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Maternal Knowledge of Neonatal Danger Signs: A Cross-Sectional Study in a Tertiary Hospital, Moradabad, India

Amit Kumar[1] ,Gauri Bharadwaj[2], Ashok Saini[3], Umme Afifa[4], Shilpa Reddy Ghanta[5]

ABSTRACT

Background

The first 28 days of life, the neonatal period, is the most vulnerable time for a child's survival. Globally, 2.3 million children died in the first month of life in 2023 – approximately 6,300 neonatal deaths every day. According to a UN IGME report, India's neonatal mortality rate (NMR) declined from 28 per 1,000 live births in 2015 to 17 per 1,000 live births in 2023. Neonatal mortality occurs mainly due to preventable causes infections, asphyxia, prematurity, hypothermia, hypoglycemia, and jaundice. Informed mothers can identify warning signs of illness in their newborns, such as difficulty breathing, high fever, or symptoms of jaundice, and then promptly seek professional medical care. This study assessed maternal awareness of neonatal danger signs

Methods

A hospital-based cross-sectional study was conducted from July to October 2024 among 378 mothers attending antenatal and postnatal services at a tertiary care hospital in Moradabad, India. Participants were selected using convenient sampling. Eligible participants included mothers with infants aged 18-45 years, who provided informed consent; mothers who were critically ill or unwilling to participate were excluded. Data were collected using a pre-tested, structured questionnaire that covered sociodemographic characteristics (age, education, occupation, parity, residence, etc.) and knowledge of neonatal danger signs, based on the World Health Organization (WHO) classification. Ethical approval was obtained from the Institutional Ethics Committee of Teerthanker Mahaveer Medical College, and informed consent was obtained from all participants. Data were entered and analyzed using software, e.g., SPSS version 25, with descriptive statistics presented as frequencies and percentages, and associations between maternal knowledge and sociodemographic factors assessed using a chi-square test, with a p-value <0.05 considered statistically significant.

Results

The majority of participants were married, belonging to the age group of 26–33 years. And were homemakers. Most were from rural areas. 73.28% of mothers had high knowledge scores (>4), 14.81% reported high confidence in recognizing danger signs. Commonly recognized signs included fever (95.76%), breathing difficulty (90.74%), whereas convulsions (21.42%) and lethargy (49.2%) were less known. Significant associations were between higher knowledge scores and older maternal age (p=0.00), higher parity (p=0.00), receipt of postnatal care (p=0.01), and full newborn immunization (p=0.00). Multivariate analysis showed that higher parity (AOR = 2.834, 95% CI: 1.494–5.373), receiving postnatal care (AOR = 2.041, 95% CI: 1.209–3.445), and full immunization of the newborn (AOR = 1.693, 95% CI: 1.012–2.832) were significantly associated with better maternal knowledge.

Conclusion

Although the majority of mothers demonstrated good knowledge of neonatal danger signs, gaps remained in specific areas such as recognition of convulsions and lethargy. Moreover, maternal exposure to structured health education was limited. Strengthening postnatal counseling and enhancing communication during routine maternal and child health visits may significantly improve maternal recognition of neonatal danger signs. Targeted interventions of this kind have the potential to promote timely care-seeking, thereby contributing to reductions in neonatal morbidity and mortality.

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2*Corresponding author: Gauri Bharadwaj, Contact: 9971732083,Mail ID : gauribharadwaj123456@gmail.com 1. Amit Kumar,3. Ashok Saini,4. Umme Afifa ,5. Shilpa Reddy Ghanta

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INTRODUCTION

Neonatal mortality, defined as neonatal death within the first 28 days of life, is a major public health challenge for health globally, especially in low and middle-income countries (LMICs) where the burden is extremely high.[1] Despite big progress in maternal and child healthcare, neonatal deaths continue to add on to a significant proportion of under-five mortality.[2] The neonatal period is the most vulnerable period for newborns, with them facing major health risks during this period, like infections, congenital anomalies and deficiencies .[3] One of the important reasons of neonatal mortality is the mother being not able to recognize and urgently seek care for neonatal danger signs, which can be potentially life-threatening.[4] These danger signs consists of a range of symptoms, such as difficulty breathing, fever, poor feeding, lethargy, jaundice, and convulsions, etc. [5] Timely identification and appropriate management of these signs is important for preventing neonatal morbidity and mortality.[6] Despite the importance of recognizing neonatal danger signs, studies have highlighted a lack of awareness and knowledge among caregivers, especially mothers, related to these important characteristics. [7] Factors such as maternal education level, socioeconomic status, cultural beliefs, and access to healthcare services can massively affect the maternal awareness related to neonatal health.[8] Therefore, understanding maternal experiences related to neonatal danger signs and related risk factors is important for developing interventions and programs to improve neonatal health results.[9] Recently, there has been a growing concern on maternal empowerment and involvement of mothers in maternal and child health programs as a means of improving health of both mothers and newborns.[10] Enriching mothers with the knowledge and skills to recognise neonatal danger signs can play a massive role in reducing neonatal mortality rates. [11] Additionally, involving mothers in the making of a program and implementation of healthcare services through it can help ensure its acceptability in mothers and effectiveness of the program. [12] This study seeks to explore maternal experiences related to neonatal danger signs and associated risk factors. By looking into the indicators of maternal awareness, knowledge and healthcare-seeking behaviour, we plan to identify gaps in maternal education and healthcare delivery systems, thus planning interventions to improve neonatal health outcomes.[13] The findings of this study will help to make programs for maternal and child health and policies, eventually aiming to reduce neonatal mortality their mothers. [14]. Given mothers' crucial role in newborn care, assessing their awareness of these signs is important. This research aims to evaluate mothers' knowledge of neonatal danger signs, to find the contributing factors, and to recommend policies and programs to improve neonatal health outcomes.

METHODOLOGY

This study was a hospital-based, cross-sectional study with the objective of assessing the knowledge of mothers regarding neonatal danger signs during their hospital stay. The research was conducted at a tertiary care hospital in Moradabad. Study settings used were maternity wards, and immunization OPDs. The study was conducted over a three-month period following approval from the Institutional Ethics Committee (IEC) and the Research Committee (CRC). The study population included mothers aged 18 years and above who were availing antenatal or postnatal care services at the hospital during the study period who were willing to provide written informed consent. Exclusion criteria involved mothers who had previously participated in neonatal health awareness programs. A convenient sampling technique was employed to collect the data till the sample size was achieved. The required sample size was initially calculated to be approximately 378, using Cochrane's formula based on awareness prevalence of 42% [19] a 95% confidence interval, and a 5% margin of error. Data was collected using a structured, pre-tested questionnaire that included sections on demographic details, knowledge and awareness of neonatal danger signs, and perceived barriers to timely healthcare seeking. The questionnaire was administered through face-to-face interviews which was done by a trained research data collector, a way that ensured privacy, comfort, and confidentiality. All the data collected was entered into Microsoft

Excel. Descriptive statistics such as means, standard deviations, frequencies, and percentages were used to summarize demographic data. Chi-square tests were performed for association between maternal demographic characteristics and knowledge score with a significance level set at $p < 0.05$. Binary logistic regression analysis was done to check the association between variables and the knowledge of neonatal danger signs. univariate logistic regression was done to calculate unadjusted odds ratios (ORs) and their 95% confidence intervals (CIs) for each independent variable. Variables with a p-value < 0.2 in the univariate analysis, were included in a multivariate logistic regression model to compute adjusted odds ratios (AORs), p-value of < 0.05 was considered statistically significant. Our study adhered to the Ethical standards which were followed strictly. Informed consent was obtained from all participants after providing clear information about the study's purpose and risks.

RESULTS

In Table 1., A total of 378 mothers participated in the study. The majority were married (99.2%), while a small percentage were either separated (0.26%) or widowed (0.52%). In terms of education, 33.86% of the mothers had completed primary education, 23.28% had attained secondary education, and 42.8% had studied up to high school level or beyond.

When examining the age distribution, 18.51% of the mothers were aged between 18 and 25 years, 42.32% were in the 26 to 33 age group, and 39.15% were older than 33 years. Most mothers (69.57%) belonged to families with more than four members, whereas 30.42% came from smaller families with four or fewer members. The majority of the mothers (81.74%) were homemakers, while 18.25% were engaged in other types of work. With regard to family income, 47.08% of participants fell into the highest income bracket (above Rs. 9131), followed by 24.33% in the Rs. 4566–9130 range, 22.48% in the Rs. 2739–4565 range, and 5.82% in the Rs. 1370–2738 category. Only 0.26% reported an income of less than Rs. 1370. Looking at family structure, 61.64% of the mothers were from joint families, while 38.35% lived in nuclear families. A significant portion of the sample (70.37%) resided in rural areas, with 29.62% living in urban settings. As for parity, 73.01% of the mothers had two or more children, whereas 26.98% had only one child. In terms of the number of living children, 73.54% had two or fewer, and 26.45% had more than two. Regarding antenatal care (ANC), a majority of the mothers (73.54%) had four or fewer ANC visits during their pregnancy, while only 26.45% had more than four. When asked about postnatal care, 42.85% reported receiving it, whereas 57.14% did not.

Table 1Demographic Characteristics and Personal Information

Variable	N	%
Marital status		
Married	375	99.2
Separated	1	0.26
Widow	2	0.52
Mother's education		
Primary	128	33.86
Secondary	88	23.28
High school and above	162	42.8
Mother's age		
≥ 18 - 25	70	18.51
26- 33	160	42.32
>33	148	39.15
No. of family members		
≤ 4	115	30.42

>4	263	69.57
Mother's occupation		
homemaker	309	81.74
others	69	18.25
Family income		
I Rs. >9131	178	47.08
II Rs. 4566-9130	92	24.33
III Rs. 2739-4565	85	22.48
IV Rs.1370-2738	22	5.82
V Rs. <1370	1	0.26
Family type		
Nuclear	145	38.35
Joint	233	61.64
Residence		
Urban	112	29.62
Rural	266	70.37
Parity		
1	102	26.98
≥2	276	73.01
No. of living children		
≤2	278	73.54
>2	100	26.45

As seen in Table 2. In terms of newborn immunization, 47.61% of mothers reported that their newborns received full immunization, while a slightly higher percentage (52.38%) stated that immunizations were not completed. Most deliveries took place in a health facility (77.77%), with 21.42% of mothers delivering at home and a small fraction (0.79%) in other locations. As for the type of delivery assistance, hospital staff assisted in the majority of cases (66.40%), followed by traditional birth attendants (18.78%) and health workers (14.28%). Only 0.52% of deliveries were assisted by others. When asked about knowledge of neonatal danger signs, 81.48% had heard of poor feeding as a danger sign, 95.76% identified high fever, and 56.61% recognized jaundice. Less than a quarter (21.42%) were aware that convulsions could be a danger sign. Lethargy was identified by 49.20%, vomiting by 70.37%, breathing difficulty by 90.74%, and cold skin by 66.66%. Assessment of overall knowledge scores revealed that 73.28% of mothers scored above 4, indicating relatively good awareness, while 26.71% scored 4 or below. In terms of self-reported confidence in recognizing danger signs, half of the mothers (50.26%) felt somewhat confident, 34.92% were not confident, and only 14.81% reported being very confident. When exploring barriers to seeking newborn care, 16.93% cited transport issues, 3.70% mentioned lack of awareness, 1.05% noted financial difficulties, and 0.79% were affected by weather conditions. The majority of mothers (77.51%) reported no barriers. Sources of information about neonatal danger signs varied, with 55.29% of mothers learning from others, 29.36% from family and friends, 9.25% from health care providers, 4.49% from media, and only 1.58% from community health workers

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Table 2. Distribution of mothers by their utilization of health services and knowledge on neonatal danger signs

Variable	N	%
ANC Visits		
≤4	278	73.54
>4	100	26.45
Postnatal care given?		
Yes	162	42.85
No	216	57.14
Did the newborn achieve full immunization?		
Yes	180	47.61
No	198	52.38
Place of delivery		
Home	81	21.42
Health facility	294	77.77
Other	3	0.79
Delivery Assistant		
Traditional birth assistant	71	18.78
Health worker	54	14.28
Hospital staff	251	66.40
Others	2	0.52
Heard of following danger signs?		
Poor feeding Yes	308	81.48
No	70	18.51
High fever Yes	362	95.76
No	16	4.23
Jaundice Yes	214	56.61
No	164	43.38
Convulsions Yes	81	21.42
No	297	78.57
Lethargy Yes	186	49.20
No	192	50.79
Vomiting Yes	266	70.37
No	112	29.62
Breathing Yes	343	90.74
No	35	9.25
Cold skin Yes	252	66.66
No	126	33.33
Knowledge score		
≤4	101	26.71

>4	277	73.28
How confident are you to recognize danger signs		
Not confident	132	34.92
Somewhat confident	190	50.26
Very confident	56	14.81
Barriers faced to seek newborn care		
Transport	64	16.93
Financial condition	4	1.05
unawareness	14	3.70
Weather condition	3	0.79
none	293	77.51
Where did you hear about the danger signs		
Community health worker	6	1.58
Family friends	111	29.36
Health care provider	35	9.25
Media	17	4.49
Others	209	55.29

Table 3. shows the mean knowledge score among the 378 mothers was 0.73 with a standard deviation (SD) of 0.443. The standard error (SE) of the mean was calculated to be 0.023, indicating a relatively consistent level of knowledge across the study participants.

Table 3. Mean, standard deviation and standard error of knowledge score amongst mothers

Knowledge score of groups	N	mean	SD	SE
Mothers	378	0.73	0.023	0.443

In Table 4.the study explored the relationship between mothers' knowledge scores on neonatal danger signs and various sociodemographic characteristics and health service usage. Age of the mother: There was a significant association between maternal age and knowledge level. Mothers above 30 years of age were more likely to have higher knowledge scores compared to those aged 30 years or younger (p = 0.00). Parity: A significant link was found between parity and knowledge scores. Mothers with two or more children were more knowledgeable than those with only one child (p = 0.00). Postnatal Care: Mothers who received postnatal care services were significantly more likely to have higher knowledge scores than those who did not receive such care (p = 0.01). Newborn Immunization: A significant association was also observed between the knowledge score and the immunization status of the newborn. Mothers whose infants were fully immunized tended to have higher knowledge levels than those whose infants were not fully immunized (p = 0.00)

Table 4. Association of knowledge score with sociodemographic data and utilization of health services

Variables	Knowledge score <=4	Knowledge score >4	P value
Age			
≤30	63	112	0.00
>30	38	165	
Parity			
1	45	57	0.00
≥2	56	220	
Did the mother receive postnatal care?			
Yes	69	147	0.01
No	32	130	
Did the newborn receive full immunization?			
Yes	68	130	0.00
No	33	147	

In Table 5. Results of univariate and multivariate analysis shows that, mothers with higher parity were significantly more likely to have knowledge of neonatal danger signs, with an adjusted odds ratio (AOR) of 2.834 (95% CI: 1.494–5.373, p = 0.001). Receiving postnatal care was also a significant predictor, increasing the odds of knowledge by more than two times (AOR = 2.041, 95% CI: 1.209–3.445, p = 0.008). Age was marginally significant in the adjusted model (AOR = 1.899, 95% CI: 1.001–3.601, p = 0.050), indicating that older mothers may be more likely to recognize danger signs. Additionally, full immunization of the newborn was associated with higher maternal knowledge (AOR = 1.693, 95% CI: 1.012–2.832, p = 0.045). In contrast, the number of children (AOR = 1.804, p = 0.085) and the employment status of the mother (AOR = 1.774, p = 0.138) were not significantly associated with knowledge in the multivariate model.

Table 5. Univariate and Multivariate Logistic Regression Analysis

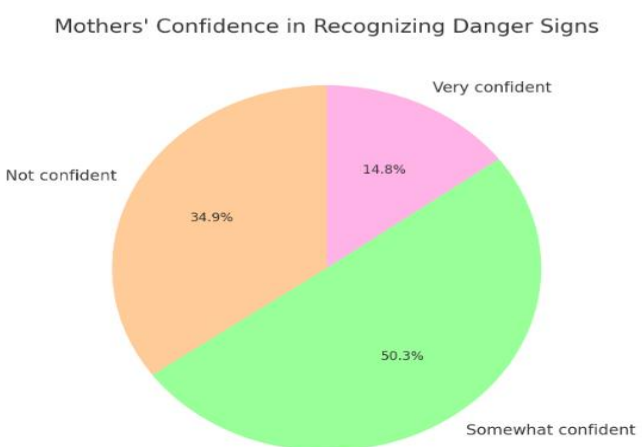
Variables	Unadjusted OR (95% CI)	P- value	Adjusted OR (95% CI)	P-value
Parity	2.750 (1.424-5.313)	0.003	2.834 (1.494- 5.373	0.001
Postnatal care	2.372 (1.175-4.787)	.016	2.041 (1.209-3.445)	0.008

age	1.944 (1.011- 3.739)	.046	1.899 (1.001- 3.601)	0.052
Full Immunization	1.640 (0.969-2.777)	0.066	1.693 (1.012 -2.832)	0.045
No. of Children	1.849 (0.823-4.152)	0.137	1.804 (0.925 -3.519)	0.85
Employment status of mother	1.813 (0.824 -3.989)	0.139	1.774 (0.832- 3.785	0.138

DISCUSSION

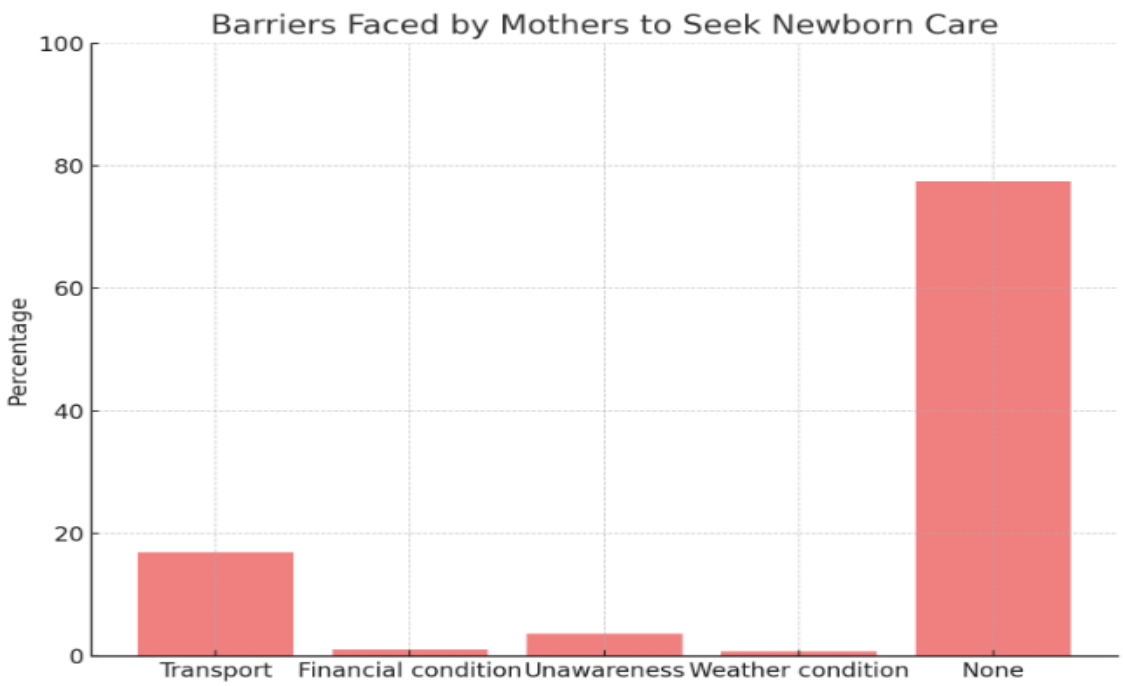
The study was conducted to evaluate mothers' knowledge about neonatal danger signs. The findings showed huge gaps in maternal knowledge regarding clinical manifestations among specific demographic groups. The study found an association between knowledge scores and demographic variables. Older mothers (>30 years) and those with higher parity (≥2 children) had significantly higher knowledge scores. This is similar to findings from other studies indicating that maternal experience contributes significantly to knowledge about child health issues [20,21]. However, this is opposite to some studies that reported no association between maternal age or parity and knowledge of neonatal danger signs [23,24]. These differences may be due to variability in cultural settings, health literacy levels, or access to maternal health services. In other studies, even older and multiparous mothers may not have received health education during their interaction with healthcare service providers, resulting in low awareness levels regardless of experience [23].

Fig.1 Mothers' Confidence in Recognizing Danger Sign



However, in our study, receiving postnatal care and complete newborn immunization were both associated with higher knowledge scores (p=0.01 and p=0.00, respectively), which highlighted the importance of maternal-child health services in increasing knowledge in mothers [22]. This is similar to studies with findings from studies conducted in Ethiopia and Nigeria, where mothers who received postnatal care showed significantly better awareness of neonatal danger signs [23,24]. These services often provide repeated contact with healthcare professionals, offering chances for health education and giving information on newborn care. However, a difference exists from studies in Bangladesh and parts of rural India, which reported no significant association between maternal knowledge and either postnatal care attendance or immunization status [25,26]. These differences may arise due to variations in the quality of health education delivered during service provision. In some regions, even though mothers attend postnatal or immunization clinics, the focus may be more on technical tasks and procedures rather than on counselling and communication. Additionally, healthcare worker shortages and high patient loads may limit the time available educating the visiting mothers.

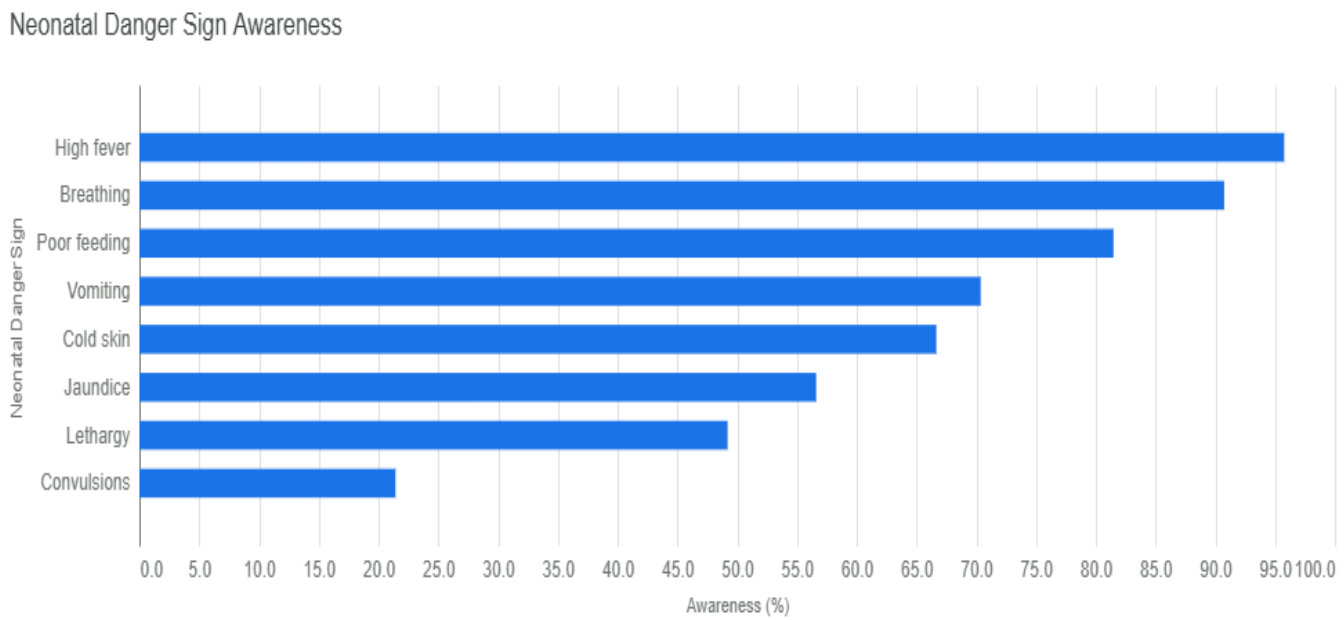
Fig 2. Barriers perceived by mothers to seeking Newborn healthcare



Sociodemographic data showed that most mothers were married. The majority belonged to the ages between 26–33 years. Most of them were homemakers living in rural areas. These findings are consistent with other studies conducted in similar settings, which also reported that rural women who were economically challenged often form the majority of maternity ward attendees in tertiary care centres in India [27,28]. The educational profile showed that 42.8% of mothers had completed high school or higher, which may have contributed to the relatively high levels of knowledge scores in the study [29]. Despite high antenatal care (ANC) attendance (73.54%), only 42.85% of mothers reported receiving postnatal care, highlighting a massive gap in the continuum of care. This is concerning as postnatal care plays an important role in educating mothers about neonatal health and their danger signs [30].

Inadequate postnatal education may have contributed to the observed knowledge gaps, especially in relation to less commonly recognized signs such as convulsions (21.42%) and lethargy (49.2%). This finding is similar to studies from Ethiopia and Nigeria, where awareness of these specific danger signs was also found to be low [20,22]. While 73.28% of mothers had high knowledge scores, only 14.81% felt "very confident" in recognizing the neonatal danger signs. This difference between knowledge and confidence may be due to a lack of experience or less interaction with health care providers. Similar findings were reported in studies from Nepal and Bangladesh, where mothers' self-efficacy did not correlate with their knowledge [25,31].

Fig 3. Awareness regarding Neonatal Danger Signs



A large number of mothers (55.29%) reported learning about neonatal danger signs from non-medical sources such as family and friends. Only 9.25% received this information from healthcare providers, suggesting underutilization of clinical visits for maternal health education. Previous literature has emphasized that hospital care providers have a major role in improving maternal knowledge during routine check-ups [32,33]. In our study mothers with higher parity were significantly more likely to have knowledge of neonatal danger signs, similarly in other study by Mose A et.al [34] multiparous mothers (AOR=1.37, 95% CI 1.24 to 2.19) were factors significantly associated with maternal knowledge of neonatal danger signs. Similar results were seen with study Bayih WA et.al [35] where parity was associated with knowledge on neonatal danger signs. On the other hand, a study by Chali JC et.al [36] showed opposite results. The difference in results can be due to confounding factors associated with assessing knowledge levels in multiparous women. In our study it was seen that receiving postnatal care was also a significant predictor, increasing the odds of knowledge by more than two times, similarly Mose A et.al [34] showed that postnatal care counselling had increased odds of good knowledge (AOR=1.53, 95% CI: 1.08–2.18) and Hunde GA et.al [37] showed postnatal follow-up as significantly associated with good knowledge of neonatal danger signs (AOR=2.13, 95% CI: 1.39, 3.27). On the other hand, Ahmadi Nezhad M et.al [38] shows that if the quality of PNC is perceived as poor, the transfer of knowledge about danger signs would be ineffective. In our study it was seen that full immunization of the newborn was associated with higher maternal knowledge (AOR = 1.693, 95% CI: 1.012–2.832, p = 0.045) , similarly Abate HA et.al [39] states neonates started vaccine [AOR=1.84: 95%

CI:(1.22, 2.76)]" was a significant predictor of mothers' knowledge about neonatal danger signs. On the contrary, despite mothers attending vaccination centres, factors related to the child's immunization was not a statistically significant predictor of maternal knowledge of neonatal danger signs. [40]

Conclusion

This study revealed that maternal knowledge of neonatal danger signs was generally good but varied by age, parity, and healthcare service use. Mothers who were multiparous, received postnatal care and completed immunization of neonates were more informed. However, confidence in recognizing signs was low, and most information came from non-medical sources. Strengthening health education during clinical visits is essential.

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