	58	1.13 (0.54–2.37)	0.75
	Primary	21	24	2.73 (1.23–6.01)	0.014
	Secondary	30	30	3.12 (1.48–5.57)	0.03
	College or above	103	42	7.65 (3.98–14.7)	<0.001
Educational level of the husband	Unable to read and write	14	28	1	
	Able to read and write	18	52	0.69 (0.3–1.60)	0.39
	Primary	13	36	0.72 (0.29–1.78)	0.48
	Secondary	24	26	1.85 (0.79–4.31)	0.16
	College or above	123	65	3.79 (1.86–7.69)	<0.001
Occupation of the husband	Farmer	26	86	1	
	Merchant	40	55	2.4 (1.32–4.38)	0.004
	Employee	122	64	6.31 (3.7–10.74)	<0.001
	Student	4	2	6.62 (1.15–38.12)	0.035
Average monthly income	<1000	26	75	1	
	1000–1999	20	26	2.22 (1.07–4.62)	0.033
	2000–4999	82	77	3.07 (1.78–5.29)	<0.001
	≥5000	64	29	6.37 (3.4–11.9)	<0.001
Residence	Urban	166	121	4.54 (2.76–7.46)	<0.001
	Rural	26	86	1	
Availability of radio/TV	No	21	76	1	
	Yes	171	131	4.72 (2.77–8.06)	<0.001
Parity	1	72	94	1	
	2–4	111	96	1.51 (1.0–2.28)	0.049
	≥5	9	17	0.69 (0.29–1.64)	0.40
Attended ANC	No	7	16	1	
	Yes	185	191	2.21 (0.89–5.5)	0.087
Place of delivery	Home	15	36	1	
	Health facility	177	171	2.48 (1.31–4.7)	0.005
Obstetric complication	No	154	183	1	
	Yes	38	24	1.88 (1.08–3.28)	0.025
Attended PNC	No	56	130	1	
	Yes	136	77	4.1 (2.69–6.24)	<0.001
Education about NTD	No	30	123	1	
	Yes	162	84	7.91 (4.9–12.76)	<0.001
Previous NDSs experience	No	117	162	1	
	Yes	75	45	2.31 (1.49–3.58)	<0.001

1.21–3.49). Moreover, mothers who got health education about NDSs were 4.87 times more likely to have good knowledge of NDSs than their counterparts (AOR: 4.87, 95% CI, 2.73–8.68). Finally, the odds of having good knowledge of NDSs were 2.35 times higher among mothers who had previous experience of NDSs than those who didn't have (AOR: 2.35, 95% CI, 1.33–4.15) (Table 5).

4. Discussion

Maternal knowledge and early detection of NDSs could significantly improve child survival [28]. Similarly, mothers who have a good knowledge of NDSs are more likely to seek care from health facilities [14]. According to the findings of this study, more than half of mothers had poor knowledge of NDSs. Furthermore, knowledge of NDSs was significantly associated with the maternal educational level of college or higher, having 2–4 children, attending PNC follow-up, receiving health education about NDSs, and previous NDSs experience.

The proportion of participants who had good knowledge of NDSs was 48.1% (95% CI, 43.6%–52.9%). This result is consistent with studies conducted in the Oromia region of Ethiopia (51.7%) [29] and Southeast Ethiopia (50.2%) [23]. However, studies conducted in North Central Ethiopia (61.7%) [30], South-East Nigeria (78.7%) [27], and Iraq (81%) [14] showed higher results. These variations might be attributed to differences in the study setting as well as socio-cultural factors. Lower results were reported from studies in Southwest Ethiopia (39%) [15], Dire Dawa Ethiopia (40.8%) [21], Northwest Ethiopia (36.5%) [18], Ethiopia (meta-analysis) (40.7%) [19], Sudan (18%) [31], Kenya (15.5%) [25], Pakistan (15%) [13], and Saudi Arabia (37%) [24]. The high literacy rate and ANC follow-up in this study, as well as greater access to health care services and television/radio, could explain these differences.

Mothers with a college degree or higher education were 3.58 times more likely to have good knowledge of NDSs than those who couldn't read and write. Educated mothers are more likely to participate in ANC and PNC services and are more informed about their newborns' health.

Table 5. Multivariate analysis of factors associated with maternal knowledge of neonatal danger signs visiting pediatric immunization clinics in Gidan District Health Centers, North Wollo, Ethiopia (n = 399).

Variable	Category	Knowledge of NDSs		AOR [95 % CI]	P-value
		Good	Poor		
Age of the mother	15–24	54	62	1	
	25–34	118	104	0.86 (0.44–1.67)	0.65
	≥35	20	41	0.64 (0.24–1.73)	0.38
Maternal education level	Unable to read and write	17	53	1	
	Able to read and write	21	58	0.63 (0.24–1.68)	0.36
	Primary	21	24	1.91 (0.57–6.45)	0.30
	Secondary	30	30	2.38 (0.77–7.34)	0.13
	College or above	103	42	3.58 (1.22–10.55)	0.02*
Average monthly income	<1000	26	75	1	
	1000–1999	20	26	1.43 (0.57–3.62)	0.45
	2000–4999	82	77	0.91 (0.41–2.01)	0.81
	≥5000	64	29	1.18 (0.44–3.14)	0.74
Availability of radio/TV	No	21	76	1	
	Yes	171	131	1.98 (0.88–4.43)	0.1
Parity	1	72	94	1	
	2–4	111	96	2.10 (1.18–3.71)	0.011*
	≥5	9	17	2.74 (0.77–9.77)	0.12
Attended ANC	No	7	16	1	
	Yes	185	191	0.40 (0.12–1.34)	0.14
Place of delivery	Home	15	36	1	
	Health facility	177	171	0.85 (0.33–2.15)	0.73
Obstetric complication	No	154	183	1	
	Yes	38	24	1.30 (0.65–2.64)	0.45
Attended PNC	No	56	130	1	
	Yes	136	77	2.05 (1.21–3.49)	0.008*
Education about NDSs	No	30	123	1	
	Yes	162	84	4.87 (2.73–8.68)	<0.001*
Previous NDSs experience	No	117	162	1	
	Yes	75	45	2.35 (1.33–4.15)	0.003*

* Significantly associated variable at 95% CI.

Several studies have shown that mothers with a higher level of education are more likely to utilize maternal and child health services and will have a greater understanding of the health education offered [32, 33, 34]. Similar findings were also reported from studies in Northeast Ethiopia [11], Oromia region Ethiopia [29], Gondar Ethiopia [10], Iraq [14], and Rwanda [35].

Parity of the mother also showed significant association with knowledge of NDSs. Mothers who had 2–4 children were 2.10 times more likely to have good knowledge of NDSs than those who had 1 child. Multiparous mothers have prior child health experiences and will also have previous ANC and PNC follow-ups, which will contribute to the greater understanding of newborn health problems. Similar findings were found in other studies in Harar Ethiopia [36], Northwest Ethiopia [18], and Rwanda [35].

Likewise, the odds of having good knowledge of NDSs were 2.05 times higher among mothers who attended PNC follow-up than those who didn't attend. The primary component of the PNC service is health education on early identification and health-seeking for NDSs [37]. Therefore, during PNC follow-up, mothers will receive sufficient health education about NDSs from health professionals. Studies from Northeast Ethiopia [11], Southwest Ethiopia [15], a meta-analysis in Ethiopia [19], and North West of Ethiopia [10] also showed a similar finding.

Moreover, mothers who received health education regarding NDSs had 4.87 times higher odds of having good knowledge of NDSs than mothers who did not. Adequate health education and awareness creation play crucial roles in improving the community's knowledge of a

particular health issue. Various studies conducted in Northeast Ethiopia [11], Central Ethiopia [16], Woldia Ethiopia [20], and North Central Ethiopia [30] resulted in a similar finding.

Finally, mothers' previous experiences of NDSs showed a significant association with knowledge of NDSs. Mothers who had prior experience of NDSs were 2.35 times more likely to have good knowledge of NDSs than those who had not. Mothers who had previously experienced NDSs in their child were more likely to seek medical help and be familiar with similar clinical manifestations. Similar findings were reported from other studies conducted in central Ethiopia [16], Dire Dawa Ethiopia [21], and Northwest Ethiopia [18].

4.1. Limitation of the study

This study will be subjected to social desirability and recall biases in certain items, and the unprompted knowledge assessment will make the response of mothers based only on signs that they can remember, which will, in turn, lower the overall knowledge score. In addition, it is known that there may be cultural and language differences in how some neonatal danger signs are described. Therefore, to address these concerns, we translated the English version of the questionnaire into an easily understandable local language (Amharic). Furthermore, the data collectors were nurses who worked in the study health centers and were familiar with the responses and descriptions of the participants. Moreover, given that the study used a cross sectional design, the associations observed in the study do not infer a causal relationship.

5. Conclusion

This study revealed that the level of maternal knowledge of NDSs was low. Educational level of the mother, parity, having PNC follow-up, health education about NDSs, and previous experience of NDSs were significantly associated variables with the maternal knowledge of NDSs. Therefore, maternal knowledge of NDSs needs to be enhanced through improving PNC service utilization and providing adequate health education about newborn health problems in a variety of settings, including ANC and PNC follow-up.

Declarations

Author contribution statement

Yibeltal Asmamaw Yitayew and Anteneh Shumet Tadele: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Zemen Mengesha Yalaw, Shiferaw Abeway Mamuye and Desalegn Abebaw Jember: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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