EVALUATING MATERNAL UNDERSTANDING OF WHO-RECOGNIZED NEONATAL DANGER SIGNS: A CROSS-SECTIONAL STUDY

Original Article

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ABSTRACT

Background: Neonatal mortality constitutes a significant proportion of under-five mortality worldwide, with over 2.4 million neonatal deaths reported annually. In Pakistan, the neonatal mortality rate (NMR) stands alarmingly high at 42 per 1,000 live births. Neonatal danger signs, such as fever, jaundice, and breathing difficulties, require immediate medical attention but often go unrecognized due to insufficient maternal knowledge. Socioeconomic disparities, cultural practices, and inadequate access to healthcare exacerbate the issue, delaying timely interventions and contributing to preventable neonatal deaths.

Objective: The study aims to assess maternal knowledge of neonatal danger signs, identify determinants of adequate awareness, and explore barriers to timely healthcare-seeking practices.

Method: A cross-sectional, community-based survey was conducted from August to December 2024 in one urban and one rural district of Sindh, targeting mothers of neonates aged 0–28 days. A structured questionnaire adapted from the WHO Safe Motherhood Toolkit was used to collect data on maternal knowledge, antenatal care (ANC) attendance, and healthcare-seeking behaviors. A multistage random sampling method ensured representativeness, with a sample size of 300 participants. Descriptive statistics and logistic regression analyses were performed using SPSS version 25 to identify key predictors of knowledge, with significance set at p<0.05.

Results: Among 300 mothers, 48.5% demonstrated adequate knowledge of neonatal danger signs. Fever (75%), poor feeding (62%), and jaundice (51%) were the most recognized signs, while hypothermia (18%) and convulsions (12%) were least identified. Maternal education, urban residence, and ANC attendance significantly predicted knowledge levels. Only 57% sought timely medical care, with rural participants reporting financial constraints, transportation challenges, and reliance on traditional healers as primary barriers.

Conclusion: Maternal knowledge of neonatal danger signs remains suboptimal, especially in rural areas. Targeted health education programs, improved healthcare access, and financial support mechanisms are essential to enhance neonatal survival and reduce preventable deaths.

Keywords: Neonatal mortality, maternal knowledge, neonatal danger signs, WHO, healthcare-seeking behavior, public health, antenatal care.

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INTRODUCTION

Neonatal mortality constitutes a significant portion of under-five mortality globally, with over 2.4 million neonatal deaths reported in 2019 (1). This alarming figure underscores the vulnerability of newborns in the first 28 days of life, a period characterized by heightened susceptibility to preventable complications such as infections, prematurity, and birth asphyxia (2). Globally, neonatal deaths account for nearly 46% of all under-five deaths, highlighting the critical need for targeted interventions to address this burden (3). The situation in Pakistan is particularly dire. The country ranks among those with the highest neonatal mortality rates globally, with an estimated neonatal mortality rate (NMR) of 42 per 1,000 live births as of 2021. This figure translates to tens of thousands of neonatal deaths annually, representing a major public health challenge. Sindh, as one of Pakistan's most populous provinces, bears a disproportionate share of this burden, especially in rural and resource-constrained areas where access to healthcare is limited and cultural practices often delay timely care-seeking (4,5).

Neonatal danger signs are critical clinical indicators requiring immediate medical attention to prevent mortality and long-term complications. The World Health Organization (WHO) has identified ten key neonatal danger signs, including fever, hypothermia, poor feeding, lethargy, difficulty breathing, convulsions, and jaundice, among others. These signs are considered universal markers of neonatal distress and are used to guide early intervention protocols. However, recognizing these signs often requires a baseline level of maternal knowledge and awareness, which is frequently lacking in low-resource settings (6,7). Several factors contribute to the low levels of maternal knowledge about neonatal danger signs in Pakistan. Socioeconomic determinants, including low maternal education levels, poverty, and limited access to healthcare services, play a significant role. Cultural beliefs and practices, such as reliance on traditional remedies and healers, further exacerbate the issue, delaying timely access to appropriate medical care. Rural areas in Sindh face additional challenges, including inadequate health infrastructure, lack of transportation, and a shortage of trained healthcare providers. These systemic barriers perpetuate a cycle of delayed care and high neonatal mortality (8).

Efforts to address neonatal health challenges in Pakistan include global and national initiatives such as the Sustainable Development Goals (SDGs), which emphasize reducing neonatal mortality to at least 12 per 1,000 live births by 2030. At the national level, programs such as the Lady Health Worker (LHW) initiative have been instrumental in promoting maternal and child health. LHWs play a critical role in community-based health education, providing essential information on maternal and neonatal care to underserved populations. Despite these efforts, significant gaps remain, particularly in reaching marginalized communities and addressing deeply entrenched cultural norms that hinder health-seeking behaviors (9,10). The rationale for this study lies in the urgent need to bridge the knowledge gap regarding neonatal danger signs among mothers in Sindh, Pakistan. Maternal recognition of these signs is crucial for timely care-seeking, which can significantly reduce neonatal morbidity and mortality. Understanding the determinants of maternal knowledge and the barriers to effective care-seeking is essential for designing targeted interventions that are culturally appropriate and contextually relevant.

This study aims to evaluate maternal understanding of WHO-recognized neonatal danger signs, identify key factors influencing knowledge levels, and assess the implications for healthcare-seeking practices. By focusing on a region with high neonatal mortality and substantial health disparities, this research contributes to the evidence base needed to inform policy and programmatic efforts aimed at improving neonatal health outcomes in Pakistan. The specific objectives of the study are to assess the level of maternal knowledge regarding WHO-recognized neonatal danger signs and to examine the care-seeking behaviors of mothers upon recognizing neonatal danger signs and associated barriers.

METHODS

This study employed a cross-sectional, community-based survey design to evaluate maternal knowledge of neonatal danger signs in Sindh, Pakistan. From August to December 2024, the study targeted one urban and one rural district, focusing on mothers with neonates aged 0–28 days. The survey aimed to comprehensively understand maternal awareness and associated factors within diverse socio-cultural contexts.

Using Cochran's formula, the sample size was determined to be 300, incorporating a 95% confidence interval, a 5% margin of error, and a 10% allowance for non-response. A multistage random sampling technique was utilized to ensure representativeness. Initially, districts were stratified by urban and rural status, followed by random selection of clusters and households within each stratum.

Data collection was carried out using a structured questionnaire adapted from the WHO Safe Motherhood Toolkit. This tool was tailored to assess maternal knowledge of neonatal danger signs, capturing demographic details, antenatal care (ANC) history, exposure to health

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education, and awareness of the ten WHO-recognized danger signs. The questionnaire was pretested to ensure clarity, cultural appropriateness, and reliability, leading to minor adjustments based on feedback.

Face-to-face interviews were conducted in local languages to enhance communication and accuracy. The collected data were entered into SPSS version 25 for analysis. Descriptive statistics were used to summarize demographic characteristics and levels of knowledge. Logistic regression was employed to identify determinants of adequate knowledge, defined as the ability to recognize at least three neonatal danger signs. Statistical significance was set at $p<0.05$.

RESULTS

Among the 300 mothers surveyed, the mean age was 28 years (SD ±4.7), with the majority (64%) residing in rural areas. Most participants (78%) were housewives, and 60% had primary or no formal education. A significant disparity was observed in education levels, with urban mothers being more likely to attain secondary or higher education ($p<0.001$). Multiparity was common, reported by 70% of mothers, and 85% had attended at least one antenatal care (ANC) visit, though only 40% had four or more visits. Urban mothers exhibited greater ANC attendance, while rural mothers faced more access barriers.

Overall, 48.5% of mothers demonstrated adequate knowledge of neonatal danger signs. Fever (75%), poor feeding (62%), and jaundice (51%) were the most commonly recognized signs. However, less than 20% could identify critical indicators such as hypothermia (18%), convulsions (12%), and chest indrawing (10%). Recognition of breathing difficulties (15%) and umbilical redness (14%) was also low. Multivariate logistic regression revealed significant predictors of maternal knowledge. Mothers with secondary or higher education were 2.7 times more likely to recognize neonatal danger signs (AOR 2.7; 95% CI 1.8–4.0). Urban residence increased knowledge levels by 3.2-fold (AOR 3.2; 95% CI 2.1–4.9), and those with four or more ANC visits were 2.5 times more likely to identify neonatal danger signs (AOR 2.5; 95% CI 1.7–3.6). Despite ANC counseling being reported by 42% of mothers, the focus remained predominantly on maternal health rather than neonatal issues.

Healthcare-seeking behavior was observed in 57% of mothers who recognized neonatal danger signs. Utilization of health facilities was significantly higher in urban areas (72%) compared to rural regions (45%, $p<0.001$). In contrast, rural mothers exhibited a greater reliance on traditional healers (30%) and unqualified providers (13%). Major barriers to formal healthcare included financial constraints (59%), transportation difficulties (25%), and cultural inclinations towards traditional remedies (16%). These findings underscore critical gaps in maternal knowledge and access to care, necessitating targeted educational interventions and improved healthcare accessibility in rural Sindh.
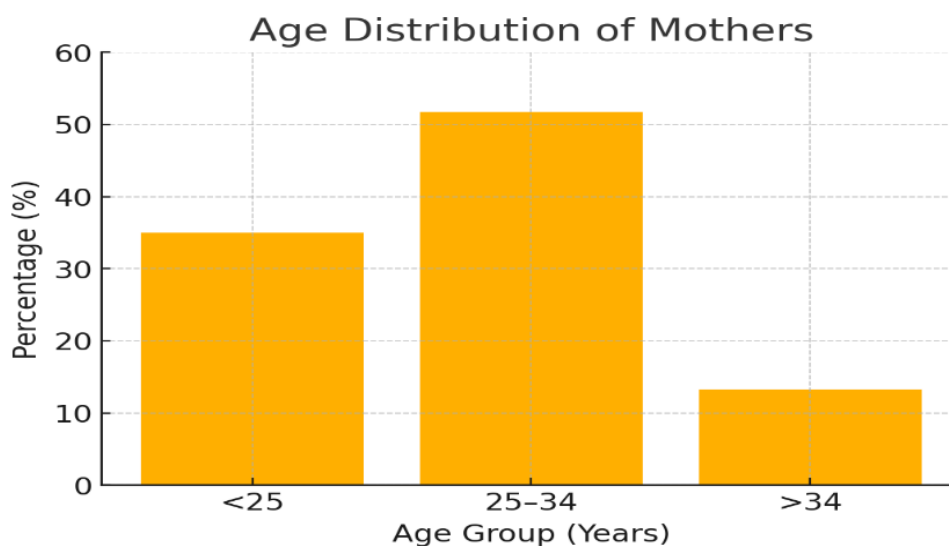

Figure 1 Age Distribution of Mothers
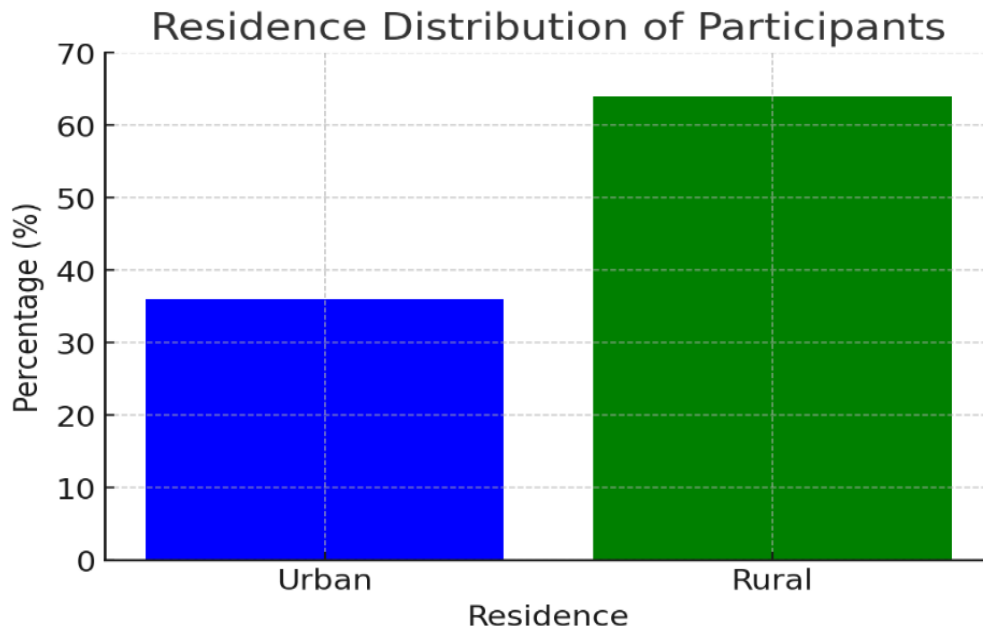
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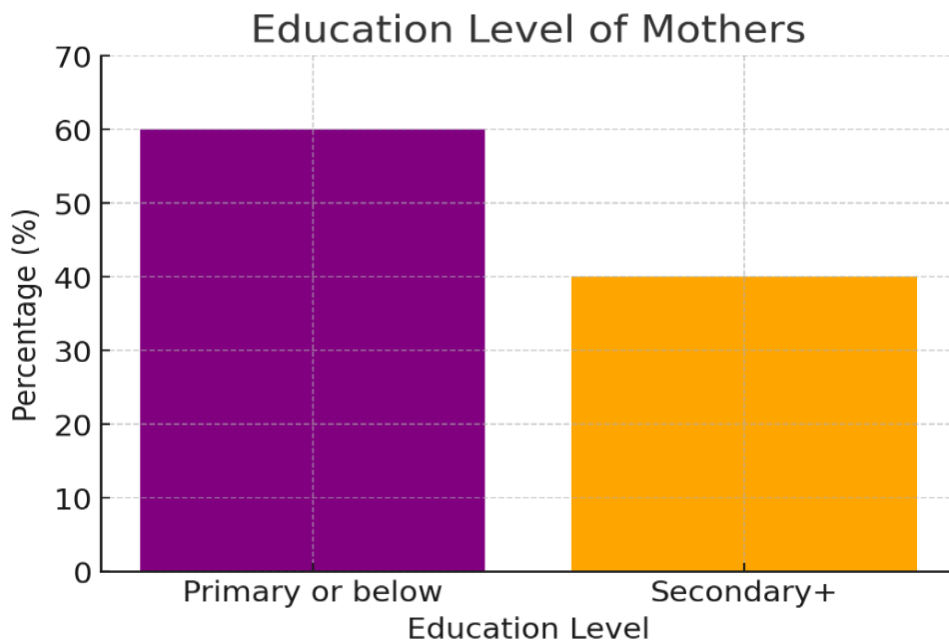*Figure 2 Residence Distribution of Participants*

Figure 3 Education Level of Mothers

Table 1. Demographic Characteristics of Participants

Variable	Category	Frequency (n=300)	Percentage (%)
Age (years)	<25	105	35.0
	25–34	155	51.7
	>34	40	13.3
Residence	Urban	108	36.0
	Rural	192	64.0
Education Level	Primary or below	180	60.0
	Secondary+	120	40.0
Occupation	Housewife	234	78.0
	Employed	66	22.0
Parity	Primiparous	90	30.0
	Multiparous	210	70.0
ANC Visits	None	45	15.0
	1–3	135	45.0
	≥4	120	40.0

Among the 300 mothers surveyed, the mean age was 28 years (SD ±4.7), with 64% residing in rural areas and 36% in urban areas. Most mothers (78%) were housewives, and 60% had primary or no formal education. Urban mothers were significantly more likely to have secondary or higher education ($p < 0.001$). Approximately 70% of respondents were multiparous, with the majority reporting at least one antenatal care (ANC) visit. Table 1 summarizes the detailed demographic characteristics.

Table 2. Knowledge of Neonatal Danger Signs

Neonatal Danger Sign	Recognized by Mothers (n=300)	Percentage (%)
Fever	225	75.0
Poor feeding	186	62.0
Jaundice	153	51.0
Hypothermia	54	18.0
Convulsions	36	12.0
Chest indrawing	30	10.0
Difficulty breathing	45	15.0
Umbilical redness	42	14.0

Overall, 48.5% of mothers demonstrated adequate knowledge of neonatal danger signs. Fever (75%), poor feeding (62%), and jaundice (51%) were the most commonly recognized signs. However, less than 20% of mothers could identify critical signs like hypothermia (18%), convulsions (12%), or chest indrawing (10%). Recognition of breathing difficulties and umbilical redness were similarly low (15% and 14%, respectively). Table 2 provides a breakdown of maternal knowledge across individual danger signs.

Multivariate logistic regression identified several significant predictors of adequate maternal knowledge. Maternal education emerged as a critical determinant, with mothers possessing secondary or higher education being 2.7 times more likely to demonstrate adequate knowledge (AOR 2.7; 95% CI 1.8–4.0). Urban residence was associated with a 3.2-fold increase in knowledge levels compared to rural counterparts (AOR 3.2; 95% CI 2.1–4.9). ANC attendance was another key factor; mothers with four or more ANC visits were 2.5 times more likely to recognize neonatal danger signs (AOR 2.5; 95% CI 1.7–3.6). Counselling during ANC was reported by 42% of mothers, though predominantly focused on maternal health rather than neonatal issues.

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Table 3. Care-Seeking Practices for Neonatal Danger Signs

Variable	Category	Frequency (n=300)	Percentage (%)
Sought care at the facility	Yes	171	57.0
	No	129	43.0
Preferred care provider	Health facility	171	57.0
	Traditional healer	90	30.0
	Unqualified provider	39	13.0
Barriers to care	Financial constraints	177	59.0
	Transportation	75	25.0
	Cultural preferences	48	16.0

Timely healthcare-seeking behaviour was observed in 57% of mothers who recognized neonatal danger signs. Urban mothers demonstrated significantly higher rates of health facility utilization (72%) compared to their rural counterparts (45%, $p<0.001$). Conversely, rural mothers were more likely to rely on traditional remedies (30%) or unqualified practitioners (25%). Key barriers to seeking formal healthcare included transportation challenges, financial constraints, and cultural preferences for traditional practices. Table 3 highlights the care-seeking behaviors and associated factors.

These findings highlight substantial gaps in maternal knowledge and care-seeking behaviors, emphasizing the need for targeted educational interventions and improved access to healthcare in rural Sindh.

DISCUSSION

Overall, less than half (48.5%) of the mothers surveyed demonstrated adequate knowledge of neonatal danger signs. While fever, poor feeding, and jaundice were relatively well-recognized, critical signs such as hypothermia, convulsions, and chest indrawing were identified by less than 20% of participants. These results align with findings from other low-resource settings, where maternal awareness of neonatal danger signs is similarly low (11-13). Maternal education emerged as a pivotal determinant of knowledge, with mothers possessing secondary or higher education levels being significantly more likely to recognize neonatal danger signs. This finding corroborates existing research emphasizing the role of education in enhancing health literacy and decision-making (14). Urban mothers, who generally had higher education levels and better access to healthcare information, demonstrated greater knowledge than their rural counterparts. These disparities highlight the interplay of socio-demographic factors and geographic inequities in shaping maternal awareness (15).

Despite modest levels of knowledge, the study revealed that 57% of mothers sought timely healthcare upon recognizing neonatal danger signs. However, urban mothers were substantially more likely to utilize formal health facilities (72%) compared to rural mothers (45%). Rural participants often relied on traditional healers or unqualified practitioners, reflecting deep-rooted cultural practices and systemic barriers to accessing healthcare. Similar trends have been documented in other low-income countries, where reliance on traditional remedies delays appropriate care and exacerbates neonatal morbidity and mortality (16). Barriers to healthcare utilization reported in this study—including financial constraints, transportation challenges, and cultural preferences—are consistent with global evidence from resource-limited settings. Transportation barriers are particularly pronounced in rural Sindh, where inadequate infrastructure and long distances to healthcare facilities hinder timely access. Additionally, financial barriers remain a critical challenge, as out-of-pocket healthcare expenditures can be prohibitive for low-income families (17-20).

The findings of this study have important implications for public health strategies aimed at reducing neonatal mortality in Pakistan. First, the significant knowledge gaps among mothers highlight the need for targeted health education initiatives that are culturally appropriate and contextually relevant. Lady Health Workers (LHWs), who play a crucial role in community-based health education, should receive enhanced training and resources to effectively disseminate information on neonatal danger signs. Incorporating visual aids, local languages, and community-based demonstrations may further enhance the reach and impact of these interventions. Second, addressing geographic inequities in healthcare access is essential. Strengthening rural health infrastructure, improving transportation networks, and expanding the coverage of community health services can mitigate the challenges faced by rural mothers. Mobile health clinics and telemedicine platforms offer promising avenues to bridge the gap in healthcare delivery for underserved populations. Third, financial barriers to care must be addressed through policies that reduce out-of-pocket expenditures. Expanding health insurance schemes and introducing subsidies for neonatal and maternal care can alleviate the financial burden on low-income families. Additionally, integrating neonatal health services into existing community health programs can enhance accessibility and affordability.

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A recent cross-sectional study conducted in southeastern Ethiopia assessed maternal knowledge of neonatal danger signs and associated care-seeking behaviors. The study found that only 50.2% of mothers had adequate knowledge of neonatal danger signs, with 61% seeking healthcare upon recognizing these signs. Key determinants of maternal knowledge included higher educational attainment, urban residence, multiple antenatal care visits, and receiving counseling during these visits. Notably, many mothers resorted to traditional healers and home remedies, underscoring the influence of cultural practices and accessibility issues on healthcare decisions. These findings mirror the challenges identified in our study, emphasizing the critical role of education and healthcare access in improving maternal recognition of neonatal danger signs and timely care-seeking behaviors (21).

While this study provides valuable insights, certain limitations should be acknowledged. The cross-sectional design precludes causal inferences about the relationship between maternal knowledge and care-seeking behaviors. Additionally, the reliance on self-reported data may introduce social desirability bias, particularly in reporting care-seeking practices. Future research should explore longitudinal approaches to assess the impact of targeted interventions on maternal knowledge and neonatal outcomes. Qualitative studies could further elucidate the cultural and contextual factors influencing maternal decision-making.

CONCLUSION

Maternal knowledge of neonatal danger signs remains suboptimal, especially in rural areas. Targeted health education programs, improved healthcare access, and financial support mechanisms are essential to enhance neonatal survival and reduce preventable deaths.

Author Contribution

Author	Contribution
Azra Ahmed	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Bushra Mushtaque	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Dur Muhammad Soomro	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Asif Ali Thebo	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Mehwish Mehmood	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Abdul Razzaque Nohri*	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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