

Knowledge and Determinants of Neonatal Danger Signs among Male Partners in Nnewi, Anambra State, Nigeria

Nwankwo Augustine Ugochukwu¹; Princess Chinenye Onuorah¹; Ezidiegwu Onyinye Diana¹; Stella Ngozi Okereke²; Akubue Nnaemeka Emmanuel⁴; Chiejine Gibson Ifechukwude⁴; Duluora Nneka Chidimma⁴; Ogbiti Mark Imhonikhe⁵; Chima Paschal Igbokwe¹; Atuchukwu Chibuzor Samuel¹; Chioma Chetachukwu Ajator⁴; and Adinma Echendu Dolly⁴; and Onwumah Ejiroghene Victoria¹

¹Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra State, Nigeria. ²Claretian University, Nekede, Imo State, Nigeria. ³Department of Paediatrics, University of Nigeria Teaching Hospital, Nigeria. ⁴Department of Community Medicine, Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra State, Nigeria. ⁵Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria.

Corresponding author: dr gib2002@gmail.com

DOI: <https://doi.org/10.62154/ajhcer.2025.020.01032>

Abstract

Male partners play a critical role in maternal and neonatal healthcare, with their involvement increasingly recognized as essential for improving health outcomes. Most causes of neonatal mortality are preventable; therefore, early recognition of neonatal danger signs is vital. This study assessed the knowledge of neonatal danger signs and associated factors among male partners in Nnewi, Anambra State. A descriptive cross-sectional study was conducted among 354 male partners selected using a multistage sampling technique. Data were collected with a pretested, interviewer-administered, and validated questionnaire. Statistical analysis was performed using IBM SPSS version 25. Descriptive statistics summarized participants' characteristics, while chi-square tests assessed associations between independent variables and knowledge of neonatal danger signs. A significance level of $p < 0.05$ was applied. Majority of the respondents (54.0%) were between 35 and 49 years old. Most of the respondents (89.5%) were married, had secondary school education (46%), were of Igbo origin (95.5%), Christians (92.4%), from urban regions (80.5%), with monthly income of between 50,000 and 99,000 Naira (39.3%). The majority of the respondents (82.8%) have heard of neonatal danger signs, with vomiting (41.5%) and seizure (28.8%) being the major neonatal danger signs reported. The major perceived intervention by the respondent was to run to the hospital with the baby (53.1%). The major source of information on neonatal danger signs was health professionals (28.4%) and friends (22.7%). The proportion of respondents with low knowledge of neonatal danger signs was significantly higher (69.5%) than those with moderate (23.7%) or high (6.8%) levels of knowledge (χ^2 : 223.53; P : 0.001). The most common factors associated with knowledge of neonatal danger signs were illiteracy (education), having the first baby, and unemployment. The majority of the respondents (93.5%) think that fathers should be more involved in newborn care and health-seeking behaviours. More than three-quarters (85.9%) of the respondents were interested in receiving more information about neonatal danger signs. The factors that were significantly associated with knowledge of neonatal danger signs were level of education, age of father, unemployment, and health

professionals as the source of information. Knowledge of neonatal danger signs among male partners remains suboptimal. Strengthening policy frameworks to promote male involvement in maternal and neonatal health, alongside community-based education initiatives, is critical for reducing preventable neonatal mortality.

Keywords: Neonatal Danger Signs, Male Partners, Knowledge, Associated Factors, Maternal And Child Health, Nnewi, Nigeria.

Introduction

It is estimated that about 2.6 million new-born deaths occur globally each year, and neonatal mortality remains a significant public health concern (Ou et. al., 2022). Prompt detection and management of new-born danger signs can prevent majority of these fatalities. Early identification of the dangers can help to avert negative outcomes since they are symptoms or clinical manifestations that point to a high risk of morbidity or mortality in the neonatal era (Ou et. al., 2022). Several neonatal danger signs have been identified, including respiratory distress, cyanosis, temperature instability, poor feeding, lethargy, seizures, and jaundice. These danger signs can occur in isolation or combination and may be indicative of underlying medical conditions such as sepsis, pneumonia, meningitis, congenital heart disease, or neonatal hypoglycaemia (Tsfay et. al., 2022). Many underlying medical disorders can result in respiratory distress in the neonatal period. The most frequent causes of respiratory distress in newborns are pneumonia, congenital heart disease, meconium aspiration syndrome, transitory tachypnoea of the new-born, and respiratory distress syndrome (RDS). Airway abnormalities, diaphragmatic hernia, new-born pulmonary hypertension, and pneumothorax are among other less frequent causes of infant respiratory distress (Lagae et.al., 2021). Although prenatal corticosteroids, surfactants, and sophisticated neonatal respiratory care have successfully addressed RDS, it continues to rank as one of the leading causes of morbidity and mortality in preterm infants (Ekhaguere et.al., 2022, Zambrano et.al., 2022). Skin and mucous membranes appear blue when cyanosed. It serves as a baby's first signal of hypoxemia, or low blood oxygen levels. It often occurs around the lips, mouth, fingers, and toes and this is a warning indication. Neonatal disorders such as disorders of metabolism, sepsis, congenital heart disease, respiratory distress syndrome, and pneumonia can all lead to cyanosis in both term and preterm newborns. Early recognition of cyanosis is essential for prompt intervention and prevention of adverse outcomes (Tsfay et. al., 2022). Poor feeding is another neonatal risk indication. It can reveal a severe underlying medical issue in neonates. The relationship between poor feeding and congenital heart disease has gained interest in studies conducted in Ethiopia, Nigeria, and Uganda (Guta et. al., 2020). It is important to note that poor feeding is often associated with other neonatal danger signs, such as lethargy, respiratory distress, and fever. Therefore, it is important to consider poor feeding within the context of a comprehensive assessment of the new-born. Neonatal lethargy in infants causes issues in the neonatal intensive care unit, but it can also appear after newborns have been discharged. Early examination and therapy must be guided by early symptom

recognition and knowledge of potential differential diagnoses. A sleepy infant generally exhibits feeding difficulties, a weak sucking reflex, hypotonia, and may be challenging to awaken. Jaundice is a common condition among newborns, characterized by a yellowing of the skin and whites of the eyes due to the build-up of bilirubin in the blood. While jaundice is typically a mild and self-limiting condition, in some cases it can be a sign of more serious underlying conditions, such as haemolytic disease, sepsis, or liver dysfunction (Ochigbo et.al.,2024). Therefore, it is important to recognize jaundice as a neonatal danger sign and seek prompt medical attention if necessary. The associated factors of neonatal danger signs include:

Maternal factors which include maternal infections, maternal age, and maternal malnutrition can contribute to neonatal danger signs (Mokuolu et.al.,2022).

Prematurity: Premature babies are more likely to experience neonatal danger signs such as respiratory distress syndrome, hypothermia, and feeding difficulties (Mokuolu et.al.,2022).

Low birth weight: Low birth weight babies are also at increased risk of neonatal danger signs such as respiratory distress syndrome, hypothermia, and hypoglycaemia (Adugna & Worku, 2022).

Infection: Infection during pregnancy or after delivery can increase the risk of neonatal danger signs such as sepsis, meningitis, and pneumonia (Fajolu et.al., 2022).

Birth trauma: Trauma during delivery, including birth asphyxia, can increase the risk of neonatal danger signs such as hypoxic-ischemic encephalopathy (HIE) (Fajolu et.al., 2022).

Congenital anomalies: Babies born with congenital anomalies, such as heart defects, neural tube defects, and chromosomal abnormalities, are at increased risk of neonatal danger signs (Maynard, 2020).

Maternal substance abuse: Maternal substance abuse during pregnancy, such as drug or alcohol use, can increase the risk of neonatal danger signs such as withdrawal symptoms (Adeoye, 2022).

The study investigated male partners' understanding of newborn danger signs and how that knowledge is influenced by social demographic factors- age, occupation, family situation: monogamous or polygamous relationships, ethnicity, and others. In addition, the study assessed the obstacles to effective management of neonatal danger signs and identifying viable solutions for better neonatal outcomes.

Statement of the Problem

Pregnancy and childbirth are frequently seen as being solely a woman's responsibility in African countries like Nigeria, and Ethiopia. Men are the social and economic majority; they have a significant impact on their wives' access to healthcare (Shitu et. al.,2021). According to a study published in The Lancet Global Health in 2020, the prevalence of neonatal danger signs was estimated to be 11.3%. In 2019, an estimated 2.4 million newborns died globally, with the highest number of deaths occurring in sub-Saharan Africa and South Asia (Kebede et.al.,2022). In a study conducted in Ethiopia, the prevalence of neonatal danger signs was found to be 29.5% (Bulto et.al.,2019) In a study conducted in Nigeria, the prevalence of

neonatal danger signs was 45.2%, with respiratory distress, fever, and lethargy being the most common (Zhou et. al, 2022). According to the World Health Organization, 16 estimated 2.5 million newborns per year pass away, with low-income nations accounting for most of these deaths (Getachew et.al.,2022). Neonatal danger signs were found to be significantly associated with neonatal mortality in Nigeria. Compared to infants who did not show danger signs, those who did had a four-fold higher risk of dying young (Burden et.al.,2016). Neonatal danger signs were found to be significantly linked to longer hospital stays, higher rates of neonatal morbidity and mortality, and higher rates of hospitalization in Ethiopia (Kebede et.al.,2022). In low- and middle-income nations for example Nigeria, neonatal danger signs are linked to higher healthcare costs. The average cost of treatment for neonatal danger signs in these nations was estimated to be \$46 per episode, placing a significant financial strain on many families (Sharma & Murki, 2021). A study conducted in Ethiopia found that families of neonates with danger signs incurred significantly higher out-of-pocket healthcare expenses compared to those without danger signs (Kebede et.al.,2022). A study conducted in Ethiopia found that families of neonates with danger signs reported higher levels of stress and anxiety compared to those without danger signs (Kebede et.al., 2020). Neonatal danger signs are a significant public health concern in Africa and Nigeria, with potentially severe consequences for newborns.

Conceptual Framework

The conceptual framework emphasizes on the different factors that determine and influence male partner knowledge and identification of neonatal danger signs. Socio-demographic factors include age, education level, occupation, income, and marital status of the male partners (Galle et. al.,2020). Maternal factors include the mother's age, education level, occupation, and parity. Environmental factors include access to healthcare services, media exposure, and social support. Cultural factors include beliefs, norms, and practices related to child-rearing and healthcare-seeking behavior. Communication factors include the quality and frequency of communication between male partners and their spouses, healthcare providers, and other sources of information (Kebede et.al.,2022).

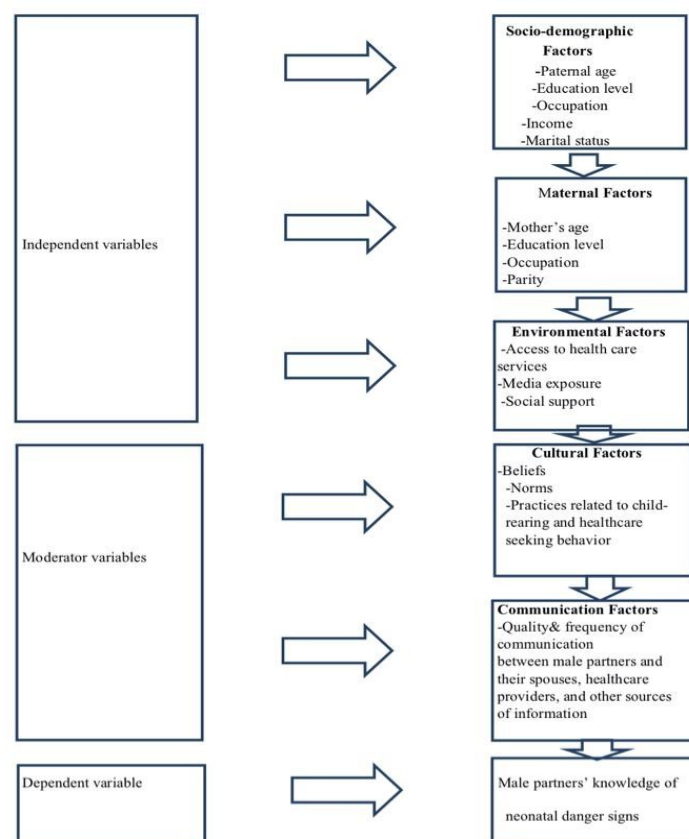


Figure 1: Conceptual framework of knowledge of neonatal danger signs among male partner

Methodology

Study Area

The study area was Nnewi, an industrial city and the second-largest city in Anambra State in southeast Nigeria. The metropolis of Nnewi is a big industrial community in Nnewi North Local Government Area and consists of the four quarters of Otolo, Uruagu, Umudim, and Nnewichi, is well recognized for producing a diversified range of transportation entrepreneurs from transporters to spare parts dealers and manufacturers. Its northern, southern, eastern, and western borders are formed by Nnobi, Utuh, Amichi, and Ojoto, respectively. According to the Nigerian census of 2006, the city, which is more than 200 square miles (520 km²) in size, has an estimated population of 391,227, making it the second-most populous town in the state. Starting at 1,051,000 in 2020, the population increased by 5.99% to 1,114,000 in 2021. This growth continued with a 5.66% increase to 1,177,000 in 2022, and a 5.27% rise to 1,239,000 in 2023 (Nnewi City Portal Anambra State, 2023).

Study Design

This was a descriptive cross-sectional study to investigate the knowledge of neonatal danger signs and associated factors among male partners of mothers who gave birth in the last six months in Nnewi, Nigeria.

Study Population

This study involved male partners of mothers who gave birth in the last six months in Nnewi, Anambra State, Nigeria.

Inclusion Criteria

Male partners of mothers who gave birth in the last six months in Nnewi, Nigeria.

Exclusion Criteria

Male partners who had not lived with the mother and new-born for at least two weeks after delivery. Male partners who were unable to provide informed consent to participate in the study. Respondents with mental health issues, speech or hearing defects were excluded due to possible distortion of their testamentary capacity.

Sample Size Determination

The sample size was determined by the Kish Leslie's formula for descriptive studies. To arrive at the sample size, a percentage awareness of 29.4 % from a study in Mozambique by Anna Galle et al. was used.

$$n = \frac{Z^2 pq}{d^2}$$

Where n = minimum sample size,

$$z=1.96,$$

$$p=0.294,$$

$$q=1-p,$$

$$d=0.05$$

$$n = (1.96)^2 \times 0.294 \times 0.706 / 0.0025$$

$$n = 319$$

A 10% non-response rate was considered using the formula, $n/(1-f)$ where n= sample size, f is the proportion of non-response rate.

Compensating for non-response, the Sample size was:

$$n =$$

$$n = 319/0.9$$

$$n = 354$$

The sample size was 354.

Sampling Technique

A multistage sampling technique was used to select the eligible respondents for the study

Stage 1: Selection of communities (stratification method and simple random sampling method)

Nnewi town is stratified into 4 communities; Nnewichi, Otolo, Umudim, and Uruagu. Two of the communities were selected by simple random sampling technique through the balloting method. They include Uruagu and Otolo.

Stage 2: Selection of four wards

Wards were selected by simple random sampling technique from the selected communities. The wards in Uruagu are Uruagu I, Uruagu II, and Uruagu III while those in Otolo are Otolo I, Otolo II, and Otolo III. This resulted in the selection of 2 wards per community and therefore a total of 4 wards which were Uruagu I, Uruagu III, Otolo I, and Otolo III were selected.

Stage 3: Selection of households and respondents

Households and male patients were selected by spinning bottles at a central prominent place in each ward using the World Health Organization Cluster sampling technique

Study Instruments

Interviewer administered semi-structured questionnaire was used for data collection. The questionnaire, written in English was self-administered to the respondents who met the criteria. The sections of the questionnaire include:

Section A which assessed the socio-demographic profile of the respondents.

Section B assessed the level of male partners' knowledge of neonatal danger signs.

Section C assessed the practice of resuscitative measures for neonatal danger signs.

Section D assessed the association between male involvement in antenatal attendance and knowledge of neonatal danger signs.

Section E assessed factors associated with knowledge of neonatal danger signs while

Section F was an overall assessment.

The questionnaire was adopted from relevant literatures and was subsequently verified by experts and supervisors in the field. Five research assistants were recruited for this study. They were university students; three males and two females, from the Igbo ethnic group, fluent in both Igbo and English languages. They were trained for two days on administration, communication, and data collection.

Pretesting

The instruments for this study were pretested amongst 35 male partners of mothers who gave birth in the last six months in Awka, Anambra State to ascertain the clarity, suitability, and comprehensiveness of the questionnaire, time spent to answer, and the need for intervention points of the research assistants. This enables all necessary corrections before the main research was done.

Statistical Analysis

The data was cleaned by checking for any data collection or coding errors. Data entry and analysis were carried out with the aid of the International Business Machines-Statistical Package for the Social Sciences (IBM-SPSS) Version 25.0. Descriptive and inferential statistics were applied where necessary. Numerical variables were reported as mean, median, and standard deviation while categorical data were reported using proportions and percentages. Frequency distributions of all relevant variables were developed. Knowledge was assessed using a scoring system of $\geq 70\%$ = high, 50–69% = moderate, and $< 50\%$ as low. The chi-square test was used to test for association between the dependent and independent variables. The level of significance was set at $p\text{-value} < 0.05$. The variables were presented using appropriate tables and charts.

Ethical Consideration

Ethical approval was obtained from the Ethical Committee of Nnamdi Azikiwe University (NAUEC), Nnewi. Informed consent was sought from the respondents. The Participants were assured of privacy and confidentiality.

Results

There were 354 male respondents in this study. Majority of the respondents (54.0%) were between 35-49 years. Most of the respondents (89.5%) were married, had secondary school education (46%), were of Igbo origin (95.5%), Christians (92.4%). Most of the respondents reside in urban regions (80.5%) and monthly income of most respondents was between 50,000-99,000 Naira (39.3%). See table 1.

The majority of the study participants (82.8%) had reportedly heard of neonatal danger signs with vomiting (41.5%) and seizure (28.8%) being the major neonatal danger reported by the participants. Concerning the intervention measures when neonatal danger signs were noticed, the major perceived intervention by the respondent (53.1%) was to rush to the hospital. Concerning the intervention measures when neonatal danger signs are noticed, the major perceived intervention by the respondent (53.1%) was to rush to the hospital while the least was the use of urine (1.40%). Other interventions (15.1%) that were reported by the respondent include self-medication (11.0%), giving onions (0.4%), use of rob and hot water (0.41%) and use of palm kernel oil or herbal drugs (3.27%). See table 2. The major source of information on neonatal danger signs was health professionals (28.4%) and friends (22.7%). See figure 1.

The proportion of participants with low knowledge of neonatal danger signs was higher (69.5%) than those with moderate (23.7%) or high (6.8%) levels of knowledge on neonatal danger signs. This difference was statistically significant (χ^2 : 223.525; P :0.001). See table 3. Regarding the factors associated with knowledge of neonatal danger signs as perceived by the respondents, the most common factor mentioned were illiteracy(education), having the first baby and unemployment (See figure 2).

The overall assessment of neonatal danger signs as perceived by the respondents show that more than half of the respondents have a perceived overall poor rating in their knowledge of neonatal danger signs (55.1%). The majority of the respondents (93.5) think that fathers should be more involved in new-born care and health-seeking behaviours. More than three-quarters (85.9%) of the respondents were interested in receiving more information about neonatal danger signs.

The social demographic factors that were significantly associated with knowledge of neonatal danger signs were:

- *Level of education*: respondents with tertiary education were the most knowledgeable (3.39%; χ^2 :20.53; P:0.009).
- *Age of father*: The older fathers were more knowledgeable (3.95%; χ^2 : 6.23; P: 0.044).
- *Unemployment*. The unemployed were more knowledgeable (3.67%; χ^2 : 6.217; P: 0.045).
- *Health Professionals as the source of information*: The respondents who had health professional as the source of information were more knowledgeable than others (5.93%; χ^2 : 23.61; P: 0.001).

Table 1: Socio-demographic characteristics of the respondents (n= 354)

Variable	Frequency	Percent
Age		
20-34 years	108	30.5
35-49 years	191	54.0
50-64 years	51	14.4
65-79 years	4	1.1
Marital status		
Single	14	4
Married	317	89.5
Divorced	11	3.1
Widowed	12	3.4
Place of residence		
Rural	69	19.5
Urban	285	80.5
Tribe		
Igbo	338	95.5
Hausa	6	1.7
Yoruba	7	2
Others	3	0.8
Religion		
Christianity	327	92.4
Islam	7	2
Traditional religion	20	5.6

Table 2: Knowledge of Neonatal Danger Signs and practice of resuscitative measures (n=354)

Variables	Frequency	Percent
Heard		
Yes	293	82.80
Nos	61	17.20
Neonatal danger signs	.	
Yellowness of eyes	166	12.30
Fast breathing	110	8.20
Cyanosis	83	6.20
Fever	167	12.40
Poor feeding	132	9.80
Reduced activity	93	6.90
Seizures	193	14.30
Vomiting	195	14.50
Diarrhoea	182	13.50
Others	25	1.86
Weight loss	10	0.74
Irritability	8	0.59
Rashes	4	0.30
Prematurity	1	0.07
Pallor	2	0.15
What would you do?		
Pray	39	8.00
Rush to the hospital	260	53.10
Wait for it to stop	41	8.40
Apply olive oil	29	5.90
Put a spoon in the mouth	40	8.20
Give urine to drink	7	1.40
Others	74	15.10
Self-medication	54	11.02
Give onions	2	0.41
Rob and hot water	2	0.41
Palm kernel oil / herbal drugs	16	3.27

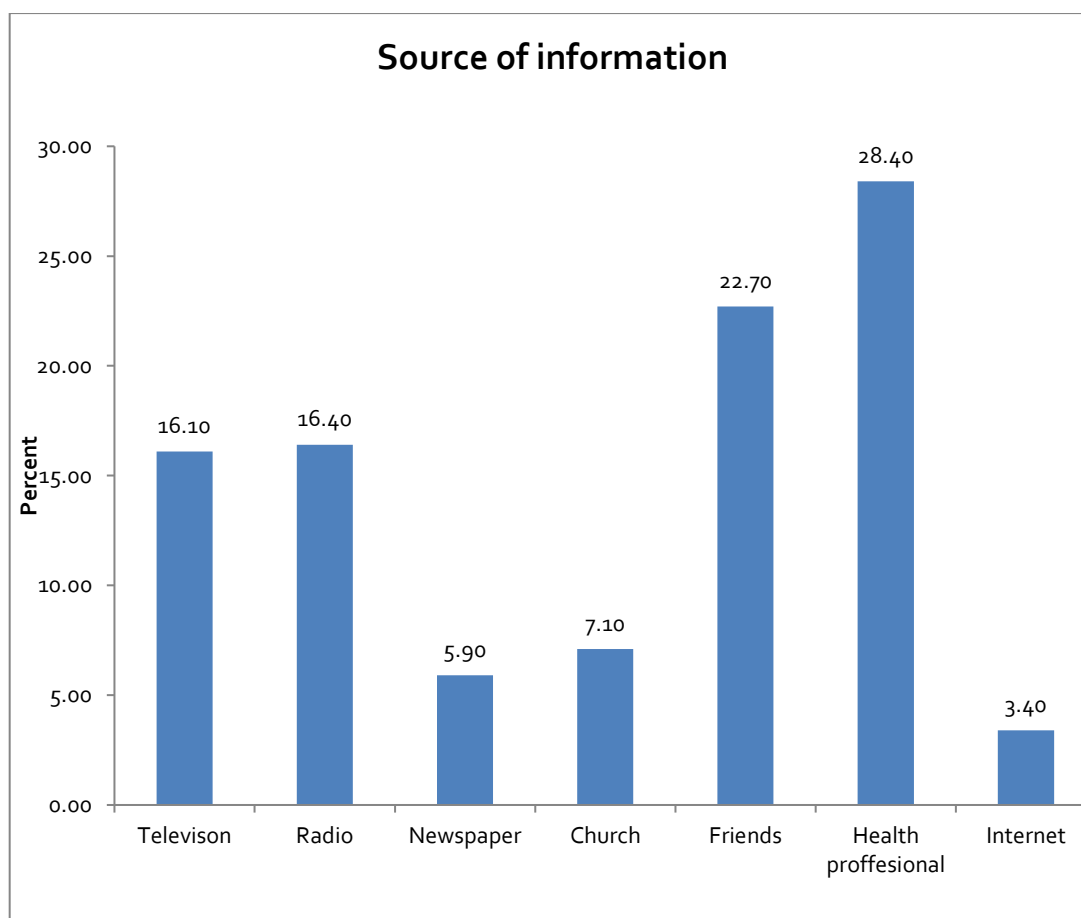


Figure 1: Source of information

Table 3: Level of knowledge of neonatal danger signs(n=354)

Knowledge	Frequency	Percent	X ²	p-value
Knowledge level			22.525	0.001
Low level	246	69.5		
Moderate level	84	23.7		
High level	24	6.8		

* Statistically significant, $p < 0.05$

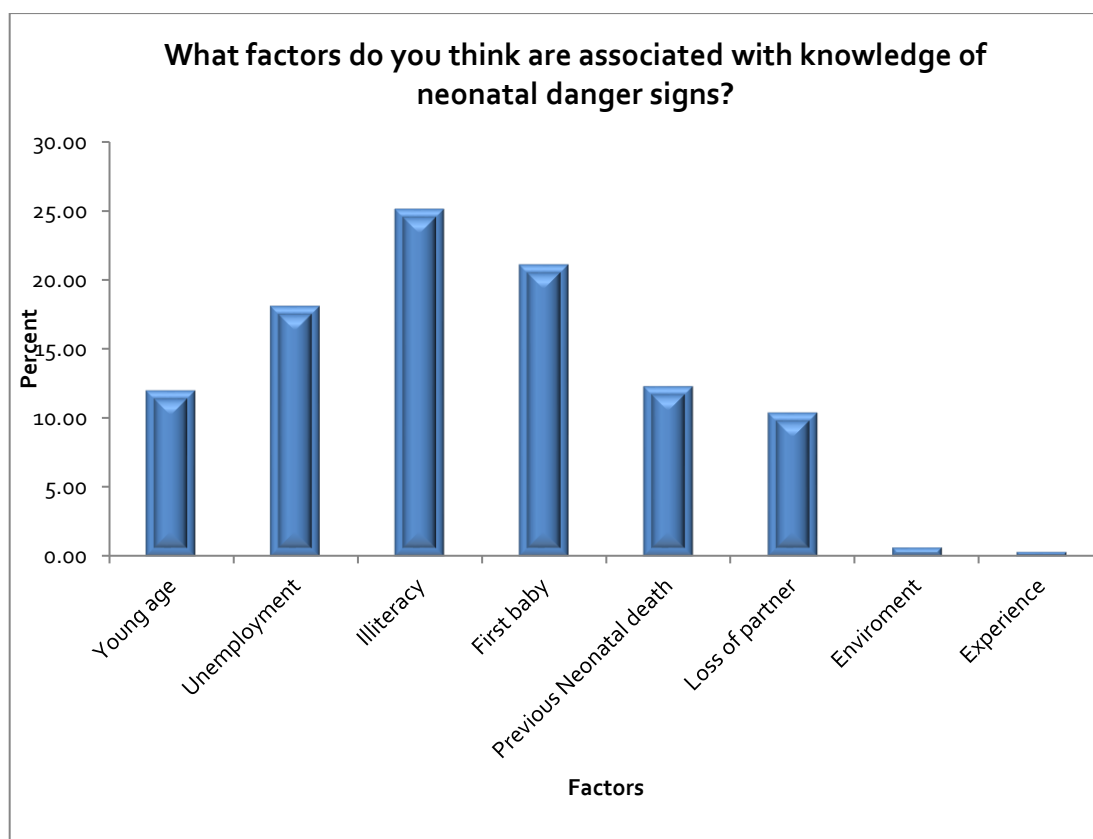


Figure 2: Perceived factors associated with knowledge of neonatal danger signs

Discussion

The study analysis the level of knowledge of neonatal danger signs among male partners of women who had their babies in the last six months before the study. It revealed that a significant proportion (69.5%) had a low level of knowledge. This aligns with previous studies in Jigawa, northern Nigeria, and Ethiopia. Interestingly, the study found a contrast in Nepal, where moderate knowledge (63.1%) was observed, possibly due to different health-seeking behaviours among male partners (Fite et.al.,2019). The low knowledge among male partners in Ethiopia (59.3%) and Jigawa, northern Nigeria might result from limited involvement due to cultural, religious, and gender-related factors, where men are seen more as providers than active contributors to maternal and neonatal well-being (Getachew et.al.,2022; Sharma et.al.,2019).In this study, the analysis of the practice of resuscitative measures for neonatal danger signs among male partners of women who gave birth in the last six months revealed a low level of resuscitation skill among partners. Research conducted in Kano State in Nigeria, Ethiopia, and Afghanistan which focused on neonatal care and resuscitation practices among healthcare facilities and professionals, recorded of good resuscitation measures (Atiqzai et.al.,2019; Asratie et.al.,2023; Usman et al.,2022). The variation in findings can be attributed to distinct study populations as these studies Ethiopia, and Afghanistan concentrate on healthcare providers and antenatal care recipients, while this study targets partners who may lack formal medical training. In this study there was statistical meaningful correlation between antenatal care visits and

knowledge of neonatal danger signs($p=0.038$). The observed association is consistent with the findings from studies conducted across varied geographical settings such as Tanzania, Ethiopia, Ghana, Lagos, western Nigeria, and Enugu, eastern Nigeria (Ekwochi et.al.,2015; Mekonen et.al., 2022; Okawa et.al.,2015; Okereke et. al.,2019; Oguntunde et. al.,2019). The association between level of education and knowledge of neonatal danger signs among male partners revealed that participants with higher education levels tend to display better knowledge. This finding is consistent with the findings in studies from Nepal, Ethiopia, and Nigeria (Guta et.al. 2020; Zhou et. Al.,2022; Degefa et.al.,2019). The consistency indicates that male partners with higher education levels possess more understanding of neonatal danger signs.

Conclusion

This study revealed that knowledge of neonatal danger signs among male partners in Nnewi, Nigeria, is generally low, with nearly 70% of participants demonstrating inadequate awareness. Although a majority of respondents had heard of neonatal danger signs, their ability to correctly identify specific signs such as vomiting and seizures was limited, and misconceptions around inappropriate interventions (e.g., use of urine, palm kernel oil, or herbal remedies) persist. Higher educational attainment, older paternal age, and health professionals as the primary source of information were significantly associated with better knowledge. Importantly, most respondents expressed willingness for increased male involvement in newborn care and a strong interest in receiving additional information on neonatal danger signs. These findings underscore the urgent need to strengthen health education programs and engage fathers as key stakeholders in new-born survival strategies.

Recommendations

The following recommendations were made according to the findings from the study and they are very important for the promotion of neonatal well-being and healthy family.

- *Policy and Health System Interventions:* The government and other stakeholders should integrate male-focused neonatal health education into antenatal and postnatal care programs, develop policies that actively promote male partner involvement in maternal and child health at all levels of care and provide structured health talks for fathers during maternal health visits, delivered by trained health professionals.
- *Community-Level Interventions:* It is very important to engage the community and community leaders and stakeholders support by conduct of awareness campaigns in communities using culturally appropriate methods to dispel harmful practices and promote correct responses to neonatal danger signs. Engage community and religious leaders to champion the role of fathers in new-born care.
- *Capacity Building:* Train healthcare providers on how to communicate effectively with male partners, addressing knowledge gaps and reinforcing positive health-

seeking behaviours. Encourage peer education, where informed fathers can share knowledge within social networks.

- *Research and Monitoring:* The establishment of surveillance systems to monitor knowledge levels and behavioural practices of male partners over time is recommended. The government should encourage operational research on interventions that improve paternal engagement in neonatal health.

Strengths of the Study

The study used a community-based, multistage sampling design, enhancing representativeness of the findings. The large sample size (354 respondents) provided adequate statistical power. Use of a validated, pretested, interviewer-administered questionnaire improved reliability of data collection. Inclusion of both knowledge and perception dimensions provided a comprehensive picture of male partners' involvement.

Limitations of the Study

Because the study is a cross-sectional study, causal relationships between socio-demographic factors and knowledge levels could not be established. The reliance on self-reported data may have introduced recall or social desirability bias, especially concerning knowledge of danger signs and reported practices. The study was conducted in a single urban–rural setting (Nnewi), which may limit generalizability to other regions of Nigeria with different cultural and socio-economic contexts. Statistical analysis was limited to bivariate analysis. Some qualitative insights (e.g., interviews with fathers or mothers) could have further enriched the understanding of attitudes and barriers.

Future Directions

Longitudinal studies to examine how knowledge of neonatal danger signs among male partners changes over time and in response to interventions will improve on this study. There is need to expand the research to multiple states in Nigeria to obtain nationally representative data. The incorporation of qualitative studies to explore deeper cultural and behavioural factors influencing fathers' knowledge and involvement will assess detailed information for policy development. It is important to evaluate the effectiveness of interventions targeting male partners such as health education campaigns, father-inclusive ANC classes, and community peer groups on improving neonatal outcomes. Further studies are important to investigate the impact of male partners' involvement on actual neonatal morbidity and mortality, not just knowledge, to strengthen the evidence for policy advocacy.

References

- Adeoye, I. A. (2022). Alcohol consumption and tobacco exposure among pregnant women in Ibadan, Nigeria. *BMC psychiatry*, 22(1), 570.

- Adugna, D. G., & Worku, M. G. (2022). Maternal and neonatal factors associated with low birth weight among neonates delivered at the University of Gondar comprehensive specialized hospital, Northwest Ethiopia. *Frontiers in pediatrics*, 10, 899922.
- Asratie, M. H., Belay, D. G., Kassie, B. A., Tsega, N. T., Aragaw, F. M., Gashaw, M., & Endalew, M. (2023). Spatial distribution and determinants of newborn care within 2 days of postpartum period among women with at least one antenatal care visit in Ethiopia: Mixed effect multilevel analysis. *Plos one*, 18(2), e0282012.
- Atiqzai, F., Manalai, P., Amin, S. S., Edmond, K. M., Naziri, M., Soroush, M. S., ... & Tappis, H. (2019). Quality of essential newborn care and neonatal resuscitation at health facilities in Afghanistan: a cross-sectional assessment. *BMJ open*, 9(8), e030496.
- Bulto GA, Fekene DB, Moti BE, Demissie GA, Daka KB. (2019). Knowledge of neonatal danger signs, care-seeking practice, and associated factors among postpartum mothers at public health facilities in Ambo town, Central Ethiopia. *BMC Res Notes*;12(1):1-7.
- Burden C, Bradley S, Storey C, et al. (2016). From grief, guilt pain, and stigma to hope and pride - a systematic review and meta-analysis of mixed-method research of the psycho-social impact of stillbirth. *BMC Pregnancy Childbirth*;16(1):1-12.
- Degefa N, Diriba K, Girma T, et al. (2019). Knowledge about Neonatal Danger Signs and Associated Factors among Mothers Attending Immunization Clinic at Arba Minch General Hospital, Southern Ethiopia: A Cross-Sectional Study;9180314.
- Ekhaguere, O. A., Okonkwo, I. R., Batra, M., & Hedstrom, A. B. (2022). Respiratory distress syndrome management in resource limited settings—Current evidence and opportunities in 2022. *Frontiers in pediatrics*, 10, 961509.
- Ekwochi U, Ndu IK, Osuorah CDI, et al. (2015). Knowledge of danger signs in newborns and health-seeking practices of mothers and care givers in Enugu state, South-East Nigeria. *Ital J Pediatr*;41:18.
- Fajolu, I. B., Satrom, K. M., Ezenwa, B. N., Kein, A. C., Slusher, T. M., & Ezeaka, V. C. (2022). Current trends in neonatal morbidity and mortality: experiences from a tertiary center in Lagos, Nigeria. *The American journal of tropical medicine and hygiene*, 107(3), 617
- Fite RO, Assefa M, Demissie A, Belachew T. (2019). Predictors of therapeutic communication between nurses and hospitalized patients. *Heliyon*;5(10):e02665.
- Galle A, De Melo M, Griffin S, Osman N, Roelens K, Degomme O. (2020). A cross-sectional study of the role of men and the knowledge of danger signs during pregnancy in southern Mozambique. *BMC Pregnancy Childbirth*;20(1):572.
- Getachew T, Assebe Yadeta T, Gerezihier T, Eyeberu A, Theresa M.(2022). Determinants of maternal knowledge on neonatal danger signs and care-seeking practices in a rural area of southeastern Ethiopia. *Int Health*;14(6):610-618.
- Guta, A., Sema, A., Amsalu, B., & Sintayehu, Y. (2020). Knowledge of neonatal danger signs and associated factors among mothers of < 6 Months old child in Dire Dawa, Ethiopia: a community based cross-sectional study. *International Journal of Women's Health*, 539-548.
- Kebede ZT, Toni AT, Amare AT, et al.(2022). Article Mothers experience on neonatal danger signs and associated factors in Northwest Ethiopia: a community-based cross-sectional study Mothers experience on neonatal danger signs and associated factors in Northwest Ethiopia: a community-based cross-sectional study. *Pan African Medical Journal*;(83):41.
- Kebede, A. A., Cherkos, E. A., & Taye, E. B. (2020). Mother's knowledge of neonatal danger signs and health-seeking practices and associated factors in Debreabor, Northwest Ethiopia: a community-based cross-sectional study. *Research and Reports in Neonatology*, 47-58.
- Lagae, D., Schuler-Barazzoni, M., Ungarelli-McEvoy, C., Stadelmann Diaw, C., & Roth-Kleiner, M. (2021). Respiratory distress in newborn infants in Western Switzerland. *The Journal of Maternal-Fetal & Neonatal Medicine*, 34(19), 3112-3119.

- Maynard, A. E. (2020). Congenital anomalies in a tertiary healthcare institution in rivers state, Nigeria. *International Journal of Neonatal Care and Pediatric Nursing*, 1(1), 17-24
- Mekonen M, Shifera N, Bogale B, Assefa A. (2022). Extent of male involvement and associated factors in antenatal care service utilization in Bench Sheko zone, Southwest Ethiopia: A community-based cross-sectional study. *Front Glob Womens Health*;3:938027
- Mokuolu, O. A., Adesiyun, O. O., Ibrahim, O. R., Suberu, H. D., Ibrahim, S., Bello, S. O., ... & Abdulkadir, M. B. (2022). Appraising neonatal morbidity and mortality in a developing country categorized by gestational age grouping and implications for targeted interventions. *Frontiers in Pediatrics*, 10, 899645.
- Newborn Mortality. (2021). Available from: <https://www.who.int/news-room/fact-sheets/detail/levels-and-trends-in-child-mortality-report-2021>. Accessed on March 5, 2023
- Nnewi History - Nnewi City Portal | Anambra State, Nigeria. (2023). Available from: <https://nnewicommunity.com/nnewi-history/> Accessed on April 2, 2023.
- Ochigbo, S., Ekpebe, P., Nyong, E. E., Ikechukwu, O., Ibeawuchi, A., Eigbedion, A., ... & Etuk, S. (2024). Neonatal jaundice incidence, risk factors and outcomes in referral-level facilities in Nigeria. *BJOG: An International Journal of Obstetrics & Gynaecology*, 131, 113-124.
- Okawa S, Ansah EK, Nanishi K, Enuameh Y, Shibnuma A, Kikuchi K, Yasuoka J, Gyapong M, Owusu-Agyei S, Oduro AR, Asare GQ, Hodgson A, Jimba M; Ghana EMBRACE. (2015). Implementation Research Project Team. High Incidence of Neonatal Danger Signs and Its Implications for Postnatal Care in Ghana: A Cross-Sectional Study. *PLoS One*;10(6):e0130712.
- Okereke, E., Ishaku, S.M., Unumeri, G. et al. (2019). Reducing maternal and newborn mortality in Nigeria—a qualitative study of stakeholders' perceptions about the performance of community health workers and the introduction of community midwifery at the primary healthcare level. *Hum Resour Health* 17, 102 Available from: <https://doi.org/10.1186/s12960-019-0430-0> Accessed on March 16, 2023.
- Ou, Z., Yu, D., Liang, Y., He, H., He, W., Li, Y., ... & Chen, Q. (2022). Global trends in incidence and death of neonatal disorders and its specific causes in 204 countries/territories during 1990–2019. *BMC public health*, 22(1), 360.
- Ristovska, S., Stomnaroska, O., & Danilovski, D. (2022). Hypoxic ischemic encephalopathy (HIE) in term and preterm infants. *prilozi*, 43(1), 77-84.
- Sharma, D., & Murki, S. (2021). Making neonatal intensive care: cost effective. *The Journal of Maternal-Fetal & Neonatal Medicine*, 34(14), 2375-2383.
- Sharma, V., Leight, J., Giroux, N., AbdulAziz, F., & Nyqvist, M. B. (2019). "That's a woman's problem": a qualitative analysis to understand male involvement in maternal and newborn health in Jigawa state, northern Nigeria. *Reproductive Health*, 16(1), 143.
- Shitu S, Abebe H, Adane D, Wassie A, Mose A, Yeshaneh A. (2021). Knowledge of neonatal danger signs and associated factors among husbands of mothers who gave birth in the last 6 months in Gurage Zone, Southern Ethiopia, 2020: a community-based cross-sectional study. *BMJ Open*;11(8):e045930.
- Tesfay, N., Tariku, R., Zenebe, A., Dejene, Z., & Woldeyohannes, F. (2022). Cause and risk factors of early neonatal death in Ethiopia. *PloS one*, 17(9), e0275475.
- Tokhi M, Comrie-Thomson L, Davis J, Portela A, Chersich M, Luchters S. (2018). Involving men to improve maternal and newborn health: A systematic review of the effectiveness of interventions. *PLoS One*;13(1):e0191620.
- Usman, F., Tsiga-Ahmed, F. I., Abdulsalam, M., Farouk, Z. L., Jibir, B. W., & Aliyu, M. H. (2022). Facility and care provider emergency preparedness for neonatal resuscitation in Kano, Nigeria. *Plos one*, 17(1), e0262446.

- Zambrano, S. L., Garcés, M. U., Mazon, J. H., Carrillo, F. R., & Morales, C. L. (2022). Factors associated with severe neonatal respiratory distress syndrome. *Revista Ecuatoriana de Pediatría*, 23(2), 93-100.
- Zhou J, Hua W, Zheng Q, Cai Q, Zhang X, Jiang L. Knowledge about neonatal danger signs and associated factors among mothers of children aged 0-12 months in a rural county, Southwest of China: a cross-sectional study. 2022 ;22(1):346