Contributing Factors to Elevated Neonatal Sepsis Rates in State Hospitals: A Mixed Methods Study in Windhoek, Namibia

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ABSTRACT

Background: Neonatal sepsis remains a significant contributor to infant morbidity and mortality worldwide, particularly in low- and middle-income countries. In Namibia, despite national health policies aimed at reducing neonatal deaths, sepsis rates remain high. Aim: This study aimed to investigate the factors contributing to high neonatal sepsis rates in state hospitals in Windhoek, Namibia, from the perspective of frontline nursing staff. Methods: A mixed methods triangulation design was employed, collecting both qualitative and quantitative data from nurses in two state hospitals. Stratified random sampling was used for the quantitative component, while purposive sampling guided qualitative interviews. Quantitative data (n=62) were analyzed using descriptive statistics in STATA, and qualitative data (n=15) underwent thematic analysis. Results: out of 77 total number of participants under Quantitative (62) findings showed most nurses had moderate experience with neonatal sepsis care but expressed a need for further training. High workload (39%), lack of equipment (23%), inadequate training (15%), and emotional stress (16%) were major challenges reported. 15 participants under Qualitative data revealed key themes including poor availability of equipment, overcrowding, high nurse-to-patient ratios, inadequate maternal hygiene practices, and insufficient healthcare facilities. Conclusion: Structural and resource-related challenges significantly contribute to neonatal sepsis in Windhoek's state hospitals. Strategic interventions, including infrastructure improvements, nurse training, and maternal hygiene education, are essential to reducing infection rates.

Keywords: Neonatal sepsis, NICU, Namibia, mixed methods, Nursing care, Infection Control

INTRODUCTION

Neonatal sepsis; a life-threatening systemic infection occurring within the first 28 days of life, remains a major public health concern and one of the leading causes of neonatal morbidity and mortality globally. It is broadly classified into early-onset sepsis (EOS), which typically occurs within the first 72 hours of life and is often linked to vertical transmission from the mother during childbirth, and late-onset sepsis (LOS), which appears after 72 hours and is commonly associated with nosocomial or community-acquired infections (Shane & Sánchez, 2020). According to the World Health Organization (2022), sepsis and other infections contribute to about 30% of the 2.4 million neonatal deaths reported annually, with the highest burden observed in low- and middle-income countries (LMICs), especially in sub-Saharan Africa. Despite global advances in maternal and neonatal care, the high incidence of neonatal sepsis underscores ongoing challenges in infection control, health infrastructure, and quality of care.

In Namibia, neonatal sepsis is particularly concerning, contributing to over 60% of infant deaths (Hatupopi et al., 2020). This is despite the country's policy efforts, including the 2019 Maternity Health Policy Framework, which aims to enhance maternal and newborn health services (Ministry of Health and Social Services [MoHSS], 2019). The situation remains dire in state hospitals, including those in Windhoek, where neonatal intensive care units (NICUs) continue to experience high infection rates. Preliminary reports from public hospitals in Windhoek point to challenges such as staff shortages, poor infection prevention practices, overcrowding, and inconsistent adherence to clinical protocols. These issues not only compromise care quality but may also be central to the persistently high rates of neonatal sepsis in these settings. Although some research has been conducted on neonatal outcomes and maternal care, few studies in Namibia have explored

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neonatal sepsis from the viewpoint of frontline nurses. As primary caregivers, nurses have firsthand experience with both systemic and clinical factors influencing infection outcomes. Their insights can contribute to designing interventions that are grounded in practical realities. This study fills an important gap by employing a mixed methods approach to understand and address the persistently high rates of neonatal sepsis in state hospitals in Windhoek.

This study aims to explore the contributing factors to elevated neonatal sepsis rates in selected state hospitals in Windhoek, Namibia, through the perspectives of frontline nurses. Specifically, it seeks to understand the institutional, environmental, and operational dynamics that may influence infection control practices. The rationale for this focus stems from the critical role nurses plays in neonatal care ; they are often the first to recognize sepsis symptoms and are central to implementing infection prevention measures. However, their insights are underrepresented in existing literature, which tends to emphasize clinical outcomes or parental experiences (Read et al., 2018; Agnche, 2020; Aku et al., 2020). By capturing nurses lived experiences and professional viewpoints, this study aims to generate practical recommendations to inform policy implementation and improve neonatal health outcomes in Namibia.

Despite the implementation of national maternal and neonatal health frameworks, neonatal sepsis continues to cause significant mortality in state hospitals in Namibia. For instance, statistics from Hospital B revealed that "87 neonatal deaths were recorded between January and June 2022," with many cases demonstrating "resistance to the standard antibiotic regimens" (Hospital B Records, 2022). In some cases**,** "we had to procure third-line antibiotics from outside the country because the neonates weren't responding to our usual stock," reported a NICU nurse at Hospital B (Key Informant Interview, June 2022). This practice placed a significant strain on the hospital's limited resources. Furthermore, the NICU, designed to accommodate a maximum of 34 infants, often hosts up to "56 neonates on a single shift," leading to severe overcrowding (NICU Staff Report, 2022). As one nurse explained, "Overcrowding is our biggest challenge—when babies are too close together, infections spread quickly" (Key Informant Interview, June 2022). These operational difficulties, compounded by rising antimicrobial resistance, "are signs that our system is not coping well," observed a senior clinician (Field Notes, 2022). These insights underscore the urgent need to investigate clinical, institutional, and structural factors contributing to the persistence of neonatal sepsis, particularly from the perspectives of nurses working at the frontline.

METHODS

Research Design: This study employed a mixed methods design, integrating both qualitative and quantitative approaches to explore the contributing factors to high neonatal sepsis rates in state hospitals in Windhoek, Namibia. A convergent parallel triangulation approach was used, wherein both qualitative and quantitative data were collected simultaneously. This approach enabled the researcher to obtain a comprehensive understanding of the clinical, institutional, and structural contributors to neonatal sepsis by drawing on both statistical trends and the lived experiences of frontline healthcare workers.

Study Setting and Population: The research was conducted in the Neonatal Intensive Care Units (NICUs) of two major state hospitals in Windhoek, Namibia—referred to as Hospital A and Hospital B. These hospitals were purposefully selected to allow for comparison between institutions and because of their high admission rates and documented neonatal sepsis cases.

Sampling Techniques: A combination of stratified random sampling and purposive (judgmental) sampling was used. For the quantitative component, stratified random sampling was employed. The universal sample size formula was used:

$$\text{sample} = \frac{\text{N}}{(1 + \text{Ne}^2)}$$

$$\text{sample} = \frac{62}{(1 + 62 \times 5\%^2)} = 54$$

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This ensured that the quantitative sample was statistically representative of the population of junior nurses directly involved in neonatal care. For the qualitative component, judgmental sampling was used. All available senior and supervisory nurses (n=15) from both hospitals were purposively selected based on their extensive experience managing neonatal sepsis cases and overseeing junior staff.

Data Collection Procedures

Data were collected in January and February 2024 from both hospitals. A **semi-structured interview guide** was used for the qualitative component, while a **structured questionnaire** was administered for the quantitative component. Interviews focused on nurses' experiences, perceived challenges, and institutional gaps. Questionnaires captured data on clinical practices, infection control measures, and workload-related variables.

Data Analysis

Qualitative Data: Interviews were audio-recorded, transcribed verbatim, and subjected to thematic analysis. The researcher read and re-read transcripts to identify recurring patterns, concepts, and categories that emerged from the narratives, using an inductive coding process.

Quantitative Data: Data were entered and cleaned using Microsoft Excel, then exported to STATA for analysis. Descriptive statistics (frequencies, means, percentages) were used to summarize the data, allowing for identification of trends and correlations related to neonatal sepsis risk factors.

Ethical Considerations

Ethical clearance was obtained from the Higher Education Institution (HEI) Ethics and Research Committee. Written informed consent was secured from all participants after the study's purpose, confidentiality protocols, and the voluntary nature of participation were clearly explained. Participants were assured that: They could withdraw at any point without penalty. Confidentiality would be strictly maintained. All collected data—including audio recordings and transcripts—were stored on a password-protected laptop accessible only to the researcher and supervisor.

RESULTS

The total study sample included 77 participants: 15 for the qualitative arm and 62 for the quantitative arm, as shown in Table 1 below:

Hospital	Qualitative (Senior/Supervisory Nurses)	Quantitative (Junior Nurses)	Total
Hospital A	8	44	52
Hospital B	7	18	25
Total	**15**	**62**	**77**

Interview Response Rate: A total of 15 senior and supervisory nurses were targeted for qualitative interviews. Of these, 10 interviews were successfully conducted, representing an overall response rate of 67%. Hospital A recorded a 70% response rate (6 of 8), while Hospital B recorded 60% (4 of 7) (Table 2).

Table 2: Interview Response Rate

Hospital	Targeted Participants	Interviews Conducted	Response Rate
Hospital A	8	6	70%

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Hospital B	7	4	60%
Total	**15**	**10**	**67%**

Hospital A: 75 nurses in the maternity/NICU department

Hospital B: 143 nurses in the maternity/NICU department

Questionnaire Response Rate: For the quantitative component, 54 junior and general nurses were targeted to complete questionnaires. A total of 42 responses were obtained, giving an overall response rate of 78%. Hospital A had an 80% response rate (29 of 36), while Hospital B had 74% (13 of 18) (Table 2).

Table 3: Questionnaire Response Rate

Hospital	Targeted Respondents	Questionnaires Completed	Response Rate
Hospital A	36	29	80%
Hospital B	18	13	74%
Total	**54**	**42**	**78%**

Quantitative Findings: Involvement in Caring for Neonates with Sepsis

Respondents rated their experience in caring for neonates with sepsis on a Likert scale (1 = Not Experienced to 5 = Highly Experienced). The overall mean scores suggest that while many respondents feel moderately confident, there is still a need for additional support and training (Table 4).

Table 4: Nurse Experience in Caring for Neonatal Sepsis Cases

Statement	Mean	SD	Min	Max	Mode
Little or no experience; feel unprepared to provide adequate care	3.75	1.06	1	5	4
Some experience but could benefit from additional training or support	3.69	1.01	1	5	4
Comfortable with care provision; room for improvement	3.75	0.86	2	5	4
Experienced and confident in abilities to provide excellent care	3.19	1.38	1	5	3
Specialist in neonatal sepsis; significant expertise	3.44	1.03	2	5	3

Source: Field Data, 2024

Number of Neonatal Sepsis Cases Encountered

Participants reported the number of neonatal sepsis cases they had managed over their practice period. The distribution is presented in Table 1.

Range number of cases	| Number of Participants |
| 0–10	3

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| 11–20	4
| 21–50	6
| 51–70	2
| 71+	1

Challenges Faced in Nursing Care Provision

Key Challenges Affecting Neonatal Care

Respondents identified several challenges that hinder effective neonatal care delivery in public health facilities. As illustrated in Figure 2, the most frequently cited challenge was high workload, reported by 39% of participants. This was followed by limited resources and equipment (23%), and insufficient knowledge or training (15%). Additionally, emotional stress was highlighted by 16% of the respondents, reflecting the psychological burden placed on healthcare workers operating in resource-constrained environments. A smaller proportion (7%) mentioned other challenges, including poor communication, inconsistent protocols, and understaffing.

These findings underscore the systemic pressures facing frontline neonatal care providers and point to key areas that require institutional support and policy attention.

(Insert bar chart showing the percentage distribution of challenges: High workload (39%), Limited resources/equipment (23%), Emotional stress (16%), Insufficient knowledge/training (15%), Other (7%))

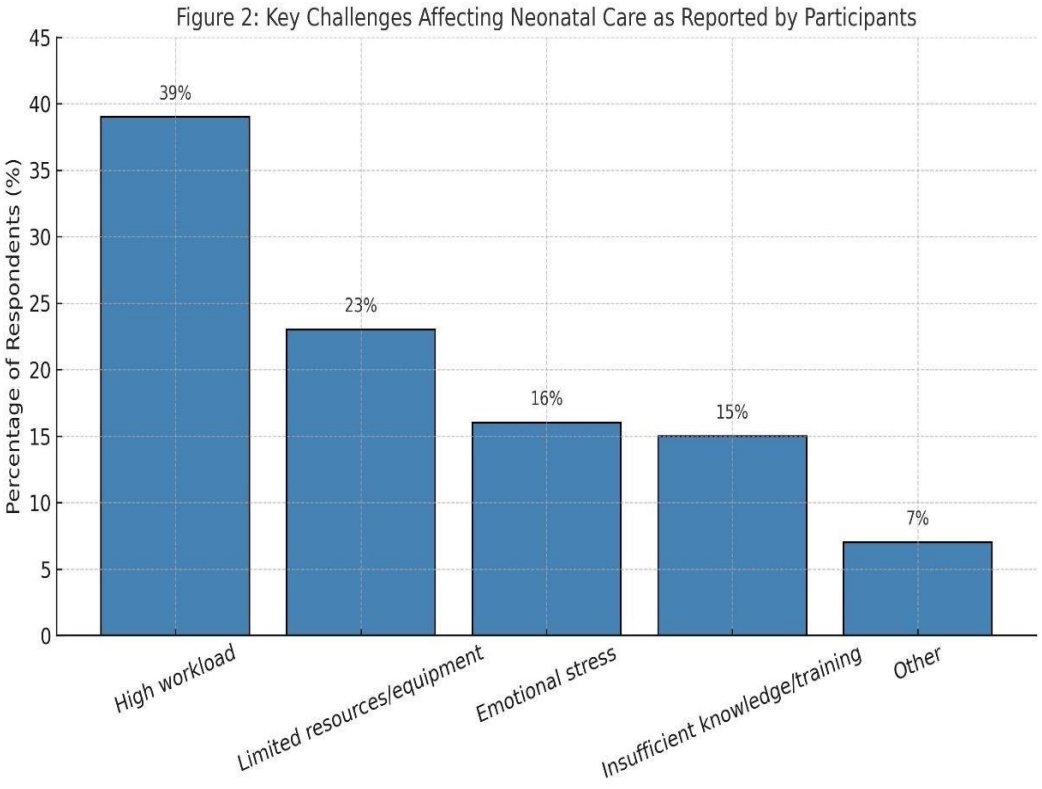

Figure 1: Key Challenges Affecting Neonatal Care as Reported by Participants

Qualitative Findings

Thematic analysis of interview data from 10 senior and supervisory nurses revealed the following major themes:

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Poor Availability of Equipment

"Having access to well-maintained and up-to-date medical equipment would greatly improve the quality of care we can provide to babies with neonatal sepsis." (Participant 5)

"Insufficient equipment hampers our ability to diagnose and treat neonatal sepsis effectively." (Participant 4)

Overcrowding in NICUs

"Overcrowding in hospitals poses a significant challenge... it limits our ability to provide individualized care." (Participant 7)

"Reducing overcrowding would allow us to allocate more time and attention to each baby." (Participant 3)

High Nurse-to-Patient Ratio: "A lower nurse-to-patient ratio would greatly enhance the care we can provide." (Participant 3)

"With more nurses, we could monitor conditions closely and intervene timely." (Participant 6)

Mothers' Poor Hygiene: "Educating mothers about proper hygiene practices can significantly reduce the risk of neonatal sepsis." (Participant 5)

Inadequate Healthcare Infrastructure: "The lack of adequate healthcare facilities poses a significant challenge." (Participant 5)

"Investing in additional healthcare facilities would help alleviate the burden on existing hospitals." (Participant 3) Additionally, several participants emphasized the need for emotional support systems and mentorship structures to improve nurse morale and resilience in caring for critically ill neonates.

DISCUSSION

Integration of Quantitative and Qualitative Findings:

This mixed methods study explored the factors contributing to elevated neonatal sepsis rates in two public hospitals in Windhoek, Namibia. Quantitative data revealed that while nurses have varying levels of experience managing neonatal sepsis, many report a need for further training and support. Challenges such as high workloads, emotional stress, and inadequate resources were common. Qualitative findings reinforced these results. Participants emphasized overcrowded NICUs, insufficient equipment, and high nurse-to-patient ratios. In addition, issues related to poor maternal hygiene and infrastructural deficiencies were identified as contributing factors to neonatal infections. These combined insights suggest that both clinical and systemic factors are responsible for the persistently high rates of neonatal sepsis. These findings suggest that although nurses generally feel somewhat equipped, most express the need for further professional development in managing neonatal sepsis cases effectively. In table 1 the study showed that there was a variation in exposure supporting the differences observed in self-rated experience levels. This indicates a satisfactory level of engagement among targeted participants.

The findings are consistent with global studies that link neonatal sepsis to inadequate infection control practices, limited infrastructure, and human resource shortages. For instance, Aku et al. (2020) and Agnche (2020) report similar challenges across sub-Saharan Africa, highlighting that overcrowding, lack of equipment, and nurse burnout are recurrent issues in NICU environments. Likewise, Read et al. (2018) found that empowering nurses through mentorship and adequate support improves care quality and outcomes in neonatal care settings. The study also confirms reports by Hatupopi et al. (2020), who noted that despite policy frameworks such as Namibia's 2019 Maternity Health Policy, implementation remains weak due to logistical and operational barriers. Apart from that, the study underscores the critical role of frontline nurses in infection prevention and neonatal care. To improve outcomes, policy frameworks must move beyond theoretical formulations and address on-the-ground realities. The Ministry of Health and Social Services and hospital

administrators should prioritize reducing nurse workloads, improving infection control infrastructure, and fostering professional development programs.

CONCLUSION

This study identified systemic, institutional, and behavioral factors contributing to high neonatal sepsis rates in public hospitals in Windhoek. The results demonstrate that although nurses generally possess moderate levels of experience, they face significant structural barriers chiefly equipment shortages, high patient loads, and poor maternal hygiene practices that impede effective care delivery. Qualitative insights emphasized the emotional and logistical toll on nursing staff, underscoring the need for supportive working environments, mentorship programs, and investment in healthcare infrastructure. Improving neonatal outcomes in Namibia will require a coordinated approach that strengthens nurse capacity, ensures availability of essential resources, and enhances public health education. These findings may also guide similar interventions in other low- and middle-income countries facing comparable challenges.

Recommendations for Training, Staffing, and Facility Improvements

The data suggest an urgent need for:

Increased nurse recruitment and redistribution to reduce patient overload.

Regular training and refresher courses focused on neonatal infection management.

Provision and maintenance of essential NICU equipment.

Hygiene education programs targeted at mothers, especially those with babies admitted in NICUs.

Long-term investments in hospital infrastructure to reduce overcrowding and improve care quality.

DECLARATIONS

Conflict of Interest: The authors declare no conflict of interest.

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Ethical Approval: Approval was obtained from the National Commission of Research Science and Technology. Ethical Review Committee, Ref No: 202304022.

Informed Consent: Written informed consent was obtained from all participants.

Author Contributions: Both authors reviewed and approved the final manuscript.

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