PREVALENCE OF HYPOTHERMIA AND ASSOCIATED FACTORS AMONG NEONATES ADMITTED TO SPECIAL CARE NURSERY AT RALEIGH FITKIN MEMORIAL HOSPITAL, MANZINI, ESWATINI

By

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Copyright Declaration

Declaration

I, **Ncanele Nokukhanya Mabuza,** solemnly affirm that I have independently completed this dissertation, acknowledging and appropriately referencing all sources cited herein. Furthermore, I confirm that this dissertation has not been previously submitted for any other academic qualifications, either at this institution or elsewhere. In the development of this proposal, I adhered to the guidelines outlined for Master of Science in nursing degree research projects as prescribed by the University of Zambia.

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(Candidate)

Abstract

Neonatal hypothermia is an abnormal thermal state in which the neonate's body temperature is less than 36.5 ˚ C. It remains a critical concern particularly in resource limited settings, contributing significantly to neonatal morbidity and mortality. While neonatal hypothermia is well documented globally, there is inadequate local data on its prevalence and contributing factors in Eswatini's healthcare settings. This gap in knowledge limits targeted interventions for addressing hypothermia in the region. This study aimed to assess the prevalence of neonatal hypothermia and its associated factors among neonates admitted to the Special Care Nursery (SCN) of Raleigh Fitkin Memorial Hospital (RFMH) in Eswatini. A descriptive cross sectional study was conducted with 274 participants, consisting of 137 neonates and 137 mothers, admitted to the Special Care Nursery (SCN). Data were collected using a structured questionnaire and checklist, as well as through the medical records of the neonates. The body temperatures of the neonates were measured on admission and 24 hours post-admission. Data analysis was performed using SPSS version 26. Chi-square tests were applied to assess associations between categorical variables and hypothermia, with Fisher's exact test used where necessary. Binary logistic regression analysis was used to identify independent variables significantly associated with neonatal hypothermia. The prevalence of neonatal hypothermia among the study participants was 69.3%. The analysis revealed several significant associations. Premature infants (28 – <37 weeks gestation) were more likely to be hypothermic compared to full-term infants (≥37 weeks gestation) (AOR = 3.34, p = 0.014). Additionally, delayed initiation of breastfeeding (beyond the first hour post-delivery) was strongly associated with increased likelihood of hypothermia (AOR = 0.203, p < 0.001). Neonates not born at RFMH also had a higher risk of hypothermia (AOR = 0.096, p = 0.025), as did those with low Apgar scores (<7) (AOR = 0.222, p = 0.017). The study found a high prevalence of neonatal hypothermia (69.3%) in the SCN of Raleigh Fitkin Memorial Hospital, with key factors including prematurity, delayed breastfeeding initiation, low Apgar scores, and environmental influences. These findings emphasize the need for targeted interventions, such as improved thermal protection, timely breastfeeding, enhanced neonatal care protocols and contributes to the limited local data on hypothermia, informing health policy and efforts to reduce neonatal mortality in Eswatini.

Key words: *Prevalence, Neonatal hypothermia, associated factor*

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List of Abbreviations

APGAR	Appearance, pulse, grimace, activity, respiration
ELBW	Extremely low birth weight
NICU	Neonatal intensive care unit
RFMH	Raleigh Fitkin Memorial Hospital
VLBW	Very low birth weight
WHO	World health organization
SCN	Special care nursery

CHAPTER ONE

1.0 Introduction

Neonatal hypothermia remains a significant challenge in global healthcare, particularly in low- and middle-income settings, where it is closely linked to increased neonatal morbidity and mortality (Laptook et al., 2018; Thayyil et al., 2021). While neonatal hypothermia is a well-documented condition globally, there is inadequate data on its specific prevalence and contributing factors within the context of Eswatini. This limitation in available research impedes the development of localized, evidence-based strategies to address hypothermia and its associated risks, hindering the implementation of effective interventions (Demtse et al., 2020; Ibrahim et al., 2021).

This study aims to fill this gap by assessing the prevalence of neonatal hypothermia and identifying the neonatal, environmental, and immediate care related factors associated with hypothermia among neonates admitted to the Special Care Nursery (SCN) at Raleigh Fitkin Memorial Hospital (RFMH) in Eswatini. Through this investigation, the research seeks to provide a better understanding of the factors contributing to neonatal hypothermia in this specific healthcare setting, with the ultimate goal of enhancing care practices and improving neonatal health outcomes.

1.1 Background

Neonatal hypothermia, defined as a body temperature of less than 36.5°C in a newborn, is a significant public health challenge with critical implications for neonatal health outcomes (Dubos et al., 2021). This condition is particularly concerning in low- and middle-income countries (LMICs), where it is a key contributor to neonatal morbidity and mortality. Hypothermia in neonates has been linked to a range of adverse clinical outcomes, including increased risk of infections, respiratory distress, hypoglycaemia, and intraventricular haemorrhage, all of which contribute to poor neonatal survival rates (McCall et al., 2018; Demissie et al., 2018). While neonatal hypothermia itself is rarely a direct cause of death, studies have shown that its presence significantly exacerbates the risk of mortality. Recent evidence suggests that for every 1°C drop in body temperature, the likelihood of mortality increases by as much as 80% (Lee et al., 2019), underscoring the gravity of the condition.

Globally, neonatal hypothermia is prevalent across both high-income and low-income settings, though the rates are disproportionately higher in countries with limited resources and inadequate healthcare infrastructure (Laptook et al., 2018; Thayyil et al., 2021). Studies conducted in different regions of the world have shown a wide variation in the prevalence of neonatal hypothermia, with reports ranging from as low as 11% to as high as 92% in some areas (Brambilla Pisoni et al., 2022; Yitayew et al., 2020). In sub-Saharan Africa, the burden of neonatal hypothermia is particularly alarming, with several studies indicating that it remains one of the leading causes of neonatal morbidity and mortality (Billner-Garcia, Spilker, & Goyal, 2018). The high prevalence of neonatal hypothermia in sub-Saharan Africa can be attributed to several factors, including inadequate access to skilled care at birth, poor infrastructure, and a lack of proper thermal protection measures for neonates, particularly in the first few hours of life (Lyu et al., 2015).

Prevention of neonatal hypothermia has the potential to significantly reduce neonatal mortality and morbidity. Evidence-based analyses indicate that improving thermal care during the first hours of life can reduce the incidence of hypothermia by up to 42%, directly lowering the risk of neonatal mortality (Brambilla Pisoni et al., 2022). In addition to temperature regulation, several clinical outcomes, such as late-onset sepsis, respiratory difficulties, and metabolic instability, are directly associated with hypothermia, further complicating neonatal care and increasing the likelihood of long-term health issues (Perlman & Kjaer, 2016).

The vulnerability of neonates to hypothermia stems from a combination of physiological and environmental factors. Neonates have a relatively high surface area to body mass ratio, which increases their susceptibility to heat loss. Their thinner skin, underdeveloped metabolic systems, and low subcutaneous fat make it difficult for them to conserve heat effectively (Bindu & Bindra, 2021). Moreover, factors such as prematurity, low birth weight, and resuscitation at birth are known to increase the risk of hypothermia due to the additional physiological stress placed on the neonate (Adhikari, 2020; Elbaum et al., 2021). External factors, including inadequate care during the perinatal period, environmental conditions such as cold ambient temperatures, and delayed initiation of breastfeeding, further exacerbate the risk of hypothermia in neonates (Merazzi et al., 2020; Nebiyu et al., 2021).

In the context of healthcare settings in LMICs, including sub-Saharan Africa, socio-economic factors such as low maternal education, poor access to healthcare, inadequate prenatal care, and financial constraints contribute to the persistence of neonatal hypothermia (Seifu et al.,

2021). For instance, neonates born in rural or under-resourced areas may lack the thermal protection needed immediately after birth due to insufficient healthcare infrastructure or delayed access to neonatal care (Techane et al., 2022). Additionally, health workers may lack the training or resources to implement effective thermal care practices, such as skin-to-skin contact or timely initiation of breastfeeding, which are critical in the prevention of hypothermia (Seifu et al., 2021).

While the global literature on neonatal hypothermia is extensive, there is a notable limitation of data regarding the prevalence and contributing factors in specific regions, particularly in Eswatini. Existing studies on neonatal health in Eswatini and other parts of Southern Africa have identified neonatal hypothermia as an emerging concern, but detailed investigations on its prevalence and the factors that influence it are limited (Billner-Garcia et al., 2018). This insufficiency of localized data is particularly concerning given the country's reliance on general guidelines and non-context-specific interventions. Without targeted research, the development of effective and culturally appropriate interventions remains elusive, impeding efforts to reduce neonatal mortality and improve neonatal care.

In light of these challenges, this study aims to assess the prevalence of neonatal hypothermia among neonates admitted to the Special Care Nursery (SCN) at Raleigh Fitkin Memorial Hospital (RFMH) in Eswatini and to identify the neonatal, environmental, and immediate care-related factors that contribute to its occurrence. By investigating the specific context of neonatal hypothermia in Eswatini, this research will contribute to the limited body of local data, providing insights that can inform healthcare practices and policy decisions aimed at reducing the burden of neonatal hypothermia in the country. Ultimately, this study hopes to serve as a foundational step towards the development of targeted interventions and improvements in neonatal care in Eswatini, addressing a key factor in the country's ongoing efforts to reduce neonatal mortality and improve overall health outcomes for newborns.

1.2 Statement of the Problem

Neonatal hypothermia remains a critical health challenge worldwide, particularly in low- and middle-income countries, where it is a major contributor to neonatal morbidity and mortality (Ibrahim et al., 2021; Phoya et al., 2020). Despite the establishment of the WHO-recommended thermal protection guidelines in 1994, which aim to prevent neonatal hypothermia, the implementation of these guidelines remains inconsistent in many resource-limited settings,

particularly in Sub-Saharan Africa (Getaneh et al., 2022; Nebiyu et al., 2021). In these regions, the prevalence of neonatal hypothermia varies significantly, ranging from 32% to 85% among hospital-born infants and from 11% to 92% in home deliveries (Brambilla Pisoni et al., 2022).

While there is a lack of empirical data on the specific prevalence of neonatal hypothermia in Eswatini, available reports suggest that the quality of nursing care, particularly in neonatal thermal management, may be suboptimal. At Raleigh Fitkin Memorial Hospital (RFMH), a key healthcare facility in Eswatini, there are significant gaps in the application of the WHO-recommended thermal care guidelines. Specifically, the assessment of axillary temperature during neonatal admission is often not performed, and the frequency of body temperature monitoring is insufficient, occurring only every 12 hours instead of the recommended four-hourly intervals. Furthermore, the hospital's neonatal care infrastructure is inadequate, with only one incubator and three radiant warmers to serve a substantial number of neonates, many of whom are premature or critically ill. This inadequate thermal support system increases the vulnerability of neonates to hypothermia, which can lead to poor weight gain, further medical complications, and, in some cases, neonatal death.

According to data from the Raleigh Fitkin Memorial Hospital Information System (RFMHIS), the hospital experiences an average of 665 neonatal admissions annually, with a neonatal mortality rate of 16%. Major causes of neonatal mortality include prematurity, birth asphyxia, and infection, which are conditions that are frequently exacerbated by neonatal hypothermia (RFMHIS, 2023; Bayih et al., 2019; Phoya et al., 2020). Despite this high mortality rate and the known relationship between hypothermia and these major causes of death, there is currently limited published local data on the prevalence of neonatal hypothermia in Eswatini. The insufficiency of robust, localized evidence on the prevalence and contributing factors of neonatal hypothermia further compounds the challenge of improving neonatal care in the country.

Given the significant gaps in both nursing practices and neonatal care infrastructure, this study seeks to examine the quality of neonatal thermal care provided at RFMH and its potential role in the high rates of neonatal hypothermia.

1.3. Justification of the Study

Neonatal hypothermia is a significant and persistent issue in neonatal care, particularly in low-resource settings such as Eswatini, where it is often under recognized and poorly managed, especially in the Special Care Nursery (SCN). Despite its well-documented impact on neonatal morbidity and mortality, the prevalence and contributing factors of neonatal hypothermia in Eswatini remain inadequately understood. This lack of data impedes the development of effective, evidence-based interventions to address the condition, which is crucial for improving neonatal health outcomes.

This study was undertaken to fill this critical gap by assessing the prevalence of neonatal hypothermia and identifying the factors associated with its occurrence among neonates admitted to the SCN at Raleigh Fitkin Memorial Hospital (RFMH). By understanding the specific factors contributing to neonatal hypothermia in this context, the research will provide important insights into how the quality of neonatal care can be improved, particularly in terms of thermal protection and early care practices.

The findings from this study are particularly significant for program managers, healthcare providers, and policymakers, as they will contribute to the design and implementation of targeted interventions aimed at reducing the burden of neonatal hypothermia. By addressing the factors contributing to hypothermia, such interventions can directly contribute to achieving Sustainable Development Goal (SDG) 3, which seeks to improve maternal and child health globally. Furthermore, this study's results will inform healthcare strategies and practices not only in Eswatini but also in similar settings with limited resources, providing valuable lessons that can be applied to enhance the quality of newborn care in those environments.

Additionally, the study will offer evidence that can be used to improve the training of healthcare professionals, particularly in the areas of thermal protection and neonatal care. It will also highlight the need for better infrastructure and more effective care protocols within neonatal units, helping to ensure that healthcare workers are equipped with the knowledge and tools to properly manage neonatal hypothermia. Ultimately, the study aims to contribute to a broader understanding of neonatal hypothermia, guiding future research and policy decisions aimed at improving neonatal survival rates and reducing preventable mortality.

1.4. Research Question

What is the prevalence of neonatal hypothermia and associated factors among neonates admitted to the SCN of RFMH in Eswatini?

1.5. Research Objectives

1.5.1 General Objective

To assess the prevalence of neonatal hypothermia and associated factors among neonates admitted to the SCN of RFMH.

1.5.2 Specific Objectives

1. To determine the prevalence of neonatal hypothermia among neonates admitted to the SCN.
2. To identify the neonatal physiological factors associated with hypothermia among neonates admitted to the SCN.
3. To identify the environmental factors associated with hypothermia among neonates admitted to the SCN.
4. To identify behavioral factors associated with hypothermia.

1.6. Conceptual Framework

The conceptual framework that was used in this study is adapted from the Mosley and Chen model that was developed in 1984 (Mosley & Chen, 1984). The Mosley and Chen model was originally developed to study factors affecting child mortality. It proposes that the child's survival probability in any society is due to the operation of social, economic, biological, and environmental forces. Mosley and Chen grouped the proximate factors into five categories, namely: maternal factors (mother's age, parity), environmental contamination (routes of infection) nutrient deficiency, injury and personal illness control. This model is suitable as this study aims to assess the association between neonatal hypothermia and neonatal physiological, behavioral and environmental factors.

1.6.1. Application of the Mosley and Chen Model to the Study

The study adapted the Mosley and Chen model to examine factors associated with neonatal hypothermia rather than child mortality. The study conceptual framework is such that socio-economic factors (mother's age, income, educational level) and obstetric factors are proposed to indirectly affect neonatal hypothermia as they contribute to neonatal factors, while neonatal physiological factors contribute to neonatal hypothermia directly. Injury and personal illness control was modified to neonatal physiological factors. Their immature hypothalamic thermal control, insufficient neural mechanisms for temperature control by shivering, low glycogen stores and adipose tissue causes them to have a decreased ability to regulate their body temperature, by producing heat through non-shivering thermogenesis.

Environmental contamination has been modified to environmental factors. This will include factors such as place of birth (home, theatre or labour ward), time of birth (day or night), and delivery room temperature that can affect a neonate’s risk of hypothermia. This study added behavioural factors to the model. The chances of hypothermia are higher among neonates with delayed initiation of breastfeeding as compared to those who started breastfeeding within 1 hour after birth. This might be due to the reason that breast milk is the source of energy or calories to produce heat for thermoregulation also skin-to-skin contact is an external heat source for the baby during breastfeeding.

1.6.2. Conceptual framework of the determinants of neonatal hypothermia

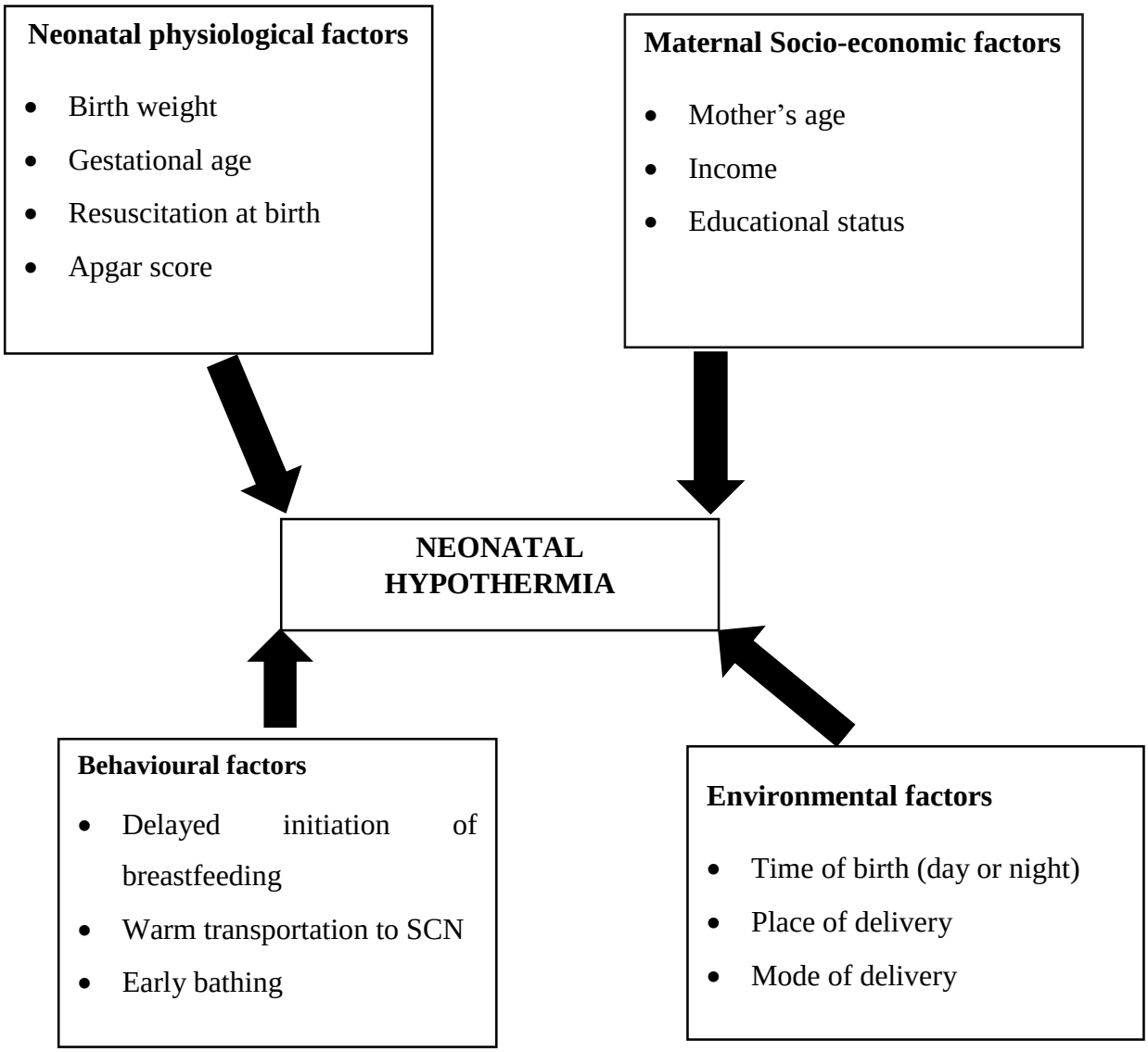


Figure 1.1: Conceptual framework on Neonatal hypothermia and associated factors adapted and modified from (Mosley and Chen, 1984).

1.7. Study Variables

1.7.1. Dependent Variable

Neonatal hypothermia

1.7.2. Independent variables

1. Neonatal physiological factors:

1.1. Birth weight
1.2. Age at admission
1.3. Gestational age at delivery
1.4. Apgar score

2. Behavioural factors:

2.1. Delayed initiation of breastfeeding
2.2. Warm transportation
2.3. Early bathing
2.4. Use of hats and socks

3. Environmental factors:

3.1 Mode of delivery
3.2. Time of delivery (daytime vs. night time)
3.3. Place of delivery

1.7.3. Variables and cut-off points

Table 1.1 Variables and cut off points

Variables	**Variable type**	**Indicators**	**Cut off points**
Dependent variable Neonatal hypothermia	Nominal	Yes No	Body temperature < 36.5˚C Body temperature ≥ 36.5˚C
Independent variables			
Birth weight	Ordinal	Normal Low Very low Extremely low	Weight at birth 2500g and above Weight at birth between 1500g – 2499g Weight at birth between 1499g – 1000g Weight at birth less than 1000g
Gestational age	Nominal	Term Preterm	≥ 37 weeks 28 to < 37 weeks
Resuscitation at birth	Nominal	Yes No	Assisted to breathe at birth Spontaneous breathing at birth
Warm transportation to SCN	Nominal	Yes No	Transported in incubator or skin – skin Not transported in incubator or skin to skin
Place of delivery	Nominal	Within RFMH Outside RFMH	Neonates born at RFM hospital Neonates not born at RFM hospital (born at home, or facilities).
Delayed breastfeeding	Nominal	Yes No	Breastfed after the first hour of life Breastfed during the first hour of life
Early bathing	Nominal	Yes No	Bathe neonate within 24 hours Delayed bathing for 24 hours

1.8. Conceptual Definitions

Neonate: an infant that is less than four weeks old (Oxford English dictionary, 2022).

Hypothermia: a serious medical condition in which a person's body temperature is below the usual level as a result of being in severe cold for a long time (Cambridge English dictionary, 2022).

Preterm: babies born alive before 37 weeks of pregnancy are completed (WHO, 2022).

Birth weight: the weight of a baby or young animal at birth (Oxford English dictionary, 2022).

Gestational age: the length of pregnancy after the first day of the last menstrual period and usually expressed in weeks and days (Mongelli, 2021).

1.9. Operational Definitions

Neonatal hypothermia: This will mean an infant with the body temperature of below 36.5°C

Neonate: This will imply a baby less than four weeks' old

Preterm neonate: refers to neonates that are born alive at 28 weeks' gestation and before 37 weeks gestation.

Birth weight: refers to the weight of the neonate at birth, categorized as normal, low, very low and extremely low.

Delayed initiation of breastfeeding: refers to when the newborn begins breastfeeding after the first hour of birth.

Gestational age: refers to the length of the pregnancy after the first day of the last menstrual period in weeks.

Resuscitation at birth: refers to emergency care that was given to help a neonate that is not breathing or who is making a lot of effort with their breathing.

Warm transportation to SCN: refers to a newborn that was transported from delivery unit to the SCN in pre-warmed infant incubator or in skin- to- skin contact with the mother.

CHAPTER TWO

LITERATURE REVIEW

2.0. Introduction

This chapter provides a comprehensive review of the literature on the prevalence and associated factors of neonatal hypothermia, focusing on global, regional, and local studies. The literature was systematically reviewed to assess existing knowledge and identify key themes in neonatal hypothermia research. Sources such as books, peer-reviewed journals, and published dissertations were consulted through electronic databases, including PubMed and Google Scholar. The review follows a structured approach, first exploring the prevalence of neonatal hypothermia in different settings and then examining the various factors contributing to its occurrence. It critically analyses the methodologies, findings, and conclusions of existing research to identify patterns, inconsistencies, and gaps in the literature. By synthesizing the available evidence, the chapter provides a clear overview of the current state of knowledge on neonatal hypothermia and highlights areas where further research is needed.

2.1. Overview of Neonatal hypothermia

Neonatal hypothermia is defined as a core body temperature below 36.5°C (Dubos et al., 2021). Despite being a global public health issue, its prevalence is particularly high in regions with high neonatal mortality rates, especially in low- and middle-income countries (Brambilla Pisoni et al., 2022). Neonatal hypothermia is typically classified into three categories based on the degree of temperature drop: mild hypothermia (36.0°C to 36.4°C), moderate hypothermia (32.0°C to 35.9°C), and severe hypothermia (<32.0°C) (Demtse et al., 2020; Kardum et al., 2022).

The first minutes of life are critical, as neonates are highly vulnerable to temperature loss due to their high body surface area-to-weight ratio and insufficient thermoregulation mechanisms (Farhadi, Rezai, & Nakhshab, 2014). Without immediate action, neonates can experience rapid temperature drops, leading to increased metabolic demands, higher susceptibility to infections like sepsis, and a range of adverse outcomes, including respiratory distress syndrome, asphyxia, and even death (Demtse et al., 2020; McCall et al., 2018). Prompt and effective rewarming

strategies after birth are critical to mitigating these risks (Dubbink-Verheij et al., 2021; Tessema et al., 2022).

Although substantial research has explored the causes of neonatal hypothermia, studies in Eswatini remain scarce, with limited published evidence on its prevalence and associated factors in the Neonatal Intensive Care Unit (NICU). This study seeks to address this gap by providing localized data that could inform policy and improve thermal care practices in Eswatini.

2.2. Prevalence of Neonatal Hypothermia

Hypothermia is one of the important causes of neonatal death and morbidity in developing countries, which increases mortality by five times, and recent studies showed that every 1 °c decrement in body temperature increases mortality by 80% (Onalo, 2013). Several studies have been conducted across the world to synthesize data on the prevalence of neonatal hypothermia, but globally representative prevalence estimates are still scarce. For instance, in a cohort study from Europe, the prevalence of hypothermia among very preterm infants was 53% (Wilson et al., 2016). A prospective cohort study of 1764 inborn neonates of 22 to 33 weeks in Brazil found that hypothermia at 5 minutes after birth and NICU admission was 44% and 51%, respectively. Hypothermia at NICU admission increased the chance of early neonatal death (de Almeida et al., 2014). However, this is lower than was reported in a recent retrospective cross-sectional study on 154 premature newborns admitted between 2017 and 2019 in NICU in Brazil which found that prevalence of hypothermia was 68.2% (Carvalho et al., 2023).

In sub-Saharan Africa, several studies have been conducted, for instance, an institutional based cross-sectional study in Addis Ababa, Ethiopia found that the prevalence of neonatal hypothermia was 64% (Demissie et al., 2018) which was almost similar to what was reported from the recent cross-sectional study conducted at Harar city in the eastern part of Ethiopia where the prevalence of neonatal hypothermia was 66.3% (Bayih et al., 2019). The prevalence in sub-Saharan Africa, where neonatal mortality rates are high, underscores the urgent need for improved thermal care interventions to address hypothermia. A prospective cross-sectional study in Kenya revealed that the prevalence of admission hypothermia was 73.7% among the neonates out of which 13% died on the first day of admission. Low adherence to the WHO thermal care guidelines was also noted (Nyandiko, Kiptoon, & Lubuya, 2021). These findings

underscore the importance of thermal care practices in preventing and managing neonatal hypothermia especially among low-birth-weight neonates.

In a cross-sectional study conducted in Ghana, hypothermia was observed in 85.8% of infants admitted to the NICU (Pellegrino et al., 2023) which was identical to a community-based cross-sectional study in Zimbabwe (85%) (Lunze et al., 2013) but much higher than what was found in Uganda 51.0% (Mukunya et al., 2021). However, this was also much higher than what was reported in a recent cross-sectional study carried out in Tanzania where neonate hypothermia was found to be 25.6% (Akida et al., 2022). In a retrospective chart review of VLBWI admitted to the neonatal unit in South Africa, the prevalence of admission hypothermia was 46.1% and 38% of neonates developed hypothermia within 24-hours of admission. Hypothermia was also found to be associated with poor outcomes such as metabolic acidosis and death within the first week of life (Ng'eny & Velaphi, 2020). This prevalence was almost similar to another cross-sectional study in South Africa where the prevalence of admission hypothermia was 42% among neonates (Patel et al., 2022). These figures highlight significant disparities in neonatal thermal care practices across regions. Despite, neonatal hypothermia being a major condition of public health importance in Eswatini, there is limited published evidence on the prevalence of hypothermia among neonates admitted to the NICU.

2.3. Factors Associated with Hypothermia

Numerous studies have identified a wide range of factors contributing to neonatal hypothermia, which can be broadly categorized into neonatal physiological, behavioural, and environmental factors. The influence of these factors varies across different settings, often shaped by local healthcare systems, cultural practices, and environmental conditions. The synthesis of these findings suggests that while the specific factors may differ, certain common themes emerge.

2.3.1. Neonatal Physiological Factors

Physiological and clinical characteristics of neonates including gestational age, birth weight, Apgar scores, and the presence of birth complications are consistently reported as key determinants of neonatal hypothermia (Demtse et al., 2020; Lee et al., 2019). These factors affect a newborn's thermoregulatory capacity due to anatomical and metabolic vulnerabilities. Neonates, especially those born preterm or with low birth weight, have thin skin, limited

subcutaneous fat, and an increased surface area-to-body mass ratio, all of which predispose them to rapid heat loss (Lissauer et al., 2020; Laptook, 2024).

A retrospective case-control study in the USA found significant associations between neonatal hypothermia and birth weight, gestational age, and Apgar scores (Elbaum et al., 2021). Similarly, a large multicentre study in China among very low birth weight infants showed that small-for-gestational-age status, low Apgar score at five minutes, and delivery room intubation significantly increased the risk of hypothermia, which was in turn associated with severe neonatal complications such as respiratory distress syndrome, intraventricular hemorrhage, and late-onset sepsis (Yu et al., 2020). Such findings emphasize that early thermal instability may both reflect and exacerbate systemic vulnerability in neonates.

In a retrospective chart review from Canada, prematurity, low 5-minute Apgar score (<7), need for resuscitation, and maternal hypertension were significantly associated with hypothermia within six hours of life (Nguyen et al., 2022a). These factors reflect a high-risk clinical profile in which impaired thermogenesis is either a direct consequence of compromised neonatal physiology or an indirect result of necessary medical interventions.

Low birth weight remains one of the most frequently reported predictors of hypothermia. In a cross-sectional study in Nepal, low birth weight neonates were significantly more likely to be hypothermic (Adhikari et al., 2020). This was supported by Seifu et al. (2021), who reported that neonates weighing less than 2,500g were 2.6 times more likely to experience hypothermia than those of normal weight. However, some studies, such as Shrestha (2019), found no significant association, suggesting the relationship may vary depending on postnatal care quality and environmental conditions.

In Ghana, Pellegrino et al. (2022) found a strong association between hypothermia and very low birth weight and extremely preterm infants. The study also highlighted that multiple births and lower gestational age were additional contributors to hypothermia risk. These findings were echoed in a study by Abdul-Mumin et al. (2024), which reported a high prevalence of hypothermia among neonates admitted to the NICU, particularly those with lower gestational age and illness at presentation. A significant correlation also exists between neonatal hypothermia and perinatal complications. Neonates with low Apgar scores or those requiring resuscitation at birth were significantly more prone to hypothermia, as found in studies from

Nepal and Ethiopia (Adhikari et al., 2020; Beletew et al., 2020). Such conditions compromise oxygenation and metabolic function, impairing the neonate's ability to generate heat.

Beletew et al. (2020) also noted that comorbidities such as asphyxia, jaundice, respiratory distress, and congenital anomalies greatly increased the risk of hypothermia, with odds ratios ranging from 2.28 to 4.24. This finding aligns with the understanding that neonates with clinical illness are not only more susceptible to hypothermia but also more likely to suffer severe outcomes when hypothermia occurs. Similarly, Laptook (2024) argues that despite longstanding evidence of these associations, thermoregulation remains underemphasized in neonatal care protocols, especially for at-risk infants.

Neonatal physiological factors such as low birth weight, prematurity, low Apgar scores, resuscitation, and concurrent illnesses are closely linked to the risk of hypothermia. These factors reflect both intrinsic vulnerability and extrinsic clinical stressors, underscoring the need for vigilant thermal care particularly for high-risk neonates. Prevention of hypothermia in these infants should be integrated into routine care, especially during the first critical hours of life (Abdul-Mumin et al., 2024; Laptook, 2024).

2.3.2. Behavioural Factors

Behavioural practices including early breastfeeding, skin-to-skin contact, appropriate clothing (such as caps and socks), delayed bathing, and mode of delivery, play a pivotal role in the prevention of neonatal hypothermia. Evidence consistently supports these as critical determinants, though some inconsistencies highlight the influence of context-specific healthcare practices (Pellegrino et al., 2023; Srivastava et al., 2014; Adhikari et al., 2020; Nyandiko et al., 2021).

Early initiation of breastfeeding particularly within the first hour postpartum has been repeatedly shown to reduce the risk of hypothermia. This protective effect is believed to stem from both the caloric energy breast milk provides and the thermoregulatory benefit of maternal body contact during feeding (Moore et al., 2016; Nimbalkar et al., 2014). Studies in Ethiopia and elsewhere have identified delayed initiation of breastfeeding as an independent risk factor for neonatal hypothermia (Shibesh et al., 2022; Tasew et al., 2018). However, some findings dispute this association, suggesting possible modulation by factors such as maternal health status or timing of delivery interventions (Adhikari et al., 2020).

Skin-to-skin contact immediately after birth is a cornerstone of neonatal thermal care, helping to reduce heat loss through conduction and convection. Lack of this practice has been strongly associated with increased hypothermia risk (Akida et al., 2022; Pellegrino et al., 2023). The warm chain, an integrated strategy including skin-to-skin contact, immediate drying and wrapping, delayed bathing, and warm transport was found to be inconsistently applied in studies from Kenya and Ethiopia, leading to significantly higher hypothermia rates (Nyandiko et al., 2021; Getaneh et al., 2022).

The timing of newborn bathing also significantly influences thermoregulation. Delayed bathing has been consistently recommended to prevent cold stress, as neonates lose heat through evaporation and are temporarily separated from maternal warmth (Warren et al., 2020; Trevisanuto et al., 2018). Early bathing within 24 hours of delivery has been identified as a significant risk factor for hypothermia in multiple studies (Nebiyu et al., 2021; Tasew et al., 2018), though one Kenyan study found no significant association, suggesting that environmental and procedural factors may play moderating roles (Nyandiko et al., 2021).

Proper newborn clothing, particularly the use of caps and socks, is vital in mitigating heat loss, especially considering the large surface area of the neonatal head. Studies from Ethiopia revealed that newborns not wearing caps were twice as likely to develop hypothermia due to substantial heat loss from the uncovered scalp (Bayih et al., 2019). Inadequate clothing and transportation without warming measures were also associated with increased hypothermia risk in similar settings.

Weighing of neonates immediately after birth without thermal precautions has also emerged as a less recognized but important factor. The practice of weighing infants while naked, often on cold surfaces, was shown to increase hypothermia incidence, underscoring the need to warm equipment and cover neonates appropriately during assessments (Akida et al., 2022; Getaneh et al., 2022).

Finally, broader socioeconomic and systemic determinants cannot be ignored. Studies from regions including Southern Nepal, Gondar, Addis Ababa, and Tigray highlight that home deliveries, poverty, and lack of maternal and provider education on thermal care exacerbate neonatal vulnerability to hypothermia (Demissie et al., 2018; Mullany et al., 2010; Tasew et al., 2018; Nyma et al., 2020). Moreover, Getaneh et al. (2022) found that hypothermic preterm

neonates had higher mortality rates, further emphasizing the life-threatening consequences of suboptimal thermal care practices.

2.3.3. Environmental Factors

Environmental factors such as room temperature, ambient temperature, and time of delivery (daytime vs. nighttime) have been found to predispose the preterm infant to hypothermia (Lai et al., 2019; Manani et al., 2013; Reuter, Messier, & Stevens, 2014). For instance a recent systematic review and meta-analysis study demonstrated that a room temperature of 23 °C compared to 20 °C improved normothermia and body temperature, and decreased moderate hypothermia (Ramaswamy et al., 2022). Similarly, a single-center randomized trial conducted in Dallas, in the USA whose aim was to examine the impact of ambient operating room temperature on neonatal and maternal outcomes (comprising 410 infants in the 20°C standard management group and 399 in the 23°C study group) showed that when the ambient operating room temperature was increased the rate of neonatal hypothermia as well as moderate to severe hypothermia was significantly lower (Duryea et al., 2016). This suggests that a room temperature of 23 °C could reduce the rate of neonatal hypothermia among late preterm and term neonates.

Emerging evidence suggests that a relatively high ambient temperature in the delivery room may prevent hypothermia in preterm infants (Johannsen, Vochem, & Neuberger, 2017). The WHO has recommended that delivery or resuscitation room temperatures be set at a minimum of 25 °C, with a suggested range of 25-28 °C. However, many healthcare facilities, especially in low-income countries, still fall short of this target due to infrastructural limitations or lack of standardized thermal care practices (Pinheiro et al., 2014; Trevisanuto et al., 2018).

A case control study in Ethiopia at Oromia, noted that delivery at night was significantly associated with hypothermia and that newborns who were delivered during nighttime were about seven times more likely to develop hypothermia as compared to those who were delivered during the daytime (Seyum & Ebrahim, 2015). Similar findings were observed in Northeast Ethiopia that observed that neonates that were delivered at night time were 2 times more likely to develop hypothermia than neonates delivered in day time (Yitayew et al., 2020). This is supported by research from Ethiopia and Uganda (Byaruhanga, Bergstrom, & Okong, 2005; Tasew et al., 2018). This is thought to be due to the room temperature being low during nighttime when compared to the daytime. Other research studies have suggested that this could

be due to work overload during the night, as the number of staff working in the labour room at night is not equivalent to the number of staff working during the day (Girma et al., 2021). These results call for improved thermal care of preterm neonates and neonates delivered at night time. Environmental factors like night-time delivery, home delivery and delivery during the cold months have been shown to increase the risk of neonatal hypothermia. According to a systematic review done in East Africa, a significant association between nighttime delivery and neonatal hypothermia was observed (Beletew et al., 2019). Home delivery has also been associated with an increased risk of neonatal hypothermia in Uganda (Mukunya et al., 2021). Mukunya et al., 2021 further stated that mothers who gave birth at home were more likely to practice suboptimal thermal care practices which could lead to hypothermia.

Ahmed (2022) further contributes to this evidence by showing that neonates delivered via caesarean section, particularly during nighttime, are at increased risk for hypothermia in South African tertiary settings. Surgical delivery rooms are often colder due to infection control standards, exacerbating the risk in newborns who have not undergone the physiological warming process associated with vaginal delivery.

A retrospective cross-sectional study in Nigeria aimed at identifying the risk factors of hypothermia on admission found that being admitted during the cold months increased the odds of admission hypothermia by 85% (Diala et al., 2022). Ensuring that delivery rooms and neonatal units have optimum temperatures, especially during cold months decreases the risk for neonatal hypothermia. Other recent studies have highlighted that seasonality contributes significantly to the wide variability in the reported incidences of hypothermia even in tropical countries (Ukke & Diriba, 2019). It postulated that the cold season causes prolonged exposures to the cold temperatures during which the body begins to lose heat faster than it is produced which will eventually use up the body's stored energy, leading to hypothermia. As part of the intervention to prevent neonatal hypothermia, guidelines in temperate countries recommend that ambient temperature in delivery rooms be set at a lower threshold of 25°C (Pinheiro et al., 2014; Trevisanuto et al., 2018). The findings suggest that where there is no provision of added warmth during cold seasons, newborn infants are at risk of becoming hypothermic.

2.4. Conclusion

Neonatal hypothermia is a worldwide issue but is especially a common problem in developing nations. Literature indicates that Asia and sub-Saharan Africa have the highest rate of neonatal

hypothermia at the global level. Additionally, the prevalence of neonatal hypothermia and associated factors among neonates appears to vary across geographical settings. Neonatal hypothermia is mainly influenced by physiological, behavioural and environmental factors, although findings vary with the study setting. The literature findings, therefore, suggest a need to investigate these factors at Raleigh Fitkin Memorial Hospital because the effect of these factors on hypothermia appears to differ from study to study. Moreover, there is limited published evidence on the prevalence of neonatal hypothermia and the associated factors among newborns in Eswatini. This gap in the existing literature highlights the need for further research, which this study aims to address.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0. Introduction

This chapter outlines the research methodology used in the study, aimed at exploring the contributing factors of neonatal hypothermia at Raleigh Fitkin Memorial Hospital's Special Care Nursery (SCN) in Eswatini. The methodology describes the quantitative, prospective cohort design, which was chosen to assess the relationship between neonatal hypothermia and various factors such as gestational age, environmental conditions, and behavioural factors. The study was conducted with 274 participants, including 137 neonates and their mothers, using a combination of primary data collection through questionnaires and secondary data from medical records. Key data collection tools included a structured questionnaire and checklist to gather information on socio-demographics, obstetric history, and neonatal care. The chapter further details the sampling techniques, data analysis methods, and ethical considerations, ensuring transparency and the scientific rigor of the study.

3.1. Study Design

A quantitative, descriptive cross-sectional study design was used in this study. This design was chosen because it allows for the assessment of the prevalence of neonatal hypothermia and the identification of associated factors at a single point in time among neonates admitted to the Special Care Nursery (SCN) at Raleigh Fitkin Memorial Hospital. The cross-sectional approach is appropriate for describing the burden of hypothermia and its correlates without following participants over a period of time. Data were collected at two defined points, upon admission and 24 hours post-admission, but analysed as a snapshot of the status and factors related to hypothermia during the hospital stay, rather than tracking changes longitudinally. This design is particularly suited for informing immediate clinical practices and guiding interventions aimed at reducing neonatal hypothermia.

3.2. Study Setting

This study was conducted in the SCN at Raleigh Fitkin Memorial Hospital in Manzini, Eswatini. The hospital offers labour and delivery, tertiary level services and serves as a referral hospital for health care centers within the Manzini region. It has an average admission of 665

neonates per year and a total bed capacity of 22 neonates**,** divided into five specialized rooms. These rooms include a resuscitation room for critically ill neonates, a room for stable term neonates, a phototherapy room for neonates with neonatal jaundice, a room for stable preterm neonates, and a separate room for neonates admitted from the outpatient department.

3.3. Target Population

The target population included all neonates and their mothers at Raleigh Fitkin Memorial hospital during the study period.

3.3.1 Study Population

The study population consisted of neonates admitted to the Special Care Nursery (SCN) at Raleigh Fitkin Memorial Hospital and their mothers. Data were collected from the mothers using questionnaires, which gathered socio-demographic and obstetric information. Additionally, medical records of both the neonates and their mothers were utilized as secondary data sources.

3.4. Sample Size

A census sampling method was used to select participants. A total of 274 participants were included in the study, consisting of 137 neonates and 137 mothers. The decision to use census sampling ensured that all eligible neonates and their mothers were included in the study, thereby providing a comprehensive dataset for analysing the contributing factors to neonatal hypothermia.

3.4. Sample Selection

The census method of sampling was used for this study. The entire population of neonates and their mothers that were admitted at Raleigh Fitkin memorial hospital SCN were included in the study. The average number of neonates admitted in the SCN per month is 65. The census method was appropriate because of the small size of the population and it allowed the researcher to get more respondents compared to using other sampling methods as data was collected for a period of two months. To ensure the robustness and validity of our approach, we initially calculated the sample size. This calculation served several purposes: it allowed us to estimate the required resources, and offered a contingency plan in case of incomplete data

collection. By aligning our census method with a calculated sample size, we ensured that our findings are both comprehensive and statistically sound, addressing potential non-response biases and maintaining high confidence in our results (Groves & Couper, 2019; Lohr, 2019).

3.4.2. Inclusion Criteria

The study included all neonates and their mothers that were admitted to the SCN of Raleigh Fitkin Memorial Hospital and willing to participate in the study during the study period.

3.4.3. Exclusion Criteria

Neonates whose mothers have postpartum depression were excluded. Neonates with complications such as congenital malformations were also excluded from the study.

3.5.1. Data Collection Tool

The data collection tool consisted of both a questionnaire and a checklist. The questionnaire was adopted from the study by Girma et al. (2021) entitled “Hypothermia on admission to a neonatal intensive care unit in Oromia, western Ethiopia” and was used to collect information directly from the mothers. The questionnaire gathered socio-demographic details, obstetric history, and immediate newborn care factors related to neonatal care, such as bathing practices. The checklist was used to collect secondary data from the neonates' medical records. Both tools were designed to ensure comprehensive data collection regarding the neonates' and mothers' conditions. The axillary temperature of the neonates was measured at admission and 24 hours post-admission using a digital thermometer. The data collection phase of the study was extended over a period of two months.

3.5.2. Data Collection Techniques

Upon getting permission from all relevant authorities, data was collected from the study participants’ medical records and the mothers using face-to-face interviews. The researcher introduced herself and the topic under study. Instructions were read to the participant to ensure understanding and informed consent was obtained. The participants were informed that their participation is voluntary, that no names of any participant involved will be indicated on the data collection tools, and that information obtained is to be kept confidential throughout the research process. After all the explanations, permission to participate in the study was obtained by signing a consent form. The axillary temperature of newborns was measured using a digital

thermometer (model-MT-101 that has a measurement accuracy of ±0.1˚C for the temperature range of 35.5˚C – 42˚C and ±0.2℃ for temperature range of 32℃- 35.5℃ or above 42℃) on admission and at 24 hours post admission to the SCN. The thermometers were regularly calibrated to ensure accuracy of temperature measurements.

The data was collected by the researcher and student midwives working in the special care nursery. A one-day training was given on proper axillary temperature measurement techniques using the digital thermometer this will include ensuring they understand the correct placement and duration for accurate readings. The researcher engaged the participant in a face-to-face interview, in which questions from the questionnaire were read and the interviewee answered while the researcher recorded the responses in the answer spaces. Where necessary questions and answers were repeated for clarity and at the end of the interview the participant was thanked. To ensure privacy, data collection and entry were conducted in a private room. Each interview lasted an average of 10-15 minutes.

3.6. Validity and Reliability

3.6.1. Validity

To ensure construct and internal validity, an extensive literature review was conducted, which guided the designing of the data collection tool to ensure that only relevant questions about the study variables were included in the checklist. Adjusting for other variables during the analysis also ensured the validity of findings. The data collection tool was adopted from a study done in Ethiopia by Girma e t al., (2021) with a Cronbach's alpha of 0.73.

3.6.2. Reliability

To ensure the reliability of study findings, the data collection tool was pre-tested at Mbabane government hospital before the main study to ensure consistency in the results obtained. During the pretest, participants were asked if there were any questions they did not understand. This allowed for adjustments to the data collection tool to ensure the appropriateness of questions and practicality of the tool concerning the available data. To ensure the reliability of the research instrument the questionnaire was written in simple English and translated to Siswati to ensure that the participants understand the questions. In addition, the data collection tool was adopted and the tool's reliability was tested yielding a Cronbach's alpha of 0.73 (Girma et al.,

2021). In the present study, the reliability Cronbach alpha for neonatal physiological factors, environmental factors and behavioral factors was 0.980, 0.710 and 0.880, respectively. The overall Cronbach alpha of the tool was 0.856 indicating a high level of internal consistency.

3.7. Data Management and Storage

To ensure security, easy reference, and quick and efficient retrieval of data; the checklists is kept in a lockable trunk. To ensure the security of electronic data access controls were implemented on the computer and server storing the data. Privacy of the data collected was ensured by limiting the transfer to gadgets and only the researcher has access to the trunk and password to the software database. The computer is password protected and access is restricted to authorized personnel only. Regular antivirus scans and software updates will be conducted to mitigate potential security risks. After completion of the study, the data will be kept safely for a period stipulated by the University, and thereafter, incinerated.

3.8. Pre-test of the Data Collection Tool

A pilot study was conducted at Mbabane Government Hospital in Eswatini, which was chosen due to its similar services to the study setting. Fourteen participants, representing 10% of the total sample size, were selected for the pre-test. The purpose of the pilot study was to correct any potential errors within the data collection tool, ensure its validity, and assess the feasibility of the study. It also allowed for the refinement of the checklist to ensure alignment with the study's objectives. Minor adjustments were made to the wording of two questionnaire items to improve clarity and respondent understanding.

3.10. Ethical Consideration

Ethical clearance was sought from the University of Zambia Biomedical Research Ethics Committee (REF. NO. 4400-20230) and the Eswatini Health and Human Research Review Board (REF EHHRR 176/2023). Written permission to conduct the study was obtained from Raleigh Fitkin Memorial Hospital management. Before conducting the interview, an informed and voluntarily signed written consent (thumbprint for those unable to write) was obtained from all the eligible mothers of the newborns. The purpose, potential benefits, risks and option to withdraw without repercussion was explained to the mother before signing the consent to the study. No compensation was given to the nurse midwives who helped in monitoring the

neonate’s temperatures. A digital thermometer (model-MT-101) was used and it was disinfected with 70% ethyl alcohol disinfectant with a cotton wool after every measure of the axillary temperature of the newborn to prevent infection transmission. To ensure confidentiality the participant’s names was not used and all data obtained was stored in a secure place where no one except the researcher have access to them.

CHAPTER 4

PRESENTATION OF FINDINGS

4.0 Introduction

This chapter presents the findings of the study titled "Prevalence of Hypothermia and Associated Factors among Neonates Admitted to the Special Care Nursery (SCN) of the Raleigh Fitkin Memorial Hospital (RFMH)." A total of 274 participants, consisting of 137 mothers and 137 neonates, were included in the study. The chapter is organized into several sections, beginning with an analysis of the socio-demographic characteristics of the mothers and neonates. It then presents descriptive statistics related to neonatal physiological factors, environmental conditions, and the behavioural care practices in the SCN. Finally, the chapter identifies the key factors associated with hypothermia among the neonates admitted to the Special Care Unit.

The results aim to provide a comprehensive understanding of the prevalence of hypothermia in neonates, alongside an exploration of the contributing factors. By examining the various socio-demographic and clinical variables, as well as the care practices provided in the SCN, the findings will contribute to understanding the scope of this health challenge and inform potential interventions.

4.1 Data Analysis

All questionnaires were checked for completeness, consistency, and accuracy. The data was entered into Microsoft excel and then exported to SPSS version 26 for data analysis. Descriptive statistics were used to summarize the data. Subject characteristics were summarized using measures of central tendency, frequencies, depending on whether they are continuous or categorical. A Chi-square and fishers exact test were used to assess the association between categorical independent variables and hypothermia. Binary logistic regression was used to assess the association of independent variables with the outcome variable. Binary logistic regression helped identify the independent variables that have a significant association with hypothermia while adjusting for the effects of possible cofounders. All assumptions of logistic regression were checked. The Odds ratio (OR) with a 95% confidence interval was used as a measure of association, and variables with p-value < 0.05 in the logistic regression was used to identify variables with significant association.

4.2 Socio demographic Characteristics

Table 4.1 below displays the distribution of the participants' socio-demographic characteristics which were considered in the study. These include age, level of education, marital status, and religion, place of residence, monthly income and number of pregnancies.

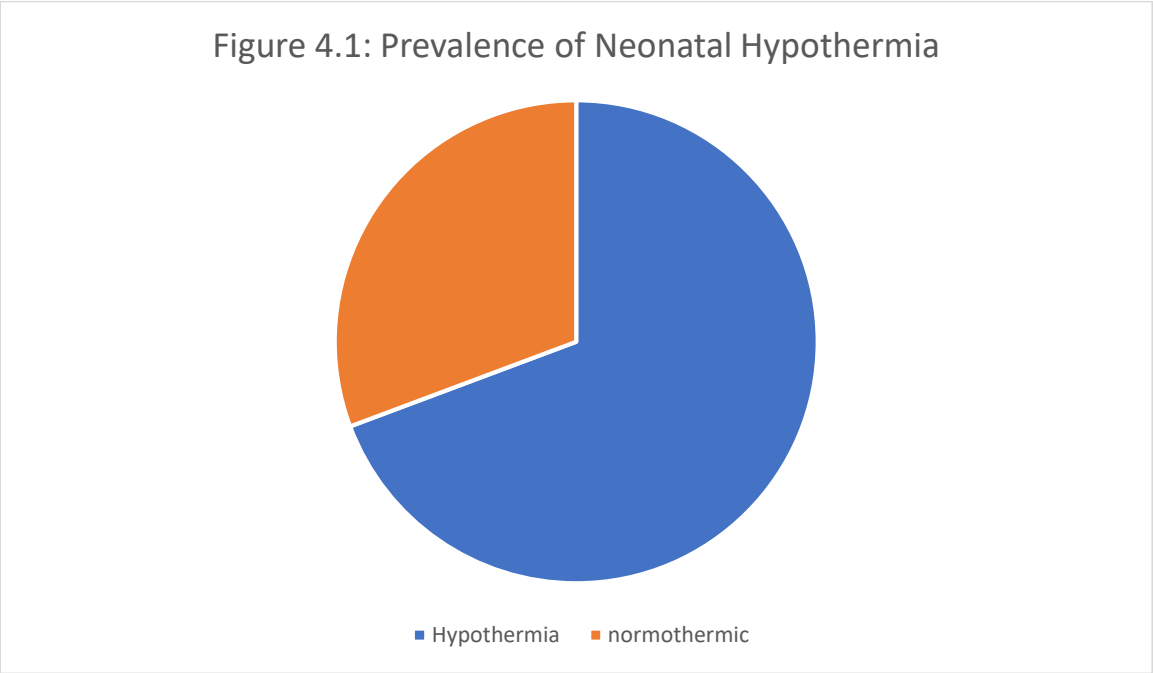
Table 4.1. Socio-demographic Characteristics of the Mothers of the Neonates (n = 137)

Variable	Frequency (n)	Percentage (%)
Age		
≤ 19 years	21	15.3
20 – 29 years	57	41.6
30 – 39 years	45	32.8
40 – 49 years	14	10.2
Mean age	**28**	
Marital Status		
Single	89	65.0
Married	47	34.2
Religion		
Christianity	133	97.1
Swazi Traditional Religion	2	1.5
Other	2	1.5
Level of education		
Primary education	24	17.5
Secondary education	84	61.3
Tertiary	29	21.1
Occupational status		
Unemployed	71	51.8
Formal employment	50	36.5
Informal employment	16	11.7
Place of residence		
Rural	59	43.0
Urban	78	57.0
Monthly income		
≤ 1900 Emalangeni	54	39.4
> 1900 Emalangeni	83	60.6
Number of pregnancies		
Primigravida	42	30.7
Multigravida	95	69.3

The respondent's ages ranged from 14 to 46 years old. Among them, 41.6% (57) of the respondents were aged between 20 – 29 years, while 32.3% (45) fell between 30 -39 and 10.2% (14) were 40 years old or above. Marital status indicates that 65% (89) of the respondent were single, while 34.2% (47) were married. Christianity emerged as the predominant religion among the respondents representing 97.1% (133) of the sample. A substantial portion of the respondents had completed secondary education 61.3% (84), followed by tertiary education 21.1% (29), while 17.5% (24) attained only primary education. About 51.8% (71) of the respondents were unemployed, while 36.5% (50) were engaged in formal employment and 11.7% were in informal sectors. Additionally, 60.6% (83) respondents earned above 1900 Emalangeni monthly, while 39.4% (54) earned below this threshold. Regarding pregnancies, 69.3% (95) of the respondents were multigravida, indicating a majority of experienced mothers, while 30.7% (42) were primigravida.

4.4 Prevalence of hypothermia

Figure: 4.1 presents the prevalence of neonates admitted in special care unit at RFM hospital in Eswatini.



Among the 137 neonates included in the study, 30.7% (42) were found to have a normal temperature, while a larger proportion, 69.3% (95), presented with hypothermia.

4.5 Neonatal Physiological Characteristics

Table 4.2 below presents the neonatal physiological characteristics of neonates admitted to special care unit at RFM hospital.

Table 4.2. Neonatal physiological characteristics

Variable	Frequency (n)	Percentage (%)
Gestational age at birth		
≥ 37	96	70.8
28 - <37	40	29.2
Birth weight		
≥ 2500 g	92	67.2
1500 – 2499 g	21	15.3
1000 – 1499 g	17	12.4
< 1000 g	7	5.1
Apgar score		
≥ 7	79	57.7
< 7	58	42.3
Resuscitation at birth		
Yes	37	27.0
No	100	73.0

About 29.2% (40) 0f the neonates were born preterm. Majority of the neonates 70.8% (96) were born at 37 or greater than 37 weeks. Additionally, 67.2% (92) of the neonates had a birth weight of 2500 grams and more. Furthermore, 57.7% (79) of the respondents achieved an Apgar score of 7 or more. A smaller proportion, only 27% (37) of the neonates required resuscitation at birth.

4.6 Environmental Characteristics

Table 4.3 below present the environmental characteristics of neonates admitted at special care unit at RFM hospital.

Table 4.3. Environmental characteristics

Variable	Frequency (n)	Percentage (%)
Time of delivery		
Day time	69	50.4
Night time	68	49.6
Mode of delivery		
Normal vaginal delivery	77	56.2
Assisted vaginal delivery	34	24.8
Caesarean section	26	18.9
Place of delivery		
Infant born within RFMH	116	84.7
Infant born and referred from other hospitals	21	15.3

Half (50.4%) of the neonates were delivered during day time and 56.2% were delivered by normal vaginal delivery and only 18.5% were delivered using caesarean section. Majority (84.7%) of the neonates were born within RFMH.

4.7 Behavioural Characteristics

Table 4.4 below presents the behavioural characteristics of neonates admitted at special care unit in Manzini RFM hospital.

Table 4.4. Behavioural Characteristics

Variable	Frequency (n)	Percentage (%)
Neonate wrapped with dry clothes		
Yes	135	98.5
No	2	1.5
Neonate wearing a hat/ cap		
Yes	105	76.6
No	32	23.4
Initiation of breastfeeding within 1 hour		
Yes	39	28.5
No	98	71.5
Neonate bath within 24 hours		
Yes	73	53.3
No	64	46.7
Warm transportation to SCN		
Yes	4	2.9
No	133	97.1

4.8 Measurement of Factors Associated with Hypothermia

This section presents the results of chi – square and fisher's exact test which tested the association between each variable associated with hypothermia among infants admitted into special care unit at RFM hospital.

4.8.1 Neonatal Physiological Factors

Neonatal physiological factors such as gestational age at birth, birth weight, Apgar score and resuscitation at birth were considered in this study. Table 4.5 below presents the neonatal physiological factors in association with hypothermia.

Table 4.5 Neonatal physiological factors associated with hypothermia among neonates

Variable	Hypothermia		Total	Chi^2
	No	Yes		(p-value)
	n (%)	n (%)	n (%)	
Gestational age at birth				
28 - < 37	6 (15.0)	34 (85.0)	40 (100.0)	6.52
≥ 37	36 (37.1)	61 (62.9)	97 (100.0)	**(0.011)**
Birth weight				
≥ 2500 g	35 (38.0)	57 (62.0)	92 (100.0)	8.77
1500 – 2499 g	5 (23.8)	16 (76.2)	21 (100.0)	**(0.032)***
1000 – 1499 g	2 (11.8)	15 (88.2)	17 (100.0)	
< 1000 g	0 (0.0)	7 (100.0)	7 (100.0)	
Apgar score				
≥ 7	32 (40.5)	47 (59.5)	79 (100.0)	9.98
< 7	10 (17.2)	48 (82.8)	58 (100.0)	**(0.007)**
Resuscitation at birth				
Yes	10 (29.4)	24 (70.6)	34 (100.0)	0.030
No	31 (31.0)	69 (69.0)	100 (100.0)	(0.862)

*fisher exact test results

Among the 40 neonates born at 28 to < 37 weeks gestation 85% (14) had hypothermia, while 15% (6) had normal temperature. Of the 17 neonates who weighed 1000 – 1499g (88.2% (15) had hypothermia while 11.8% (2) had normal temperature. Additionally, 82.8% (48) of the neonates who had an Apgar score <7 had hypothermia while 17.2% (10) had normal temperature. Similarly, 70.6% (24) of the neonates resuscitated at birth had hypothermia while 29.4% (10) maintained normal temperature. Therefore, the association between resuscitation at birth and hypothermia is not statistically significant ($p = 0.862$). Gestational age at birth ($p = 0.011$), birth weight ($p = 0.032$) and Apgar score ($p = 0.007$) is significantly associated with hypothermia among infant admitted at special care at RFM hospital.

4.8.2 Environmental Factors

Table 4.6 below presents the environmental factors. The environmental factors including time of delivery, place of delivery and mode of delivery were considered in this study.

Table 4.6 Environmental factors associated with hypothermia among neonates

Variable	Hypothermia		Total	Chi^2
	No	**Yes**		**(*p-value)***
	n (%)	**n (%)**	**n (%)**	
Time of delivery				
Day time	24 (35.3)	44 (64.7)	68 (100.0)	1.24
Night time	18 (26.5)	50 (73.5)	68 (100.0)	(0.265)
Mode of delivery				
Normal vaginal delivery	24 (31.2)	53 (68.8)	77 (100.0)	4.29
Assisted vaginal delivery	14 (41.2)	20 (58.8)	34 (100.0)	(0.117)*
Caesarean section	4 (16.0)	21 (84.0)	25 (100.0)	
Place of delivery				
Within RFMH	41 (35.3)	75 (64.7)	116 (100.0)	7.35
Outside RFMH	1 (5.0)	19 (95.0)	20 (100.0)	**(0.007)***

*fisher exact test results

Among the 68 neonates born at night time 73.5% (50) had hypothermia while 26.5% (18) had no hypothermia. Similarly, 84% (21) of the 25 neonates born through caesarean section experienced hypothermia, while 16% (4) were normothermic. There is no significant association between time of delivery and hypothermia (p = 0.265) and neither is there statistically significant association between mode of delivery and hypothermia (p = 0.117). Additionally, 95% (19) of the neonates born outside RFMH were hypothermic, while 5% (1) maintained normal temperature. There is a statistically significant association between the place of delivery and hypothermia among neonates admitted at Special Care Nursery at RFMH (p = 0.007).

4.8.3 Behavioral Factors

Table 4.7 below presents the behavioral factors associated with hypothermia among infant born at RFM hospital in Manzini Eswatini.

Table 4.7 Behavioral factors associated with hypothermia among neonates

Variable	Hypothermia		Total	Chi^2
	No	Yes	n (%)	(*p-value)*
	n (%)	n (%)		
Neonate wrapped with dry clothes				
Yes	42 (31.1)	93 (68.9)	135 (100.0)	0.450
No	0 (0.0)	1 (100.0)	1 (100.0)	(0.502)*
Neonate wearing a hat/ cap				
Yes	12 (38.7)	19 (61.3)	31 (100.0)	1.15
No	30 (28.6)	75 (71.4)	105 (100.0)	(0.283)
Initiation of breastfeeding within 1 hour				
Yes	22 (56.4)	17 (43.6)	39 (100.0)	16.4
No	20 (20.8)	76 (79.2)	96 (100.0)	**(<0.001)**
Neonate bath within 24 hours				
No	17 (23.3)	56 (76.7)	73 (100.0)	4.26
Yes	25 (39.7)	38 (60.3)	63 (100.0)	(**0.039**)
Warm transportation to SCN				
Yes	1 (25.0)	3 (75.0)	4 (100.0)	0.067
No	41 (31.1)	91 (68.9)	132 (100.0)	(0.796)*

*fisher exact test results

Among the 31 neonates that had worn a hat 61.3% (19) had hypothermia while 38.7% (12) had normal temperature. Similarly, of the 39 neonates who were initiated on breastfeeding within one hour 43.6% (17) had hypothermia while 56.4% (22) maintained normal temperature. About 76.7% (56) of the neonates who were bathe within 24 hours had hypothermia while 23.3% (17) had normal temperature. Additionally, 75% (3) of the neonates warmly transported exhibited hypothermia compared 25% (1) with normal temperature. The table above shows that there is no statistically significant association between certain factors like wrapping neonates in dry clothing, wearing a hat, warm transportation, or room temperature, and the occurrence of hypothermia (with p = 0.502, 0.283,0.796 and 0.124, respectively). However, there is a

significant association between initiating breastfeeding within one hour (p <0.001) and neonates being bathed within 24 hours (p =0.039) with hypothermia.

4.9 Factors associated with hypothermia - Results from Logistic Regression

This section presents the results from binary regression analysis which identified factors associated with hypothermia, as shown by the p-values which are less than 0.05.

4.9.1 Logistic Regression Neonatal physiological factors associated with hypothermia

Table 4.8 below shows the regression analysis for neonatal physiological factors such as gestational age at birth, birth weight, Apgar score and resuscitation at birth.

Table 4.8 Logistic Regression Neonatal physiological Factors associated with hypothermia

Variable	**Unadjusted Odds Ratio (95% CI)**	***p – value***	**Adjusted Odds Ratio (95% CI**	***p – value***
Gestational age at birth				
≥ 37	0.299(0.114 – 0.781)	0.014	Ref	
28 - < 37	0.299(0.114 – 0.781)	0.014	3.34(1.28 – 8.74)	**(0.014)**
Birth weight				
< 1000 g	2.32 (1.27 – 4.24)	0.006	Ref	
1500 – 2499 g	2.32 (1.27 – 4.24)	0.006	0.00 (0.00)	0.999
1000 – 1499 g	2.32 (1.27 – 4.24)	0.006	0.00 (0.00)	0.999
≥ 2500 g	2.32 (1.27 – 4.24)	0.006	0.00 (0.00)	0.999
Apgar score				
≥7	1.06 (0.592 – 1.89)	0.849	Ref	
<7	1.06 (0.592 – 1.89)	0.849	0.222 (0.026 – 1.91)	**(0.017)**
Resuscitation at birth				
No	0.927 (0.396 – 2.17)	0.862	Ref	
Yes	0.927 (0.396 – 2.17)	0.862	1.08 (0.462 – 2.53)	0.862

In terms of neonatal physiological factors, neonates born between 28 to < 37 weeks were more likely to present with hypothermia than those born at ≥ 37 weeks by a factor of 3.34 (AOR = 3.34, 95% confidence interval = 1.28 -8.74 , p = 0.014). On another note, neonates with an

Apgar score <7 were more likely to present with hypothermia than those who had am Apgar score ≥7 by a factor of 0.222 (AOR = 0.222, 95% confidence interval =0.026 – 1.91, p = 0.017). Additionally neonates that were resuscitated at birth were 1.08 times more likely to present with hypothermia than those not resuscitated at birth (AOR = 1.08, 95% confidence interval = 0.462 -2.53, *p* = 0.862).

4.9.2 Logistic Regression Environmental factors associated with hypothermia

Table 4.9 below shows the regression analysis for environmental factors such as time of delivery, mode of delivery and place of delivery.

Table 4.9. Logistic Regression Environmental factors associated with hypothermia

Variable	**Unadjusted Odds Ratio (95% CI)**	***p – value***	**Adjusted Odds Ratio (95% CI**	***p – value***
Time of delivery				
Day time			Ref	
Night time	1.52 (0.728 – 3.15)	0.267	0.660 (0.317 – 1.37)	**(0.026)**
Mode of delivery				
NVD	1.26 (0.777 – 2.05)	0.348	Ref	
AVD	1.26 (0.777 – 2.05)	0.348	0.421 (0.130 – 1.36)	0.148
Caesarean section	1.26 (0.777 – 2.05)	0.348	0.272 (0.077 – 0.968)	**(0.044)**
Place of delivery				
Within RFMH				
Outside RFMH	10.4 (1.34 – 80.4)	0.025	0.096 (0.012 – 0.745)	**(0.025)**

NVD: Normal vaginal delivery; AVD: Assisted vaginal delivery; CI: Confidence Interval

For environmental factors, infants born during the night were more likely to present with hypothermia than those born during the day by a factor of 0.660 (AOR = 0.660, 95% confidence interval = 0.317 – 1.37, *p* = 0.267). The odds of neonates developing hypothermia were lower for those born via caesarean section compared to those born through assisted vaginal delivery (AOR =0.272 (0.077 – 0.968). However, caesarean section was significantly associated with hypothermia (*p* = 0.044), whereas assisted vaginal delivery did not show a significant association with hypothermia (p = 0.148). On another note, neonates born outside RFMH were more likely to have hypothermia than those born within RFMH by a factor of 0.096 (AOR = 0.096, 95% confidence interval = 0.012 – 0.745, *p* = 0.025). Night time, caesarean section and being born outside of RFMH are therefore, significantly associated with hypothermia (*p* = 0.026, 0.044, 0.025, respectively).

4.9.3 Logistic Regression Behavioral factors associated with hypothermia

Table 4.10 below shows the regression analysis for behavioral factors such as neonate wrapped with dry clothes, neonate wearing a hat or cap, initiation of breastfeeding within 1 hour, neonate bath within 24 hours and warm transportation.

Table 4.10 Logistic Regression Behavioral factors associated with hypothermia

Variable	**Unadjusted Odds Ratio (95% CI)**	***p – value***	**Adjusted Odds Ratio (95% CI)**	***p – value***
Neonate wrapped with dry clothes				
Yes			Ref	
No	729570691.0 (0.00)	1.00	0.00 (0.00)	1.000
Neonate wearing a hat/ cap				
Yes			Ref	
No	1.58 (0.683 – 3.65)	0.285	0.633 (0.274 – 1.46)	0.285
Initiation of breastfeeding within 1 hour				
Yes			Ref	
No	4.91 (2.21 – 11.0)	<0.001	0.203 (0.091 – 0.453)	**(< 0.001)**
Neonate bath within 24 hours				
No			Ref	
Yes	0.461 (0.220 – 0.968)	0.041	2.17 (1.03 – 4.55)	**(0.041)**
Warm transportation				
Yes			Ref	
No	0.740 (0.075 – 7.33)	0.797	1.35 (0.136 – 13.4)	0.797

Neonates who were not initiated to breastfeeding within 1-hour post-delivery were more likely to present with hypothermia than those who did not breastfeed within 1 hour post-delivery by a factor of 0.203 (AOR = 0.203, 95% confidence interval = 0.091 – 0.453, $p < 0.001$). On another note, neonates who did not bathe within the first 24 hours were more likely to present with hypothermia than those who did not bath by a factor of 2.17 (AOR = 2.17, 95% confidence interval = 1.03 – 4.55, $p = 0.041$). Therefore, not initiating breastfeeding within 1 hour and bathing within 24hours is significantly associated with hypothermia (p = <0.001, 0.041 respectively.

4.10 Conclusion

This chapter presented the study findings. The main objective of this study was to assess the prevalence of neonatal hypothermia and associated factors among neonates admitted to the SCN of RFMH. Based in chi – squared test, it was noted that gestational age at birth (chi – squared test = 6.52, p = 0.011), birth weight (chi squared test = 8.77, p = 0.032) and Apgar score (chi – squared test = 9.98, p = 0.007) were significantly associated with hypothermia among neonates admitted at special care at RFM. Moreover, on environmental factors the place of delivery (X^2 = 7.35, p = 0.007) was significantly associated with hypothermia among neonates admitted in special care unit at RFM hospital. Lastly, breastfeeding initiation within 1 hour (X2 = 16.4, p < 0.001) and neonate bathing within 24 hours (X2 = 4.26, p < 0.039) was significantly associated with hypothermia among neonates admitted to special care unit. It was worth noting that gestational age, Apgar score, the place of delivery, breastfeeding initiation after 1 hour and neonate bathing within 24 hours were significantly associated with hypothermia among neonates admitted to special care unit at RFM hospital in Eswatini.

CHAPTER 5

DISCUSSION OF FINDINGS

5.1 Introduction

This chapter provides a comprehensive discussion of the findings from the study, which aimed to assess the prevalence of neonatal hypothermia and identify the factors associated with its occurrence in the Special Care Nursery (SCN). The study revealed that 69.3% of neonates were affected by hypothermia, a concerning figure that highlights a significant health issue in neonatal care. Several factors were found to contribute to the risk of hypothermia, including neonatal characteristics such as low Apgar scores, preterm birth, and the need for resuscitation at birth. Environmental factors, such as the time of delivery and the mode of birth, also played a role in the likelihood of hypothermia, with neonates born at night or via caesarean section being at higher risk. Additionally, newborn care practices, such as early breastfeeding initiation and delaying the first bath, were found to be crucial in preventing hypothermia. This chapter explores these findings in detail, discusses their implications for neonatal care, and offers recommendations for improving thermal care practices to reduce the incidence of hypothermia in neonates.

5.2 Discussion

5.2.1 Socio-demographic Characteristics of the Mothers of the Neonates

Majority of the respondents in this study were within the child bearing age 15 – 49 years with a mean age of 28 years. The lowest age was 14 years which is consistent with the Ministry of Health Eswatini, (2022) which revealed that 2.5% of females in Eswatini engage in sexual activity before the age of 15, emphasizing the importance of addressing maternal and neonatal health concerns from an early age. Education is often associated with improved health outcomes. All the respondents in the current study had attained formal education with more than half 61.3% reaching secondary education and 21.1% reaching tertiary level of education. The high percentage of respondents attaining formal education could be attributed to the effective implementation of free primary education in Eswatini which was implemented in 2010.

About 97.1% of the respondents in the study were Christians. This was an expected finding as Manzini is populated mainly by Christians and the minority of residents belonging to other religions. This is attributed to Eswatini being largely a Christian country with about 90% of the population believing in the Christian faith (International Religious Freedom Report, 2021). Understanding the religious beliefs and practices of the population is essential for culturally sensitive healthcare interventions aimed at preventing and managing hypothermia among neonates.

More than half of the respondents were unemployed, which is slightly above the World Bank 47.4% female labour force participation rate in Eswatini (World Bank, 2023). The slight difference in employment statistics between the current study and data reported by the World Bank may be attributed to the inclusion of girls below the legal working age in our sample. This means that majority of the respondents had no formal income of their own but depended on their partners or parents. The prevalence of unemployment highlights the economic challenges faced by many families in Eswatini, which may have implications for access to essential resources such as hats and warm blankets for neonates and could consequently result to hypothermia.

5.2.2 Prevalence of hypothermia

The findings of this study underscores a concerning prevalence of hypothermia among neonates, standing at 69.3%. This indicates a significant health concern within RFMH, highlighting potential gaps in the health systems ability to effectively prevent and manage neonatal hypothermia. This findings are almost similar to a study conducted in Addis Ababa, Ethiopia in 2018 on hypothermia and associated factors, it was discovered that the prevalence of hypothermia was 65.9% (Demissie et al., 2018). This is consistent with a study conducted in Addis Ababa public hospitals, Ethiopia (64%) (Demissie et al., 2018) and Dhaka 69.35% (Nyma et al., 2020). This may be due to inadequate infrastructure and healthcare resources that hinder the ability of health systems to effectively prevent and manage hypothermia, this includes insufficient facilities for neonatal care, inadequate training of health care workers on neonatal care practices and limited availability of equipment such as incubators.

Contrary to the findings of this study in a retrospective cohort study conducted in Kenya the prevalence of hypothermia was 17.5% which was much lower than our findings (Wainaina et al., 2024). Similarly the prevalence of hypothermia were still much lower than findings in the

current study in studies conducted in Tanzania 25.6% (Adika et al., 2022) and Ethiopia 50.3% (Ukke and Diriba 2019). The reason for this could be that they may have better health care infrastructure including facilities equipped with appropriate health systems and better trained staff to manage neonatal care effectively.

5.2.3 Factors associated with neonatal hypothermia

5.2.3.1 Neonatal Physiological Factors

A significant proportion of neonatal hypothermia cases are attributed to neonatal physiological factors. Neonates are particularly susceptible to hypothermia due to their large surface area relative to their mass, so there is an imbalance between heat generation and heat loss (Lissauer, Fanaroff, & Miall, 2020). In the current study Apgar score was significantly associated with neonatal hypothermia ($p = 0.017$). Neonates with a 5 minutes Apgar score < 7 were 0.22 times more likely to develop hypothermia. Neonates with a 5 minutes Apgar score of < 7 were more likely to be hypothermic than those who had an Apgar score ≥ 7. The results are consistent with findings of studies conducted by Nguyen et al., (2022) and Elbaum et al., (2021) who also reported an association between 5 minutes Apgar score < 7 and hypothermia. Infants with low Apgar scores may exhibit decreased metabolic rates, leading to reduced heat production. This metabolic instability can exacerbate heat loss and contribute to the development of hypothermia (Singh, 2018).

Findings from this study revealed that infants who were resuscitated at birth were 1.08 times more likely to be hypothermic than those who had no resuscitation at birth. This suggest that neonates who are resuscitated at birth are at an increased risk of hypothermia compared to those who are not resuscitated. However, the association between resuscitation at birth and hypothermia were not statistically significant in this study ($p = 0.862$). The findings are contrary to findings of studies conducted by Ng'eny & Velaphi, (2022) and Yitayew, et al., (2020) where resuscitation was statistically associated with neonatal hypothermia. This variation may be due to the difference in thermal care practice during resuscitation and the duration of the resuscitation process across the studies. This underscores the importance of considering thermal care practices alongside the primary objective of aiding newborns in breathing during resuscitation.

Approximately 12% of neonates in Eswatini are born before completing 37 weeks of gestation (Ministry of Health, Eswatini, 2022). In the current study 29.2% of the neonates were born preterm (less than 37 completed weeks). Among these preterm neonates, 85% experienced hypothermia. The high incidence of hypothermia may be attributed to the neonates being exposed to cool air during transfer from the delivery to the special care nursery, as nurses at RFMH do not use transport incubators or plastics wraps for neonates weighing less than 1.5 kg. Preterm neonates are at increased risk to develop hypothermia as they have less brown fat, less subcutaneous fat, and inefficient metabolic heat production (Pellegrino et al., 2023). In the present study gestational age was statistically associated with hypothermia ($p = 0.011$). Preterm neonates were 3.34 times more likely to develop hypothermia than term neonates. The results are consistent with previous studies by Pellegrino et al., (2023) and Getahan et al., (2022) who reported a significant association between gestations age less than 37 and hypothermia. These findings highlight the need for RFMH to implement measures to provide extra warmth for preterm neonates. This includes wrapping preterm neonates weighing less than 1.5kg in plastic bags to prevent heat loss by evaporation and using a transport incubator or skin to skin contact when moving neonates from the delivery room to the special care nursery. Currently this practices are not standard at RFMH.

5.2.3.2 Environmental Factors

In the present study time of delivery was significantly associated with neonatal hypothermia ($p = 0.026$). It revealed that neonates born during the night were 0.66 times more likely to present with hypothermia than those born during the day. This is thought to be due to the room temperature being lower during night time when compared to day time. In another study conducted in Ethiopia neonates delivered at night time were 2 times more likely to be hypothermic than those delivered during the day (Yitayew et al., 2020). During the night air is cooler and when there is no adequate warming neonates can loss heat by convection, air circulation in the room can lead to heat loss as cooler air moves over the newborn's body and takes heat with it (Laptook, 2024). These two findings are similar, but the odds in this study is a bit lower than that of Yitayew et al., (2020). This highlight the need for improved thermal care practices of neonates delivered during the night to decrease the likelihood of hypothermia. Neonates delivered at night especially in cold weather should be covered with adequate warmth clothing to ensure that they are kept warm at all time. Data in this study was collected during

summer period which might have contributed to lower odds difference between neonates born during day and night.

The World Health Organization advocates for maintaining a warm delivery room environment, recommending a temperature range of 25 to 28°C during childbirth (WHO, 2022). However, operating rooms typically maintain cooler temperatures, which may elevate the risk of neonatal hypothermia. In the present study, 18.9% of neonates were delivered via caesarean section, with 84% of these neonates subsequently developing hypothermia. This notable incidence highlights the imperative for RFMH to enhance thermal care practices, particularly for neonates delivered via caesarean section. Neonates born through caesarean section exhibited a 0.272 times higher likelihood of developing hypothermia compared to those delivered vaginally, with this association being statistically significant ($p = 0.044$).

This finding aligns with the results of a study conducted by Abdul-Mumin et al., (2024), which similarly demonstrated a statistically significant association between caesarean section delivery and hypothermia. However, it contrasts with the findings of studies by Ahmed et al., (2022) and Nyandiko et al., (2021), which reported no discernible association between caesarean section and hypothermia. The discrepancy in findings across studies may stem from variations in sample characteristics, study methodologies, or environmental contexts. Nonetheless, the consistent observation of a heightened risk of hypothermia following caesarean section delivery underscores the importance of implementing targeted interventions to optimize thermal care practices for neonates born via this method.

The findings of this study underscore that neonates born outside the hospital setting face a significantly elevated risk of hypothermia compared to those born within hospital facilities. Specifically, neonates born outside the hospital were 0.096 times more likely to develop hypothermia than their counterparts born within hospital premises. This aligns with the results of a study conducted in Addis Ababa, Ethiopia, in 2022, which emphasized that out born infants were 2.18 times more likely to experience hypothermia compared to inborn infants (Getaneh et al., 2022). The convergence of these findings underscores the heightened vulnerability of neonates born outside hospital settings to hypothermia.

To mitigate this risk, ensuring warm transportation for neonates born outside hospitals is imperative to maintain adequate warmth and prevent hypothermia. Implementing low-cost interventions such as maintaining skin-to-skin contact between neonates and their mothers

during transportation and utilizing plastic bag wrapping for small infants can effectively reduce the likelihood of neonatal hypothermia (Getaneh et al., 2022). The elevated incidence of hypothermia among neonates born outside hospital environments may be attributed to several factors, including maternal practices such as bathing the newborn at home before seeking medical care. Addressing these challenges requires concerted efforts to promote awareness of proper neonatal care practices and to implement strategies for ensuring optimal thermal management, particularly during transportation and transition to hospital care.

5.2.3.3 Behavioral Factors

The guidelines set forth by the World Health Organization underscore the importance of promptly covering newborns head with a hat following birth to mitigate the risk of hypothermia (World Health Organization, 2022). However, the outcomes of the current investigations failed to establish a significant statistical relationship between the utilization of a hat and the incidence of hypothermia (p = 0.285). This contradicts prior research findings, which demonstrated a notable correlation between the use of a hat and the occurrence of hypothermia. For instance, Bayih et al., (2019) contended that neonates adorned with a hat exhibits decreased susceptibility to hypothermia, supporting their assertion with statistically significant evidence of such an association. The discrepancies observed between the current study and previous research findings could potentially be attributed to variances in the seasons during which data were collected. Notably, the data for the present study were gathered during the summer season, characterized by relatively elevated temperatures. In contrast, prior studies may have been conducted during different seasons, wherein environmental conditions, including ambient temperature and humidity levels markedly diverge.

Early initiation of breastfeeding can significantly contribute to preventing hypothermia in newborns through various mechanisms. Typically, early breastfeeding initiation involves placing the newborn in direct skin-to-skin contact with the mother, harnessing the maternal body heat to regulate the neonate's temperature effectively. Additionally, breastfeeding provides essential nutrients and calories crucial for maintaining metabolic processes and generating body heat. This nutritional support aids in preventing hypothermia by meeting the energy requirements of the neonate (Yu et al., 2020). For instance, the current study revealed that 79.2% of neonates who did not undergo early breastfeeding initiation within one hour post-delivery developed hypothermia. The study further demonstrated a statistically significant association, indicating that neonates lacking early breastfeeding initiation were 0.203 times

more likely to experience hypothermia compared to those breastfed within the first hour after birth, ($p < 0.001$).

Similarly, research conducted in South Africa in 2020 corroborated these findings, showing that neonates who did not undergo early breastfeeding initiation within the first hour after birth were 3.7 times more likely to develop hypothermia compared to those breastfed within the same timeframe (Ng'eny & Velaphi, 2020). Although the magnitude of the odds ratio differed, the overall trend remained consistent with the current study, suggesting the importance of early breastfeeding initiation in preventing hypothermia. However, it is noteworthy that a study by Adhikari et al., (2020) did not find a statistically significant association between lack of early breastfeeding initiation and hypothermia. The current study underscores the importance of early breastfeeding initiation, acknowledging challenges such as medical restrictions or neonatal gestation and weight, which may hinder immediate breastfeeding.

Moreover, this study revealed that neonates who bathe within 24 hours' post – delivery were 2.17 more likely to be hypothermic than those who were not bathe within 24 hours' post – delivery. This was found to be statistically associated with hypothermia ($p = 0.041$). The exposure of the neonates to the cold environment and wet skin may cause heat loss through evaporation and increase the risk of them being hypothermic. Bathing could also increase risk of hypothermia because a neonate must be separated from the mother's body contact during the time of bathing, in RFMH almost all the neonates that are admitted are given a bath either by the healthcare professional or their mothers with permission form the health care professional. This findings have shown the need to follow proper thermal care guidelines in RFHM and conduct refresher training for the nurses on proper thermal care. On the contrary a study conducted in Ethiopia showed no statistical association between bathing before 24 hours and neonatal hypothermia (Yitayew, 2020).

5.3 Implications

5.3.1 Nursing Practice

- High Prevalence of Hypothermia (69.3%): Given that 69.3% of neonates were affected by hypothermia upon admission, it is critical for nurses to prioritize thermal management practices as part of their daily routine. Nurses should ensure that neonates

at high risk, such as those born preterm or with low Apgar scores, receive immediate warming interventions.

- Transport Incubators and Skin-to-Skin Contact: Since a significant proportion of neonates were not adequately thermally protected during transit, nurses should ensure the use of insulated transport incubators to prevent heat loss. When transport incubators are unavailable, they should actively facilitate skin-to-skin contact between the neonate and caregiver, which has been shown to improve thermal regulation and promote attachment, especially for neonates born outside the hospital.
- Importance of Timely Breastfeeding and Delayed Bathing: Neonates who were not breastfed within the first hour or who received a bath within 24 hours had a higher likelihood of hypothermia. Nurses should emphasize to caregivers the importance of early breastfeeding and delaying the first bath to prevent hypothermia, as these practices support both thermoregulation and newborn health.

5.3.2 Nursing Research

- Regional representation in future Studies: This study was conducted in a single referral hospital in the Manzini region, which limits the ability to generalize the findings. Future research should be conducted across multiple regions, including both urban and rural settings, to understand the full scope of neonatal hypothermia at the national level.
- Health outcomes of hypothermic neonates: The study did not explore the long-term health outcomes of neonates affected by hypothermia. Future studies should assess whether early hypothermia impacts neonatal survival rates, growth, and development. Additionally, research should focus on neonatal hypothermia's association with other health complications like infection or neurodevelopmental outcomes.
- Comparison between public and private health facilities: Neonatal hypothermia levels may vary between public and private healthcare facilities due to differences in resources and care practices. Future research should examine hypothermia incidence in both settings to determine if institutional factors influence the rate of hypothermia and if differences in care protocols exist.

5.3.3 Nursing Education

- Integration of hypothermia education: The study highlights the need for better training regarding neonatal thermoregulation. Nursing education programs should incorporate

in-depth modules on hypothermia prevention and management, including evidence-based practices for maintaining thermal stability.

- Thermoregulation and early interventions: Nursing educators should emphasize the importance of immediate thermal care practices, such as early skin-to-skin contact, timely breastfeeding initiation, and delayed bathing. These interventions should be considered foundational in any nursing curriculum.
- Ongoing professional development: Nurses should have access to regular workshops and seminars focusing on neonatal hypothermia, enabling them to stay updated with the latest research findings and best practices in neonatal care.

5.3.4 Nursing Management

- Implementation of evidence-based Guidelines: The findings underscore the necessity of establishing clear, evidence-based guidelines for preventing neonatal hypothermia. Nursing management should ensure that all staff are well versed in these guidelines, which should include the use of transport incubators, the promotion of early breastfeeding, and thermal protection during and after birth.
- Quality improvement and monitoring: The study indicates a need for a more rigorous quality improvement framework to monitor adherence to hypothermia prevention practices. Nursing management should encourage regular audits of neonatal care procedures, tracking the rate of hypothermia and identifying areas for improvement.
- Training and development for continuous improvement: Nursing management should foster a culture of continuous professional development, offering nurses opportunities for further education on neonatal care. This can include attending national or international conferences and workshops on neonatal thermoregulation.

5.3.5 Ministry of Health

- Resource allocation and infrastructure: With a high prevalence of hypothermia identified in the study, the Ministry of Health must prioritize investments in essential neonatal equipment, such as incubators and radiant warmers, to improve neonatal thermal care. Ensuring that all health facilities are adequately equipped is crucial for preventing hypothermia and improving neonatal outcomes.
- Updating national guidelines: The findings suggest a need to revise national neonatal care guidelines, with a specific focus on hypothermia prevention strategies. This could

include the creation of more comprehensive protocols for newborn care immediately after delivery, ensuring that practices such as timely breastfeeding and skin-to-skin contact are standard procedures across all healthcare settings.

- Targeted training for health professionals: The Ministry of Health should develop comprehensive training programs for health professionals, including doctors, nurses, and midwives, to increase their knowledge of hypothermia prevention. These programs should cover temperature monitoring, risk assessment, and appropriate interventions to manage hypothermic neonates.
- Promoting hospital deliveries and reducing risk: The study identified a higher incidence of hypothermia among neonates born outside the hospital. The Ministry should focus on increasing the proportion of hospital deliveries through awareness campaigns and community education programs. Reducing home births would reduce the need for long-distance transport of neonates, which is a significant risk factor for hypothermia.

5.4 Recommendations

- Future research should consider conducting similar studies in at least two regions of the country, including both urban and rural settings, to ensure a more representative sample of neonatal hypothermia cases across the country. This will allow for a more comprehensive understanding of the factors contributing to hypothermia on a national level.
- The Ministry of Health and relevant stakeholders should prioritize initiatives aimed at promoting hospital deliveries, particularly through awareness campaigns and community education programs. Increasing the proportion of hospital deliveries will reduce the need for long-distance transportation of newborns, minimizing the risk of hypothermia. The Ministry should also review and update neonatal guidelines to address early thermal management practices, including early breastfeeding initiation and delaying the first bath.
- Healthcare workers should be empowered through regular refresher training programs focusing on neonatal thermal care. These programs should educate staff on best practices for immediate newborn care, including timely breastfeeding initiation, the importance of delaying the first bath, and thermal protection during transport. This training should also emphasize the use of skin-to-skin contact and the proper use of transport incubators to prevent heat loss during neonatal transport.

- Healthcare facilities should develop and implement standardized protocols for neonatal transportation. These protocols should ensure consistency and high-quality care across different healthcare settings
- The Ministry of Health should allocate resources and prioritize investments in the necessary healthcare infrastructure and equipment for neonatal care. This includes ensuring that neonatal units are equipped with radiant warmers, incubators, and temperature monitoring devices to effectively manage neonatal thermal regulation. Hospitals should also ensure that sufficient resources are available for transportation, such as insulated incubators.
- The Ministry of Health should review and update the national neonatal care guidelines to incorporate evidence-based practices aimed at preventing neonatal hypothermia.

5.5 Strengths

This study used census sampling which gave almost everyone an equal chance to partake in the study which will enable the results of this study to be generalized. On another note, the study was more objective which shows that there was no biasness in this study.

5.6 Limitations of the study

Despite its strengths, this study had several limitations. One significant limitation was the geographical focus of the study, as it was conducted in just one referral hospital in the Manzini region. This restricts the ability to generalize the findings to other regions of the country, as healthcare practices and infrastructure might differ in other areas. Additionally, time constraints limited the research to a short timeframe, preventing the exploration of long-term outcomes for neonates who experienced hypothermia. The study did not assess how neonatal hypothermia impacted the long term health and development of these infants, which would have provided valuable insights for postnatal care. These limitations suggest that further research, including long term follow ups and broader geographic coverage, is needed to fully understand the effects of neonatal hypothermia.

5.7 Dissemination of findings

Final copies of the study will be given to the Ministry of Health Office, Raleigh Fitkin Memorial Hospital and Mbabane Government Hospital in Eswatini. A copy of the final

research report will be submitted to the University of Zambia, through the School of Medicine Library and the School of Nursing Sciences. In addition, the researcher will publish research findings in at least one peer-reviewed journal. The study findings are expected to be used in providing direction for present and future planning and implementation of interventions aimed at reducing neonatal hypothermia.

5.8 Conclusion

The prevalence of neonatal hypothermia among neonates admitted to neonatal special care unit at RFM hospital was high (69.3%). Neonatal (gestational age 28 to < 37 and Apgar score), environmental factors (time and mode of delivery) and behavioral factors (not breastfeeding within 1 hour, neonate bath within 24 hours and neonate wearing hat) were associated with hypothermia. As a result, special attention must be paid to the thermal care of neonates and the WHO warm chain principle, which emphasizes early breast feeding, skin-to-skin contact, and warm resuscitation. In developing nations without access to sophisticated warming devices and incubators, it is important to promote the effective warm chain principle of skin-to-skin contact as soon as possible after delivery.

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APPENDICES

Appendix I: Data Collection tool

PREVALENCE OF HYPOTHERMIA AND ASSOCIATED FACTORS AMONG NEONATES ADMITTED TO SPECIAL CARE NURSERY AT RALEIGH FITKIN MEMORIAL HOSPITAL, MANZINI, ESWATINI.

Date: …….

Place: …….

Serial Number: | |

Instructions

1. No name should be indicated on this questionnaire.
2. For questions with alternatives, **Circle** the chosen response.
3. All questions should be answered honestly and clearly.

QUESTIONNAIRE

SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE MOTHERS

1. What is your age? ..... years

2. Indicate your marital status

1. Single
2. Married
3. Separated
4. Divorced
5. Widowed

3. What is your religious affiliation?

1. Christianity
2. Swazi tradition
3. Others (specify) …….

4. Indicate your highest education level attained

1. Never been to school
2. Primary
3. Secondary
4. Tertiary

5. What is your occupational status?

1. Unemployed
2. Formal employment
3. Informal employment
4. Others (specify)

……

6. What is your place of residence?

1. Rural
2. Urban

7. What is approximately your family's monthly income?

1. Not more than E 1900
2. over E 1900

How many pregnancies have you had so far----------?

SECTION B: NEONATAL PHYSIOLOGIC, BEHAVIORAL, AND ENVIRONMENTAL FACTORS

Checklist (to be filled from the delivery summary chart)

Questions	Options	Tick
8. Axillary temperature on admission	≥ 36.5℃	
	36 – 36.4℃	
	32 – 35.9℃	
	< 32℃	
9. Axillary temperature after 24 hours upon admission	≥ 36.5℃	
	36 – 36.4℃	
	32 – 35.9℃	
	< 32℃	
11. Gender	Male	
	Female	
Neonatal Factors		
12. Gestational age at birth	28 to < 37 weeks	
	≥ 37weeks	
13. Birth weight	≥ 2500g	
	1500g – 2499g	
	1499g – 1000g	
	< 1000g	
14. Apgar score	< 7	
	≥ 7	

	None	
15. Resuscitation at birth	Yes	
	No	
Environmental Factors		
16. Time of delivery	Day	
	Night	
18. Mode of delivery	Normal vaginal delivery	
	Assisted vaginal delivery	
	Caesarean section delivery	
19. Place of delivery	Within RFMH	
	Outside RFMH	
Behavioural Factors		
20. Neonate wrapped with dry clothing	Yes	
	No	
21. Neonate wearing a cap	Yes	
	No	
22. Initiation of breastfeeding within one hour	Yes	
	No	
23. Neonate bathe within 24 hours	Yes	
	No	
24. Warm transportation	Yes	
	No	

END...THANK YOU FOR YOUR PARTICIPATION

Appendix II: Informed Consent Form

I have read (or have been explained to) and understand the nature of the research in which I have been requested to participate as explained in the information sheet. I have had the opportunity to ask questions about the research and I have been answered to my satisfaction.
I further understand that by agreeing to take part in this study, I have the right to withdraw at any time without having to give any explanation and that taking part in this study is purely voluntary and will have no influence on the treatment and care that I will be receiving in this hospital.

Participant signature or **thumbprint**

Signed: _____Date: _____
(Participant)

Signed: _____ Date: _____
(Researcher)

Appendix III: Participants' Information Sheet

Introduction

My name is Ncanele Nokukhanya Mabuza a student pursuing a Master of Science in Neonatal Nursing at the University of Zambia, School of Nursing Science. I am a qualified Nurse Midwife, registered with the Nursing and Midwifery Council of Eswatini. I am conducting research on prevalence of hypothermia and associated factors among neonates admitted to the Special Care Nursery at Raleigh Fitkin Memorial hospital, Manzini, Eswatini. In doing this I hope to gain a holistic understanding of the prevalence of hypothermia and associated factors among neonates admitted into the special care nursery. I am going to give you information and invite you to be part of this study. Participation in this research is voluntary and before you decide, please take time to read the following information and if you wish to discuss this further, you may contact me on my email address at ncanelemabuza25@gmail.com, call or WhatsApp on +26876996909. Please feel free to talk to anyone over the study before you decide. Please ask me if you find words that are difficult to understand as we go through the information and I will make sure I answer them clearly. If you have questions later on you are free to ask them of me.

Purpose of the Study

Neonatal hypothermia is usually under managed and ignored and this has been shown to contribute to increased neonatal morbidity and mortality. We need to reduce the morbidity and mortality associated with neonatal hypothermia. We believe you can help us by telling us your socio-economic status, demographic data, obstetric history and how you take care of your neonate within 24 hours. We need to learn how neonates in the neonatal intensive care are taken care off from delivery until 24 hours and what can be associated with hypothermia. This study will give policymakers and the general public a better understanding of the burden of Neonatal hypothermia and its associated factors, and help health planners to consider this problem in their quest to deliver quality neonatal services.

Study interventions

This study will involve your participation in answering a questionnaire which will last for about 15-20 minutes.

Participant Selection

You have been chosen to participate in this study because you have a neonate in the neonatal intensive care unit who could be at risk of developing hypothermia and your experiences can contribute to understanding the factors associated with neonatal hypothermia.

Voluntary Participation

Your participation in this research is entirely voluntary. It is your choice whether or not to participate in the study. If you refuse to participate in the study all the medical care you receive in this hospital will continue and nothing will change.

Procedures

We are asking you to help us learn more about hypothermia and associated factors in neonates admitted into the special care nursery here at Raleigh Fitkin Memorial hospital. You are invited to take part in this research study. If you accept you will be asked to fill out a questionnaire that will be administered by myself. You may answer the questionnaire yourself or it can be read to you and you can say out loud the answer. If you do not wish to answer any of the questions you may say so and move on to the next question. The information recorded is confidential, your name is not included on the questionnaire, only a number will identify you and no one else except the principal investigator (Ncanele Mabuza) and the supervisor (Dr Maureen Masumo) will have access to the information.

Duration

The research will take place over a period of two months. During that time, you will be required to fill the questionnaire only once and it should take about 15 to 20 minutes.

Uses of information

The information we shall get from you will be used to help in making decisions by policy makers in the hospital on how best we could prevent neonatal hypothermia.

Risks

There are no major risks involved in participating in this study despite that it will take a few minutes of your time. However, where clarification is sought, help will be rendered.

Benefits

There will be no direct benefit to you, however, the information that you will give will be used to come up with measures that may help prevent neonatal hypothermia.

Reimbursements

You will not be provided any incentives to take part in the study, but your time will be highly appreciated.

Confidentiality

Information you share will not be shared with anyone outside of the research team. The information that we will collect from this research project will be kept private. Any information about you will have a number on it instead of your name. Only the researcher will know what your number is and we will lock that information up with a lock and key.

Sharing of results

At the end of the study, the information will be used to write a report and equally used for further research. Knowledge that we get from this research will be shared with Raleigh Fitkin Memorial hospital and will be made widely available to the public.

Right to refuse or withdraw

You do not have to take part in this research if you do not wish to do so, and choosing to participate will not affect the medical care you receive. You may stop participating in the study at any time you wish without the medical care you and your neonate receive being affected.

Contact information

If you have questions at any time concerning this study or if you feel any discomfort whilst participating in this study. Please feel free to contact the researcher whose contact details have

been provided below for further clarification. This study has also been approved by the University of Zambia, Biomedical Research Ethics Committee and Eswatini Health and Human Research Review board (EHHRRB), which ensures that participants of the study are protected from any harm. If you want to find out more about this study, you can contact them on the number provided below.

1. **Principal Investigator**: Miss Ncanele Nokukhanya Mabuza. P.O.BOX 1932 Matsapha. Email address ncanelemabuza25@gmail.com. Telephone +268 76996909.
2. **Research Supervisor**: Dr. Maureen Masumo. The University of Zambia, School of Nursing Sciences, Department of Midwifery, Women's and Child Health. Email: maureenmasumo@unza.zm. Telephone: +260977862284.
3. **The chairperson**. Mr. Rudolph T.D. Maziya. Eswatini Health and Human Research Review board. P.O. Box 5, Mbabane, Eswatini. Telephone: +268 24047751/9553. Email: ehhrrbeswatini@gmail.com.
4. **The Chairperson. University of Zambia, Biomedical Research Ethics Committee.** P.O. Box 50110, Lusaka. Email: s.munsaka@unza.zm . Tel: +260977925304

Appendix: IV Research Budget

Budget plan	**Cost per item**	**Quantity**	**Total cost**
Stationery	E 70	05	E 350
Printing and binding	E 50	06	E 300
Ethics committee (UNZABREC & NHRA)	E 2000	2	E 2000
Ethics committee (Eswatini)	E 500	1	E 500
Transport costs	E 100	60	E 6000
Refreshments	E 30	60	E 1800
Contingency	E 1095		E 1095
Gross total			E 12045

BUDGET JUSTIFICATION

The budget is planned to facilitate the carrying out of the research project, it will help meet all the costs to be encountered including, ethics clearance fee, stationery, secretarial and contingency which is 10% of the total budget and it will be funded by the researcher.

Appendix V: Letters of Authority to Conduct the Study

ETHICS APPROVAL UNZABREC

UNIVERSITY OF ZAMBIA
BIOMEDICAL RESEARCH ETHICS COMMITTEE

Telephone: +260 977925304
Telegrams: UNZA, LUSAKA
Telex: UNZALU ZA 44370
Fax: + 260-1-250753

Ridgeway Campus
P.O. Box 50110
Lusaka, Zambia
E-mail: unzarec@unza.zm

Federal Assurance No. FWA00000338 IRB00001131 of IORG0000774 NHRAR-REC No 2021-05-0002

25th October 2023

Your REF. No. 4400-2023

Ms. Ncanele Nokukhanya Mabuza,
University of Zambia,
School of Nursing Sciences,
P.O Box 50110,
Lusaka.

Dear Ms. Mabuza,

RE: PREVALENCE OF HYPOTHERMIA AND ASSOCIATED FACTORS AMONG NEONATES ADMITTED TO THE NEONATAL INTENSIVE CARE UNIT AT RALEIGH FITKIN MEMORIAL HOSPITAL, MANZINI, ESWATINI. (REF. NO. 4400-2023)

The above-mentioned research proposal was presented to the Biomedical Research Ethics Committee on 23rd October, 2023. The proposal is **approved**. The approval is based on the following documents that were submitted for review:

a) **Study proposal**
b) **Questionnaires**
c) **Participant Consent Form**

APPROVAL NUMBER : REF. No. 4400-2023

This number should be used on all correspondence, consent forms and documents as appropriate.

i. **APPROVAL DATE : 23rd October 2023**
ii. **TYPE OF APPROVAL : Standard**
iii. **EXPIRATION DATE OF APPROVAL : 22nd October 2024**
iv. After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the UNZABREC Offices should be submitted one month before the expiration date for continuing review.
v. **SERIOUS ADVERSE EVENT REPORTING**: All SAEs and any other serious challenges/problems having to do with participant welfare, participant safety and study integrity must be reported to UNZABREC within 3 working days using standard forms obtainable from UNZABREC.

vi. **MODIFICATIONS**: Prior UNZABREC approval using standard forms obtainable from the UNZABREC Offices is required before implementing any changes in the Protocol (including changes in the consent documents).

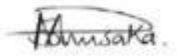
vii. **TERMINATION OF STUDY**: On termination of a study, a report has to be submitted to the UNZABREC using standard forms obtainable from the UNZABREC Offices.

viii. **NHRA:** You are advised to obtain final study clearance and approval to conduct research in Zambia from the National Health Research Authority (NHRA) before commencing the research project.

ix. **QUESTIONS**: Please contact the UNZABREC on Telephone No. +260977925304 or by e-mail on unzarec@unza.zm.

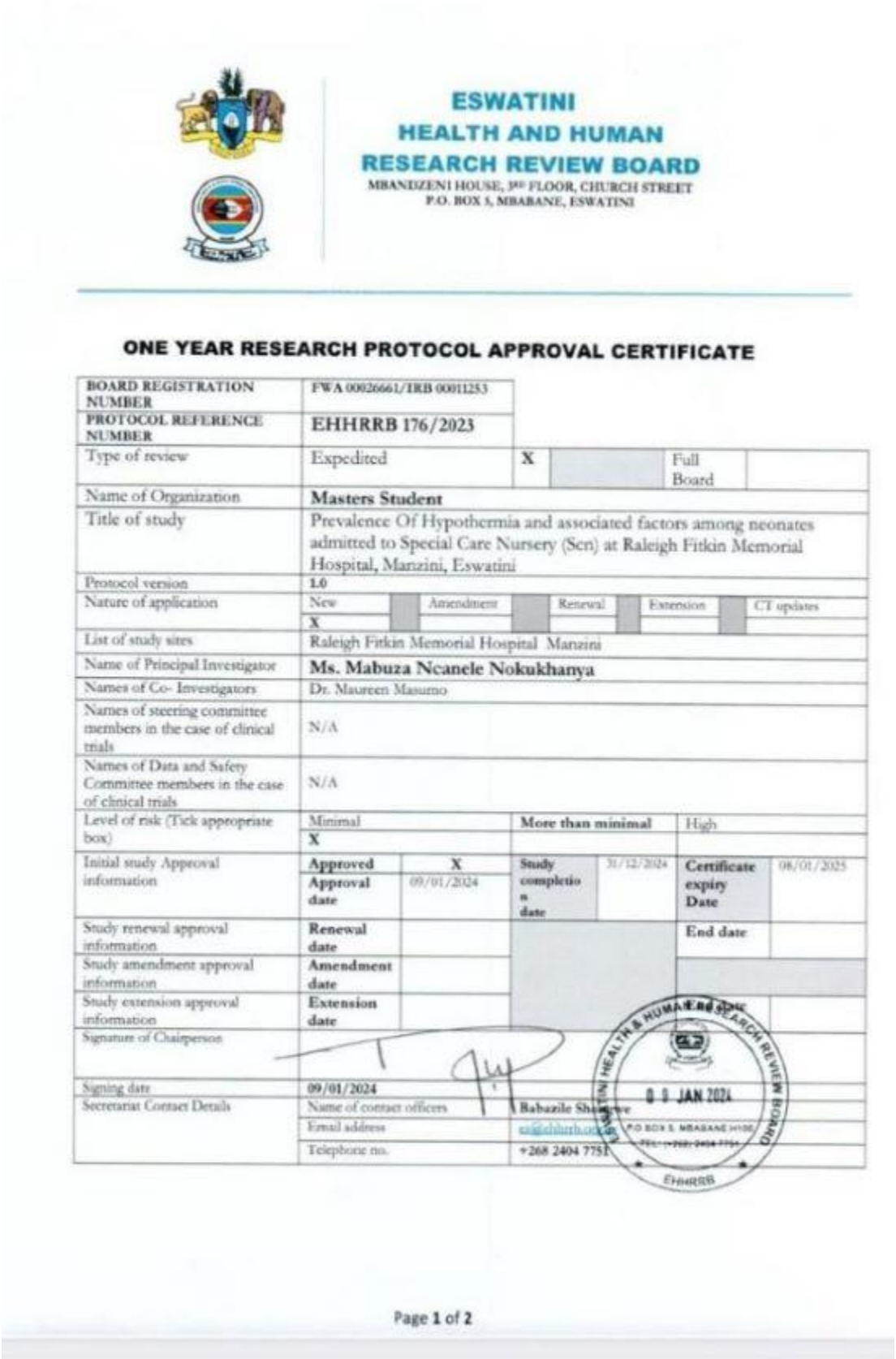
x. **OTHER**: Please be reminded to send in copies of your research findings/results for our records. You are also required to submit electronic copies of your publications in peer-reviewed journals that may emanate from this study. Use the online portal: unza.rhinno.net for further submissions.

Yours sincerely,



Prof. Sody Mweetwa Munsaka, BSc., MSc., PhD
CHAIRPERSON
Tel: +260977925304
E-mail: s.munsaka@unza.zm

ETHICS APPROVAL EHHRRB



ESWATINI
HEALTH AND HUMAN
RESEARCH REVIEW BOARD
MBANDZENI HOUSE, 3RD FLOOR, CHURCH STREET
P.O. BOX 5, MBABANE, ESWATINI

ONE YEAR RESEARCH PROTOCOL APPROVAL CERTIFICATE

BOARD REGISTRATION NUMBER	FWA 00026661/IRB 00011253							
PROTOCOL REFERENCE NUMBER	**EHHRRB 176/2023**							
Type of review	Expedited		**X**		Full Board			
Name of Organization	**Masters Student**							
Title of study	Prevalence Of Hypothermia and associated factors among neonates admitted to Special Care Nursery (Scn) at Raleigh Fitkin Memorial Hospital, Manzini, Eswatini							
Protocol version	1.0							
Nature of application	New		Amendment		Renewal		Extension	CT updates
	X							
List of study sites	Raleigh Fitkin Memorial Hospital Manzini							
Name of Principal Investigator	**Ms. Mabuza Ncanele Nokukhanya**							
Names of Co- Investigators	Dr. Maureen Masumo							
Names of steering committee members in the case of clinical trials	N/A							
Names of Data and Safety Committee members in the case of clinical trials	N/A							
Level of risk (Tick appropriate box)	Minimal		**More than minimal**		High			
	X							
Initial study Approval information	**Approved**	X	**Study completion date**	31/12/2024	**Certificate expiry Date**	08/01/2025		
	Approval date	09/01/2024						
Study renewal approval information	**Renewal date**				**End date**			
Study amendment approval information	**Amendment date**							
Study extension approval information	**Extension date**							
Signature of Chairperson								
Signing date	09/01/2024							
Secretariat Contact Details	Name of contact officers		Babazile Shongwe					
	Email address		[illegible]					
	Telephone no.		+268 2404 7751					

ESWATINI HEALTH & HUMAN RESEARCH REVIEW BOARD
0 9 JAN 2024
P.O BOX 5, MBABANE H100
EHHRRB

Page 1 of 2

APPROVAL CONDITIONS

Ref.	Conditions	Indication of conditions (tick appropriate box)				
		Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
1.	Submission of progress reporting for multi-year studies					
2.	Submission of end of project report (Hard copy)	✓				
3.	Submission of end of project report (Soft copy)	✓				
4.	Submission of data sets	✓				

List of reviewed documents

Ref.	Documents	Reviewed documents (tick appropriate box)
1.	Completed application form	✓
2.	Cover letters	✓
3.	Evidence of administrative permission to conduct the research by involved institutions/sites (where applicable)	
4.	Detailed current resume or curriculum vitae of Principal Investigator/s including Principal investigators declaration	✓
5.	Summary resume or biography for other investigator(s)	✓
6.	Evidence of approval/rejection by other Ethics Committees, including comments and requested alterations to the protocol, where appropriate.	✓
7.	Research protocol (see outline in Annex 1)	✓
8.	Questionnaires and interview guides (with back-translated versions where applicable)	✓
9.	Case report forms (CRFs), abstraction forms and other data collection tools	
10.	Participant/subjects Information Statement(s) (where applicable)	✓
11.	Informed consent form(s) including photographic and electronic media consent statements.	✓
12.	Advertisements relevant to the study (where applicable)	
13.	Source of funding and detailed budget breakdown including material and incentives to participants if applicable	✓
14.	Notification form for adverse effects/events.	
15.	Proof of payment	✓
16.	Proof of insurance cover for research subjects in clinical trials or where applicable	
17.	Any other special requirements should be stated, if applicable	N/A

[redacted]

APPROVAL LETTER FROM STUDY SITE

Eswatini Nazarene Health Institution (ENHI)
Raleigh Fitkin Memorial (RFM) Hospital
& the Community Health Clinics

CHURCH OF THE NAZARENE

11 January 2024

Ncanele Mabuza
University of Zambia
School of Nursing
P.O.Box 50110
Lusaka

Dear Madam

RE: AUTHORIZATION TO DO RESEARCH IN THE HOSPITAL

Your request on the fore mentioned endeavours has been duly considered and permission granted on the following conditions please:

a). That confidentiality is strictly observed
b). That the hospital receives a copy of the report on the proposed research.

Yours Sincerely

Dr. M. Sihlongonyane
HOSPITAL ADMINISTRATOR ACTING

CC: Matron 1
SMO

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(+268) 2505 5077
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info@enhiswaziland.com
P.O.Box 14 Manzini M200