

## Review Article

# Neonatal Sepsis Risk Factors in Zambia: A Review

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### Article History

Received: 06.10.2024  
Accepted: 15.11.2024  
Published: 21.11.2024

### Journal homepage:

<https://www.easpublisher.com>

### Quick Response Code



**Abstract:** Neonatal sepsis remains a significant cause of morbidity and mortality particularly in Zambia accounting for 45% of all the deaths in under-five period (MoH Action Plan, 2022-2026). Zambia face a lifetime risk of 1 in 37 infants die in their first months of life with the neonatal mortality rate of 27 per 1000 live births (Zambia Statistical agency, 2019). The aim of this article is to determine risk factors associated with neonatal sepsis in Zambia. Appreciating these factors is critical for implementing effective measures in the prevention and improving neonatal health outcomes in Zambia. The risk factors of neonatal sepsis are classified into maternal, perinatal and neonatal factors drawing insights from recent studies conducted within the Zambian context.

**Keywords:** Neonatal, Risk factors, Zambia.

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## INTRODUCTION

There are approximately 1.3 million cases of neonatal sepsis reported worldwide with deaths occurring more commonly in preterm and low-weight new-borns (Mahmoud *et al.*, 2023). A systematic literature review conducted by Traore *et al.*, (2024) on the occurrence and factors associated with maternal and neonatal sepsis in Sub-Saharan Africa, the prevalence of neonatal sepsis was reported to be at 36.2%. In a study conducted by Monde *et al.*, 2024, it was revealed that sepsis resulted in 26% of mortalities in children below the age of five worldwide, countries in Sub-Saharan African recording the highest deaths. According to Zambia demographic health survey, neonatal mortality increased from 24 deaths per 1,000 live births in 2013-14 to 27 deaths per 1,000 live births in 2018 (Zambia demographic and health Survey, 2018). A study by Kateule, *et al.*, (2022) revealed that in Zambia, neonatal sepsis caused 38.1% percent of the recorded neonatal mortalities.

Neonatal sepsis is a serious medical condition characterised by a systemic infection in newborn infants, typically within the first 28 days of life (Ershad *et al.*, 2019). It occurs when bacteria or other pathogens invade the bloodstream or tissues of the newborn leading to symptoms such as fever, lethargy, poor feeding, respiratory distress and jaundice. Neonatal sepsis can be classified as early-onset (within the first 72 hours of life)

or late onset (after 72 hours) and may result from vertical transmission of maternal infections, exposure to pathogens during delivery or nosocomial infections acquired in healthcare settings (Stoll, *et al.*, 2002). Laboratory tests such as blood cultures, complete blood count, C-creative protein levels and other biomarkers aid in confirming the diagnosis and guiding treatment (Ershad *et al.*, 2019). Prompt and appropriate management of neonatal sepsis is crucial to prevent severe complications including septic shock, multiple organ dysfunction syndrome and death. In Zambia, despite milestones to improve maternal and child health, neonatal sepsis continues to pose a significant public health challenge. Identifying the risk factors associated with neonatal sepsis is essential for targeted interventions and reducing its burden on the health care system and society as whole.

### Neonatal Sepsis Risk Factors

In Zambia demographic factors such as low socio-economic status, emerged as significant predictors with studies indicating a notable association between socio-economic disadvantage and heightened risk of neonatal sepsis (Bech *et al.*, 2022).

Maternal infections play a crucial role in the transmission of pathogens to the new born during pregnancy, labour and delivery. Various maternal infections such as urinary tract infection, sexually

transmitted infections such as syphilis, gonorrhoea, chlamydia and bacterial vaginosis can be transmitted vertically to the fetus during pregnancy and delivery (Amir *et al.*, 2020). The pathogens can breach the protective barriers of the placenta or infect the newborn during passage through the birth canal leading to early onset sepsis (Mahmoud *et al.*, 2023). This is demonstrated by a systematic and meta-analysis review by Bayih *et al.*, (2021) and Yeta *et al.*, (2021) where urinary tract infections antenatally had positive odds of association with neonatal sepsis.

Inadequate antenatal attendance can be a contributory factor to neonatal sepsis. According to the World Health Organisation, every woman should start antenatal care immediately after recognising that she is pregnant or within 12 weeks gestation (Shinyawani *et al.*, 2023) and should have 8 contacts throughout the pregnancy period which could be more depending on the condition of the woman. A study conducted in Zambia by Laisser and colleagues (2022), reported that 64% of women in Zambia attend at least 4 antenatal visits with only 37% starting antenatal care in the first trimester and third and 53% of the women from the rural areas attending four antenatal visits. On the contrary, a study conducted in Ethiopia ANC service utilization, was not found to be predictors of neonatal sepsis (Gebremedhin, Berhe and Gebrekirstos, 2016). The reasons for these differences may range from the background of the participants, access to health facilities and health professionals.

According to Bitman *et al.*, (2023), inadequate antenatal care and screening exacerbate the risk as undiagnosed or untreated maternal infections remain unchecked, allowing for vertical transmission to occur without intervention). In addition, a study by Banda *et al.*, highlighted the association between maternal HIV infection and an increased risk of neonatal sepsis through vertical transmission (Banda *et al.*, 2018; Mwansa Kambafwile *et al.*, 2017).

The place of birth significantly influences neonatal mortality rates with deliveries occurring at health centers and homes showing higher mortality rates compared to those in hospitals (Tembo *et al.*, 2024). Neonates born at health centers experiences a 48% increase in mortality rates while those born at home faced a 70% increase (Tembo *et al.*, 2024). Despite measures put in place by Government to encourage women to deliver at the hospital some women still deliver at home (Sinkamba 2019) or before arrival at the hospital. For instance a study conducted by Scott *et al.*, (2018) in a remote area of Zambia among women who had recently delivered and live 10 km from the health facility found that almost all their respondents intended to deliver at a health facility but 15.3 % delivered at home and 3.3 % delivered on their way to the health facility. Similarly, a study conducted by Mulenga *et al.*, (2018) in the Western province of Zambia reported

women preferred to deliver at the health facility but were unaware of the signs of labour as a result they delivered on their way to the health facility.

Studies have also demonstrated an association between prolonged rupture of membranes defined as rupture of membranes more than 18 hours before delivery and neonatal sepsis as well as maternal fever and incidences of neonatal sepsis (Banda *et al.*, 2018; Al-lawama *et al.*, 2019). These results are similar to a research done in Ethiopia in which it was found that prolonged rupture of membrane (PROM) had significant association with risk of neonatal sepsis. The odds of neonatal sepsis among mothers who gave birth after 18 hours of rupture of membrane was 7.4 times higher than those mothers who gave birth before 18 hours of rupture of membrane (Gebremedhin, Berhe and Gebrekirstos, 2016).

Cultural beliefs and practices could impact the health of the neonate. Monde *et al.*, (2024) study revealed that 50.2 % of the respondents in their study applied herbs and other substances on the new-born's umbilical cord to aid healing. The findings showed that 18.6% of the women applied herbs on the umbilical cord, 17.9% applied chicken droppings, and 16.9% applied baby powder. Such actions could result in neonatal sepsis. In addition, prolonged labour could contribute to neonatal sepsis because of ascending infections into the birth canal. According to annual health statistics report, 2.8 % of women who delivered in 2020 in Zambia had prolonged labour (MOH, 2021). Furthermore, adolescent mothers are at a high risk of having prolonged labour due to immature pelvis which may not accommodate the baby which result in neonatal sepsis (Tembo *et al.*, 2020).

Bech and colleagues (2022) reported an association between Neonatal resuscitation at birth and neonatal sepsis due to invasive procedures or exposure to healthcare associated pathogens. This is because resuscitation equipment may not be sterile and introduce pathogens into the neonate. On the other hand, the health care worker handling the neonate can also introduce infections to the neonate when hand hygiene is not practiced (Mutai *et al.*, 2021). In Zambia, birth asphyxia is also common therefore some babies require resuscitation immediately after birth. A study conducted by Zulu *et al.*, 2023 at the University teaching hospital showed that 38% of babies in their study had birth asphyxia.

Additionally, preterm birth have been found to be associated with neonatal infections due to immaturity of their immune system (Curnutt, 2023). This is in line with a study by Odabasi and Bulbul, (2020) that showed that similar findings. In addition, low levels of transplacental maternal IgG levels in preterm babies are among the risk factors (Odabasi and Bulbul, 2020). Prematurity, could be a contributing factor to neonatal

sepsis in Zambia. This fact can be attested by a study conducted in 2018 at Women and newborn hospital in Lusaka where the prevalence of preterm birth was estimated at 13 percent and 77, 600 preterm babies were born. Out of these, 6800 babies died due to complications of prematurity and sepsis (Ministry of Health 2017). Preterm babies also have an immature gastrointestinal system which puts them at risk of necrotising enterocolitis (Embleton *et al.*, 2023). The bacteria can translocate from the intestines to the blood stream hence increasing the risk of sepsis.

## CONCLUSION

Neonatal sepsis remains a major public challenge in Zambia with various maternal, intrapartum, neonatal, socio-economic and healthcare system factors contributing to its occurrence. Addressing these risk factors through targeted interventions is crucial for reducing the burden of neonatal sepsis and improving neonatal health outcomes in Zambia. Collaboration between policy makers, healthcare providers, communities and other stakeholders is essential for implementing effective prevention and management strategies.

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**Cite This Article:** Catherine Mubita Ngoma (2024). Neonatal Sepsis Risk Factors in Zambia: A Review. *EAS J Nurs Midwifery*, 6(5), 170-173.

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