Hamburg University of Applied Sciences
Faculty of Life Sciences

Healthcare Professionals' Training, Experiences, and Management Outcomes in Neonatal Respiratory Care in Ghana: A Qualitative Investigation

Master's Thesis
Master of Public Health

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Dedication

2 Timothy 4:7

I have fought the good fight; I have finished the race; I have kept the **FAITH.**

Acknowledgements

What an incredible journey it has been, a journey that began honestly with self-doubt but has ended with a deep confidence in the person I have become and the strength I have built throughout my time at the Hamburg University of Applied Sciences.

I would like to begin by thanking God for seeing me through this journey. This thesis may mark the end, but I could have never survived this beautiful journey without Him—and He never once left my side.

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To all family and friends who encouraged and rooted for me in one way or another—it truly takes a village, and I am beyond grateful to have incredible people around me, cheering me on—ALWAYS.

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List of abbreviations

ABG	Arterial blood gas
CBT	Classroom Based Training
bCPAP	Bubble Continuous Positive Airway Pressure
CPD	Continuous Professional Development
GARH	Greater Accra Regional Hospital
GDHS	Ghana Demographic and Health Survey
GHS-ERC	Ghana Health Service Ethical Review Committee
HBBP	Helping Babies Breathe Programme
HFNC	High-Flow Nasal Cannula
LMIC	Low-Middle-Income Country
NICU	Neonatal Intensive Care Unit
NRP	Neonatal Resuscitation Programme
PEEP	Positive end-expiratory Pressure
nRDS	Neonatal respiratory distress syndrome
ROP	Retinopathy of prematurity
RSS	Respiratory Severity Score
SBT	Simulation Based Training
SDG	Sustainable Development Goal
WHO	World Health Organisation

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Abstract

Background: In environments with limited resources, neonatal respiratory conditions continue to be a leading cause of death. Non-invasive breathing techniques like Continuous Positive Airway Pressure (CPAP) have been shown to be successful; nevertheless, systemic, institutional, and training-related obstacles hinder their use in sub-Saharan Africa. This study explores the lived experiences, level of training, and perceived outcomes of healthcare personnel involved in neonatal respiratory care at the Greater Accra Regional Hospital (GARH) in Ghana.

Methods: In-depth semi-structured interviews with 15 healthcare professionals, including doctors, nurses, respiratory therapists, and a clinical engineer, were conducted using a qualitative phenomenology approach. The selection of participants was based on their involvement in newborn care. MAXQDA software was used to analyze the data thematically, and the results were interpreted using a multi-theoretical framework that included social cognitive theory, human factors theory, and role theory.

Findings: To provide clarity and explanation of the presentation,four major themes were generated from the results: (1) Structural and Systemic Constraints in Neonatal Respiratory Care, (2) Training, Competency, and Capacity Building, (3) Outcome on Neonatal Respiratory Care (4) Institutional Support and System-Level. Each theme includes a variety of sub-themes that represent the different yet interconnected aspects of neonatal respiratory care in the facility. The main issues raised by the participants were inadequate referral and transport mechanisms, a lack of formal CPAP training, overburden on available equipment, and inadequate equipment. Despite these challenges, staff members showed a strong sense of internal motivation and a dedication to enhancing newborn outcomes, frequently using peer-led training and relying on improvisation.

Conclusion: The results highlight the urgent need for targeted training initiatives, improved infrastructure support, and context-adapted CPAP implementation strategies in neonatal units across Ghana. In situations with limited resources, addressing workforce development and strengthening institutional support structures can greatly improve the standard of neonatal respiratory care.

Keywords: Neonatal respiratory care; CPAP; training; Ghana; qualitative study; health workforce; institutional support; low-resource settings

1. Introduction

Neonatal respiratory care refers to medical interventions that support newborns with respiratory distress (Goldsmith's Assisted Ventilation of the Neonate, 2021). Despite advancements in technology, respiratory conditions remain a leading cause of neonatal mortality, particularly in resource-limited regions such as Sub-Saharan Africa. These regions face persistent challenges such as poor access to essential healthcare for newborns, inadequate training of healthcare personnel, and a lack of resources for life-saving interventions. In 2022, Sub-Saharan Africa recorded the highest neonatal mortality, with a neonatal mortality rate of 27 deaths per 1,000 live births, amounting to 2.3 million deaths within the first 28 days of life. In comparison, high-income countries reported significantly lower rates, often below 10 deaths per 1,000 live births (WHO, 2024).

Ghana, located in Sub-Saharan Africa, has a neonatal mortality rate of 22.8 per 1,000 live births and requires accelerated progress to meet global health targets. A majority of these deaths are caused by prematurity, infections, and intrapartum complications, all of which are often associated with severe respiratory distress (Dewez & van den Broek, 2017). Addressing neonatal respiratory care is therefore critical for improving survival outcomes, especially in Ghana, where health systems are constrained by systemic barriers such as equipment shortages, insufficient training, and delays in maintenance of medical devices.

This research investigates the experiences, challenges, and training levels of the healthcare personnel at the Greater Accra Regional Hospital in Ghana. By identifying systemic barriers such as resource availability, equipment maintenance, and gaps in training, the study aims to enhance neonatal care outcomes through improved training programs, resource management, and ensuring sustainable maintenance strategies, particularly in resource-limited settings.

1.1. Problem Statement

In resource-limited areas such as Ghana, neonatal respiratory distress has a significant impact on neonatal health outcomes (WHO, 2024). Healthcare workers' experiences and training significantly influence the effectiveness of CPAP in neonatal respiratory care within resource-constrained environments. Key barriers include inadequate infrastructure, a shortage of skilled staff, and insufficient knowledge and training (Dada et al., 2021; Nabwera et al., 2020).

These barriers can lead to complications like nasal trauma and caregiver fears about the equipment (Nyondo-Mipando et al., 2020). As CPAP use in sub-Saharan Africa expands, there

is a growing need for widely acceptable training guidelines and capacity-building approaches to ensure safe and effective use in district health facilities (Baiden, 2020).

While most research focuses on limitations in resources and staff, a few studies explore how healthcare workers' experiences and training influence the effectiveness of CPAP and other ventilation use. There is a need to investigate the factors that affect neonatal care outcomes in these contexts, especially in healthcare institutions where standardized training is often lacking. The study aims to address these gaps by investigating the experiences and training of healthcare workers at the Greater Accra Regional Hospital (GARH) to enhance the effectiveness of neonatal respiratory care strategies in resource-limited settings.

1.2. Significance of the Study

This study aims to improve the standard of neonatal respiratory care by seeking to understand the experiences, training, and obstacles encountered by healthcare workers. The results will provide recommendations to redefine training programs, ensuring that healthcare staff are better prepared to address neonatal respiratory conditions. Furthermore, the results of the study will inform evidence-based guidelines and protocols, which will improve the level of care in resource-limited settings. Finally, this research will support and strengthen collaboration among healthcare teams, ultimately advancing the quality of sustainable neonatal care.

1.3. Outline of the Study

The thesis is structured into six chapters. Chapter one provides a general overview of the importance of this thesis topic and the significance of the study. Chapter two presents a review of existing literature related to the topic and identifies gaps concerning the challenges faced by health workers in the use of neonatal ventilatory methods. Chapter three describes the qualitative, inductive approach and its relation to selected theoretical frameworks. It also details the research design and data collection methods. Chapter four presents the empirical findings from the interviews, revealing the healthcare professionals' experiences and challenges with neonatal ventilatory therapy. Chapter five analyzes the findings in existing literature and theoretical perspectives, exploring their implications for practice, policy, and future research. Finally, Chapter Six summarizes the study's contributions, discusses its limitations, and suggests recommendations to improve neonatal care strategies and guide future research.

2. Literature Review

2.1. Introduction

This chapter presents a review of existing literature to identify key themes and gaps related to challenges faced by healthcare professionals in the management of neonatal respiratory conditions using ventilatory methods.

This literature review assesses available research on neonatal respiratory care in resource-limited settings, especially in low- and middle-income countries (LMICs). It examines neonatal respiratory care across various healthcare levels by employing a multi-theoretical approach that integrates role theory, human factor theory, and social cognitive theory. It focuses on three primary themes: the experiences and challenges faced by the healthcare professionals, the impact of training and professional competence in addressing neonatal respiratory issues, and the outcome of care in settings with limited resources. By analyzing current literature, this review identifies existing knowledge and practice gaps and provides insights to inform interventions aimed at improving neonatal care outcomes.

2.2. Theoretical Background

This study used a phenomenological qualitative research approach to explore the lived experiences of healthcare professionals involved in neonatal respiratory care at the GARH. The aim was to gain in-depth insights into how these professionals perceived and navigated the challenges, training gaps, and outcomes associated with managing neonatal respiratory conditions in a resource-limited environment.

Semi-structured interviews were conducted with medical personnel in the neonatal intensive care unit to gather personal and detailed experiences. This method enabled participants to express themselves in their own words, allowing thematic patterns and shared meanings to emerge. As Creswell stated, phenomenological research focuses on understanding participants' subjective realities by using thematic analysis to understand the significance of their lived experiences (Creswell, 2007).

While the initial analysis follows a phenomenological approach, a multi-theoretical framework guided the interpretation of the results to enhance understanding of the data gathered. The study, therefore, draws on role theory, human factor theory, and social cognitive theory. Each provides a unique perspective for analyzing the effects of individuals, organizations, and systems on neonatal care.

2.2.1. Role Theory

Role theory offers a useful lens for examining the expectations and role conflicts that healthcare professionals face. This theory provides a valuable framework for examining the challenges faced by healthcare professionals in neonatal and intensive care settings. Li highlights that role ambiguity and conflicts often arise due to unclear task delineation, which hinders effective respiratory care delivery (Li, 2022). An example is in the neonatal intensive care setting, where Wells states that unclear task delegation and overlapping responsibilities between health workers can result in role ambiguity, leading to stress and burnout (Wells, 2021). It was noted that respiratory therapists, though critical in improving patient outcomes, often encounter significant emotional strain and a lack of institutional clarity regarding their roles, especially in neonatal care (Al-Anazi et al., 2024). Understanding these role-related dynamics is essential for enhancing healthcare worker satisfaction and improving outcomes in neonatal respiratory care.

2.2.2. Human Factors Theory

Human Factor Theory focuses on how environmental design, equipment usability, and workflow dynamics affect the performance of healthcare personnel. In neonatal intensive care units (NICU), the physical layout, equipment arrangement, and cognitive demands placed on staff significantly impact care delivery. The NICU setting presents personnel with situations where they have to carry out numerous data inputs and complex procedures in crowded units under stressful conditions, which contribute to increased workload and burnout among health personnel (Dye et al., 2024). Yamada and Halamek stress that aside from physiological care, including human factors and the principle of ergonomics is important in neonatal settings. A thorough understanding of the physical, cognitive, and organisational aspects of care settings can enhance human performance, reduce errors, and improve patient safety. Despite its importance, ergonomics remains an understudied area in the field of neonatal health. Advancement in neonatal patient safety has moved focus from individual blame to system-level improvements, incorporating human factors principles into simulation, debriefing, and quality improvement initiatives (Yamada & Halamek, 2023). Redesigning the NICU with concepts from human factors can enhance neonatal care delivery by taking stakeholders' goals, requirements, and challenges into account (Grome et al., 2019). Continued efforts to develop technologies that help medical practitioners provide safe patient care are needed for future developments in neonatal care.

2.2.3. Social Cognitive Theory

Social Cognitive Theory provides insights into how self-efficacy, observational learning, and structured training contribute to capacity-building among neonatal care providers. Originating from Bandura, the theory states that individuals acquire skills and behaviours through modelling, reinforcement, and direct experiences within a social context. It provides insights into how healthcare personnel acquire needed clinical skills in high-pressure settings such as the NICU.

Organised training programs have been shown to lead to a significant increase in staff competence with ventilatory equipment (Islam et al., 2023). Maenhout et al. demonstrated that simulation-based training boosts confidence and leadership among NICU personnel, regardless of prior experience. Similarly, in low-resource settings, the knowledge and self-confidence of traditional birth attendants increased when role-play, demonstrations, and visual aids were introduced into newborn resuscitation teaching (Maenhout et al., 2021).

Instruments designed to measure self-efficacy, many of which are based on Bandura's framework, are reliable for assessing the outcomes of neonatal resuscitation programs (Mendhi et al., 2020). Furthermore, simulation modalities that incorporate serious game design have outperformed traditional methods in improving ventilation and chest compression skills among nursing students (Sarvan & Efe, 2022).

These studies support the importance of social cognitive theory in guiding the development and evaluation of neonatal respiratory care training programs. By fostering the acquisition of practical skills and building self-efficacy, such programs can enhance the quality of care in both high- and low-resource healthcare settings.

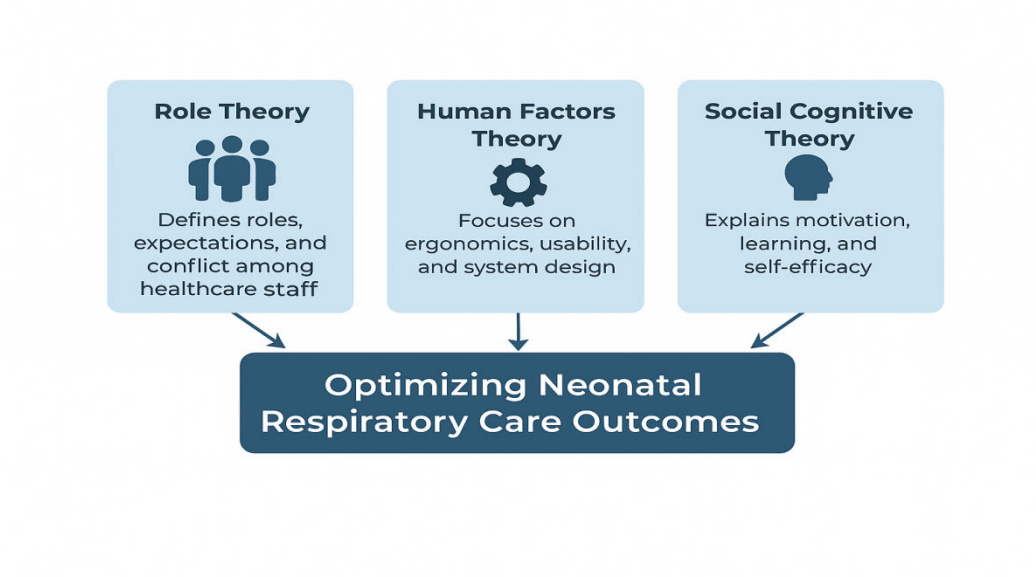

Figure 1. Multi-theoretical Framework for Optimizing Neonatal Respiratory Care Outcomes.

Source: Own Illustration

2.3. Neonatal Mortality and Respiratory Care in LMICs

2.3.1. The Neonatal Period and Global Mortality Trends

The neonatal period, defined as the first 28 days of life, is the most vulnerable phase for child survival, with neonates facing the highest risk of death due to complications related to birth and early development. In 2023, an estimated 2.3 million neonatal deaths occurred globally. While neonatal mortality has declined by 44% since 2000, nearly half of all under-five child deaths still occur during this critical period (UNICEF, 2025).

Sub-Saharan Africa continues to bear a disproportionate burden of neonatal mortality. Although the region accounts for only 30% of global live births, it contributes over 57% of all under-five deaths. In 2023, the region recorded the highest neonatal mortality rate in the world, with 26 deaths per 1,000 live births (WHO, 2024). This figure underscores the persistent structural challenges in many low- and middle-income countries (LMICs) and highlights the urgent need for targeted interventions. In response to these unmet targets, the international community has renewed its commitment through Sustainable Development Goal (SDG) 3.2, which aims to reduce neonatal mortality to no more than 12 deaths per 1,000 live births by 2030 in all countries, with a particular focus on LMICs. However, projections indicate that at least 65 countries, many in sub-Saharan Africa, including Ghana, are unlikely to meet this target without accelerated investments in policy, training, and healthcare infrastructure (WHO, 2024).

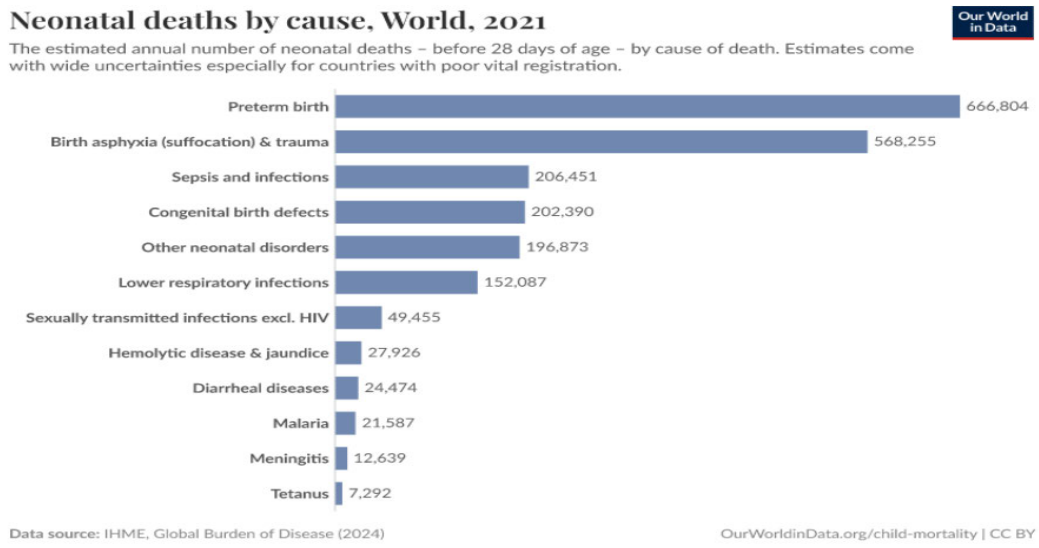

Figure 2. Neonatal deaths by cause in the world, 2021.

Source: (*Our World in Data*, 2025)

2.3.2. Neonatal Mortality Trends and Challenges in Ghana

Neonatal mortality remains a pressing public health concern in Ghana, contributing significantly to under-five mortality rates. As a lower-middle-income country in Sub-Saharan Africa, Ghana faces considerable challenges in achieving Sustainable Development Goal (SDG) target 3.2, which aims to reduce neonatal mortality to no more than 12 deaths per 1,000 live births by 2030. Recent estimates indicate that Ghana's neonatal mortality rate stands at approximately 21 deaths per 1,000 live births, while the under-five mortality rate is 37 per 1,000 live births, highlighting the disproportionate burden during the neonatal period (UNICEF, 2025).

Ghana has demonstrated its commitment to improving neonatal health by participating in global initiatives such as the Every Woman Every Child campaign and the Every Newborn Action Plan (WHO, 2024). Despite these efforts, the country remains off track in achieving its set targets. A major concern is that increases in maternal and neonatal health service coverage have not translated into proportional reductions in mortality (Adongo & Ganle, 2023). According to the 2022 Ghana Demographic and Health Survey (GDHS), the national neonatal mortality rate was reported at 17 deaths per 1,000 live births, indicating a decline from previous years. This figure reflects progress towards the Sustainable Development Goal (SDG) target of reducing neonatal mortality to at least 12 deaths per 1,000 live births by 2030 (Ghana Statistical Service, Accra, Ghana, 2023). However, neonatal mortality continues to account for a significant proportion of under-five mortality, pointing to persistent gaps in quality of care. At the Tamale Teaching Hospital, complications arising from prematurity and birth asphyxia account for approximately one-third of neonatal deaths (Abdul-Mumin et al., 2021). A complementary study at the Eastern Regional Hospital also identified low birth weight, hypothermia, and hyperthermia as major contributors to early neonatal mortality (Adongo & Ganle, 2023).

These clinical risks are compounded by structural and systemic challenges. Unequal distribution of skilled healthcare personnel, poor facility preparedness, and shortages of essential neonatal equipment hinder the consistent delivery of high-quality care. In response, national policies such as the National *Newborn Health Strategy* and *Free Maternal Health Care Policy* were introduced to bridge these barriers (Adongo & Ganle, 2023). Sacks et al., observed that improvements in facility-based care, particularly better equipment and clearer clinical procedures, contributed to reductions in neonatal mortality across three regions of Ghana (Sacks et al., 2022).

Taken together, these findings underscore the need for a context-sensitive and integrated approach to neonatal care in Ghana. Addressing neonatal mortality will require not only strengthening clinical interventions such as resuscitation, thermal care, and infection prevention, but also dismantling the sociodemographic and systemic barriers that continue to impede access to quality newborn care.

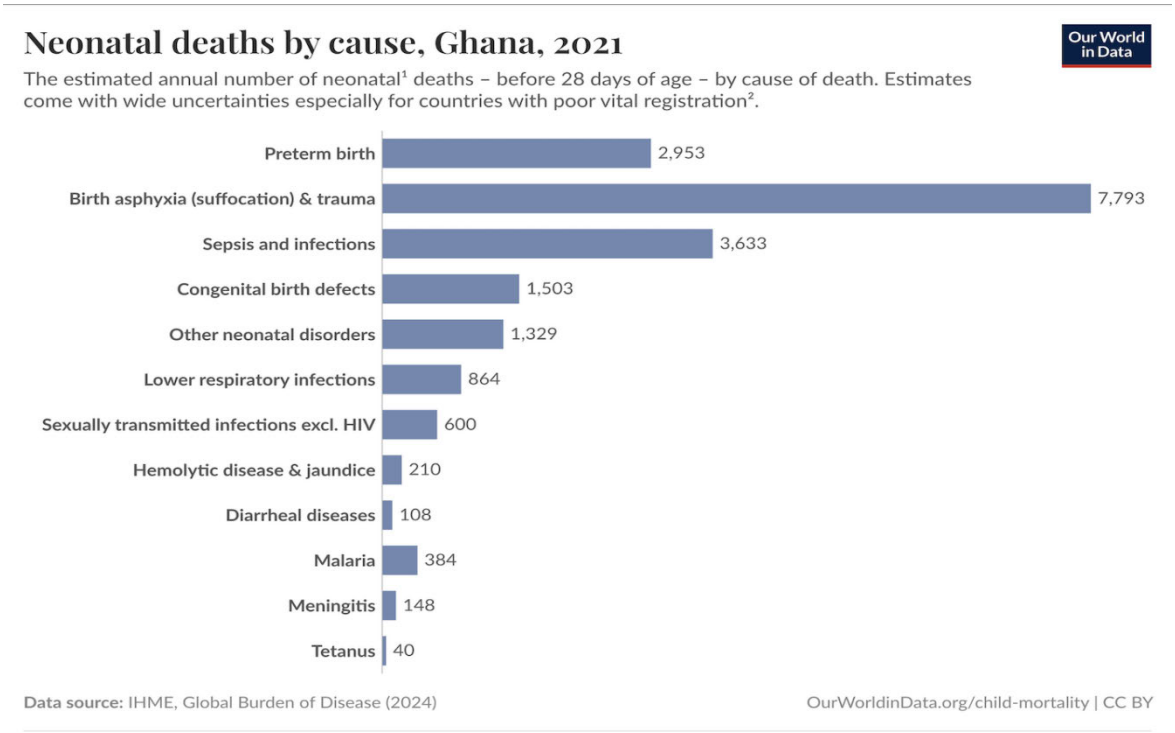

Figure 3. Neonatal deaths by cause in Ghana, 2021.

Source: (Our World in Data, 2025)

2.3.3. Interventions and Challenges in Neonatal Respiratory Care

In response to the high neonatal mortality rate from preventable causes, the American Academy of Paediatrics and the World Health Organization (WHO) have developed evidence-based guidelines for newborn resuscitation and respiratory support (Yamada & Halamek, 2023). These include simple but useful techniques like stimulating the newborn or starting breathing with bag-and-mask ventilation equipment (*Essential Newborn Care Course Second Edition).*

The Helping Babies Breathe program is an important initiative that adapts the WHO Neonatal Resuscitation Programme (NRP) for low-resource settings. The program offers health workers in LMICs valuable training and instructional materials that improve their ability to perform immediate and efficient neonatal resuscitation (Mendhi et al., 2020). However, despite such programmes, the proportion of neonatal deaths among under-five children has

continued to rise in some settings, highlighting persistent challenges related to care quality, timely intervention, and the availability of trained personnel. For instance, intrapartum asphyxia, which refers to a condition where a baby experiences oxygen deprivation during the labor and delivery process, remains a major cause of neonatal mortality and is associated with long-term neurodevelopmental impairments in an estimated 1 million survivors and approximately 2 million stillbirths annually (V. V. Shukla & Nimbalkar, 2021).

These realities highlight the urgent need for improved implementation strategies and quality assurance mechanisms, particularly in resource-constrained health systems.

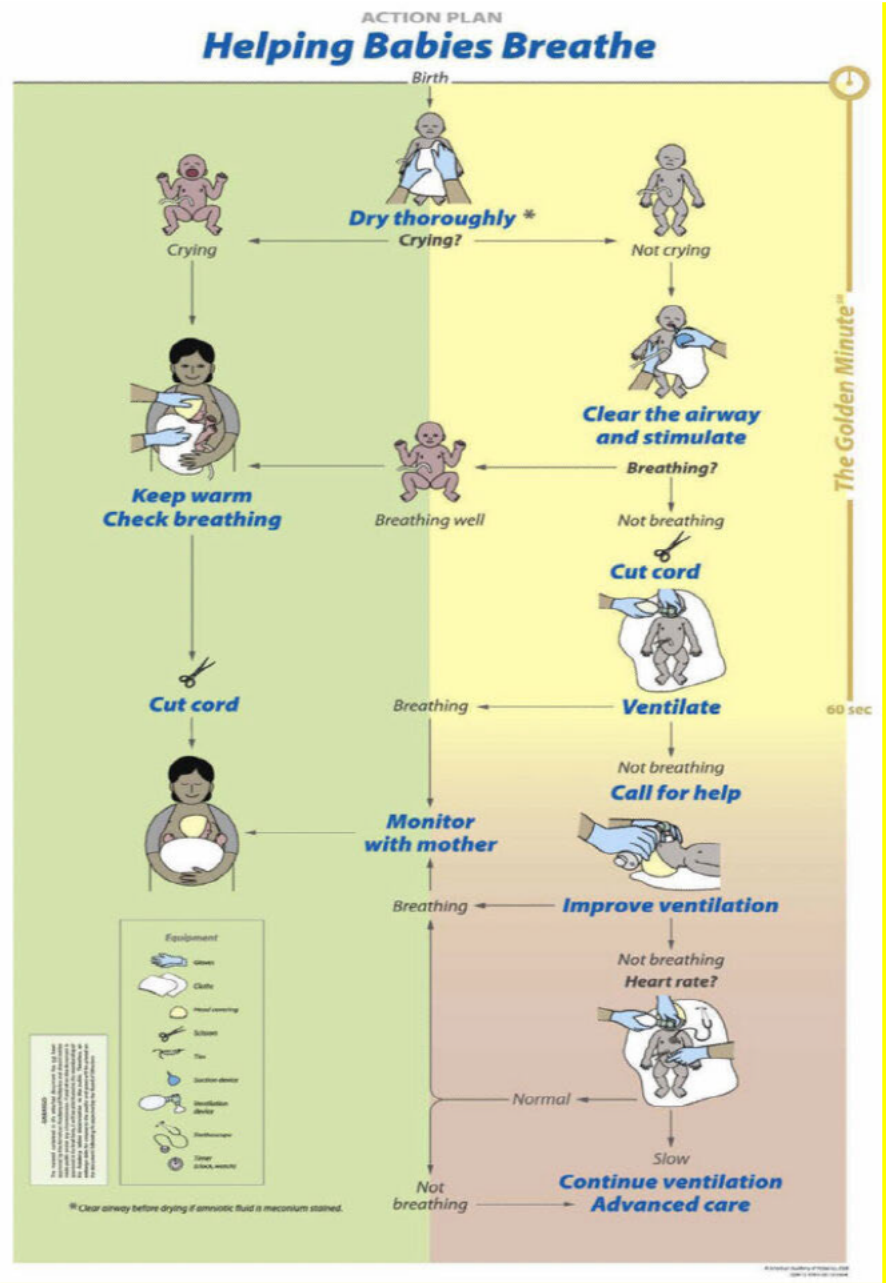

Figure 4. Action Plan for Helping Babies Breathe for lower levels of the health system.

Source: (Wall et al., 2009)

2.4. Neonatal Respiratory Distress Syndrome (RDS) and Its Management

2.4.1. Clinical Background and Diagnosis

Neonatal respiratory distress syndrome (nRDS) is a leading cause of respiratory morbidity and mortality among preterm neonates, particularly in low- and middle-income countries (LMICs), where access to advanced respiratory technologies is limited (V. V. Shukla & Nimbalkar, 2021). RDS is caused by a deficiency of pulmonary surfactant, a substance essential for reducing alveolar surface tension and preventing lung collapse. Although surfactant production begins between 24 and 28 weeks of gestation, it typically does not reach optimal levels until around 35 weeks. As a result, premature neonates are especially vulnerable to respiratory failure. While respiratory distress affects both preterm and term neonates, the causes differ. In term newborns, conditions such as birth asphyxia, meconium aspiration, retained lung fluid, or infections. In contrast, preterm neonates typically present with classic RDS due to insufficient surfactant production (Hedstrom et al., 2018). These conditions result in neonatal mortality and long-term neurodevelopment challenges, especially when immediate and effective respiratory care is not provided (Baiden & Wilson, 2021).

In resource-limited settings, where diagnostic tools such as radiographic imaging or blood gas analysis may be unavailable, healthcare professionals often rely on clinical scoring systems to assess disease severity and triage care. Developed in 1956, the Silverman Andersen Respiratory Severity Score (RSS) is now a commonly used bedside tool. It offers a simple, non-invasive method for evaluating five observable signs of respiratory effort: upper chest movement, lower chest retraction, xiphoid retraction, nasal flaring, and expiratory grunting. Each is scored from 0 (normal) to 2 (severe), with a maximum score of 10. The RSS has been effectively implemented in many LMICs to guide treatment based solely on physical observation (Hedstrom et al., 2018). A modified version of the RSS, introduced by Feldman et al., incorporates additional indicators such as respiratory rate, oxygen saturation, and wheezing (Feldman et al., 2015).

Despite its practicality and low training requirements, the RSS has not been extensively validated in recent studies. Further research is needed to understand its application in clinical decision-making, such as patient transfer or escalation of respiratory support (Hedstrom et al., 2018). Nonetheless, the tool remains particularly valuable in LMICs due to its simplicity, quick administration, and minimal resource demands.

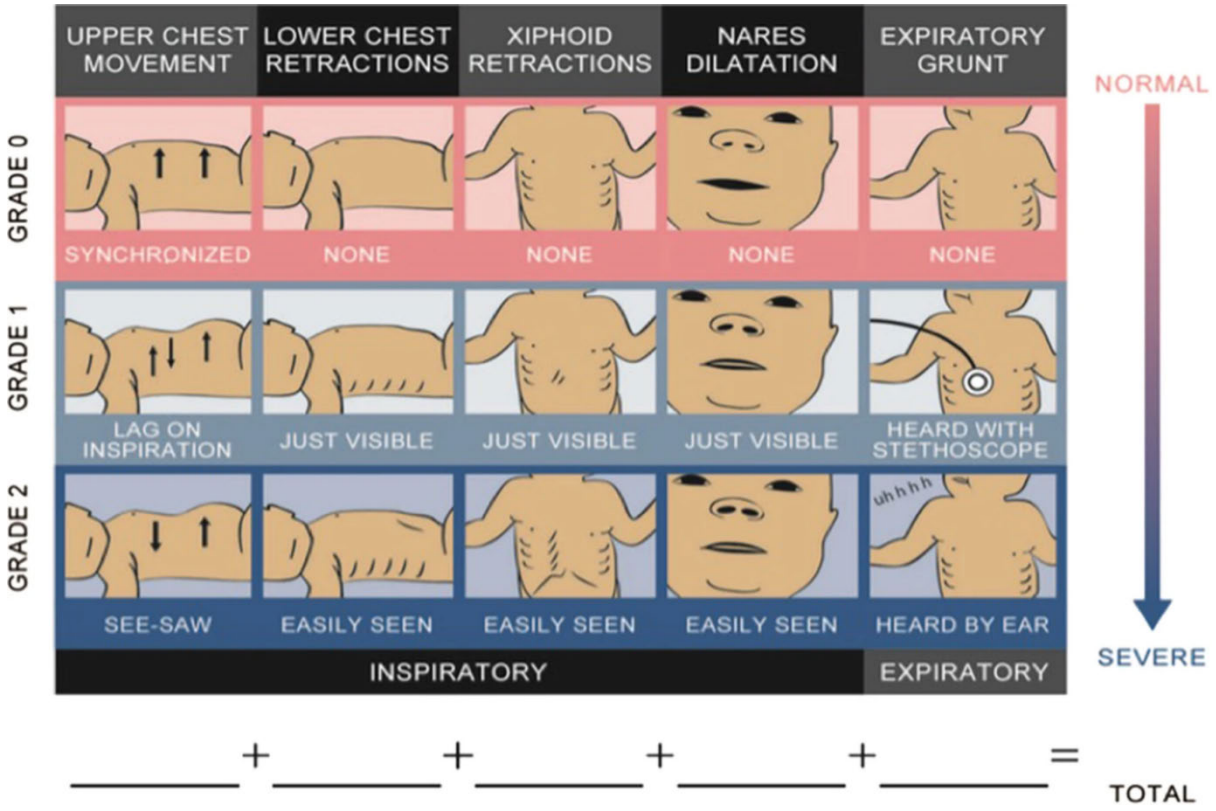

Figure 5. Silverman Andersen Respiratory Severity Score (RSS).

Source: (Hedstrom et al., 2018)

2.4.2. Treatment Strategies

2.4.2.1. Invasive and Non-Invasive Ventilation Approaches

Neonatal respiratory support can be broadly categorized into two types: invasive methods and noninvasive methods. Invasive ventilation, such as mechanical ventilation via endotracheal intubation, is typically reserved for critically ill neonates and requires access to specialized equipment and skilled healthcare providers. Although effective, this method is associated with a higher risk of complications, including ventilator-associated infections and lung injury (Mahmoud et al., 2022). In contrast, non-invasive approaches, especially continuous positive airway pressure (CPAP), have become increasingly common, particularly in resource-limited settings. CPAP is considered a safe, cost-effective, and practical intervention for managing neonatal respiratory distress. According to Martin et al., CPAP has proven especially valuable in low- and middle-income countries, where it has become an essential component of neonatal care (Martin et al., 2014).

2.4.2.2. Mechanisms and Benefits of CPAP

Continuous positive airway pressure (CPAP) is a widely used noninvasive technique for supporting breathing in neonates, particularly those with respiratory distress syndrome (RDS) or apnea of prematurity. CPAP works by gently applying continuous pressure to the neonate's airways, helping to keep the lungs open, improve oxygenation, and reduce the effort required to breathe. This consistent support reduces the risk of frequent breathing pauses. Multiple studies have demonstrated that CPAP is a safe and effective intervention for managing respiratory difficulties in preterm neonates (Lemyre et al., 2017).

When combined with early surfactant administration, CPAP has been shown to further reduce injury and improve clinical outcomes, especially in preterm neonates weighing more than 1500 grams. Clinical research also shows that using CPAP is linked to a decreased incidence of chronic lung illness and reduced neonatal mortality. However, like all interventions, CPAP carries risk, including the potential for complications such as pneumothorax (Ho et al., 2020).

2.4.2.3. CPAP Modalities and Adaptation in LMICs

Bubble continuous positive airway pressure (bCPAP) is one of the most commonly used CPAP delivery systems in low- and middle-income countries. It is valued for its affordability, simplicity, and adaptability. Unlike more complex ventilator devices, bCPAP generates positive airway pressure by immersing the expiratory limb of the breathing circuit in water, eliminating the need for advanced equipment (Dundek et al., 2021). Despite its effectiveness, several challenges have been documented, including nasal injuries, inconsistent pressure delivery, and the absence of standardized maintenance protocols, which highlight the need for further research and optimization (Prakash et al., 2023). In resource-limited settings, bCPAP systems are typically assembled using oxygen concentrators and short bi-nasal prongs, with wide-diameter tubing (≥1 cm) used to stabilize pressure. These basic components are crucial for ensuring safe and effective operation(Kawaza et al., 2014).

However, efforts to scale up CPAP implementation in LMICs continue to face significant barriers, such as unreliable supply chains, limited biomedical engineering support, and frequent power outages (Dada et al., 2021). Nevertheless, the life-saving potential of bCPAP is well documented. For example, a study conducted in South Africa reported a substantial decline in neonatal mortality from 42.5% to 14.1% following the introduction of CPAP (Lategan et al., 2022). While CPAP has long been a standard intervention in high-income countries to reduce the need for invasive ventilation, its broader application in LMICs requires context-specific solutions to address infrastructural and operational constraints (Dewez et al., 2018).

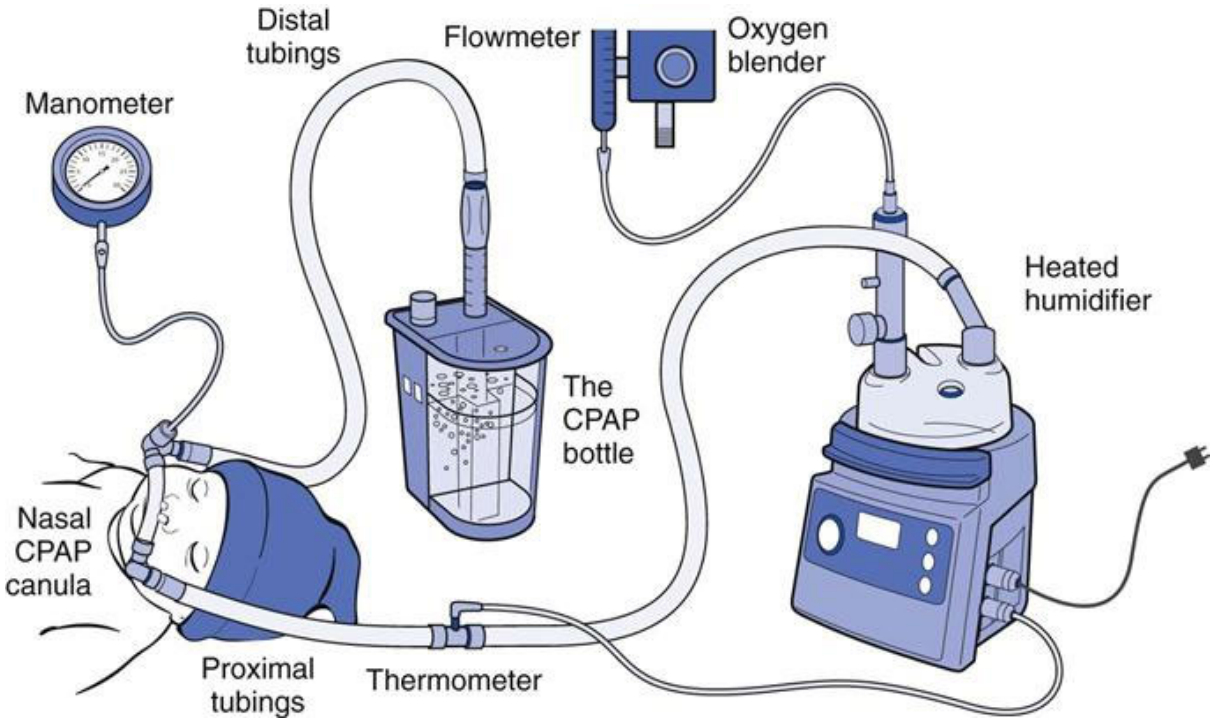

Figure 6. Diagram of the Bubble CPAP Delivery System.

Source : (Themes, 2016)

2.4.3. Clinical Guidelines and Contextual Adaptation of CPAP Use

2.4.3.1. International Guidelines on CPAP Use

The European Consensus on the Management of Neonatal Respiratory Distress Syndrome recommends starting CPAP early in preterm neonates, especially those born before 30 weeks of gestation, provided they are breathing spontaneously (Sweet et al., 2013). The guidelines advise starting CPAP at pressure levels between 6 and 8 cm H_2O to help maintain alveolar stability without causing overinflation. To reduce the risk of oxygen toxicity, oxygen saturation levels should be maintained between 90% and 95%. This approach is supported by clinical evidence. For instance, a study by Cao et al., confirmed the effectiveness of these CPAP settings in improving outcomes among preterm neonates (Cao et al., 2020). Early CPAP initiation, ideally in the delivery room, has also been shown to reduce the need for surfactant administration and mechanical ventilation. A systematic review by Ramaswamy et al., found that early use of CPAP in preterm newborns was linked to improved respiratory outcomes and a decreased need for invasive assistance (Ramaswamy et al., 2023).

To ensure safe and effective delivery of care, the World Health Organization recommends that CPAP use be carried out by adequately trained healthcare personnel, using functional respiratory equipment and adhering to standardized protocols (WHO, 2019).

2.4.3.2. Contextual Adaptation in Low- and Middle-Income Countries (LMICs)

Implementing global CPAP recommendations in low- and middle-income countries (LMICs) often requires careful adaptation to overcome constraints with infrastructure limitations, workforce shortages, and constrained resources. The Belize Neonatal Clinical Guidelines (2018–2021) offer a practical example of how international guidelines can be tailored for use in resource-limited settings.

According to these national guidelines, neonates at risk of RDS, particularly those born before 30 weeks of gestation who do not require immediate intubation, should be started on nasal CPAP (nCPAP) as early as possible. The recommended interface includes a nasal mask or short bi-nasal prongs, with an initial positive end-expiratory pressure (PEEP) of 6 and 8 cm H_2O. This pressure should be adjusted based on the neonate's oxygenation and perfusion status. To prevent both hypoxia and hyperopia, the guidelines recommend setting oxygen saturation alarm limits between 89% and 96%, a range intended to reduce complications such as retinopathy of prematurity (ROP), necrotizing enterocolitis (NEC), and increased mortality. The guideline further recommends combining nCPAP with early rescue surfactant therapy as the optimal approach for managing RDS in preterm infants. Additionally, for the weaning phase, the high-flow nasal cannula (HFNC) is suggested as a suitable alternative to nCPAP, offering greater ease of use and improved patient comfort (MINISTRY OF HEALTH BELIZE, 2021).

For these adaptations to be effective and sustainable, LMICs must invest in systems that support their implementation. This includes user-centred training and mentorship programmes for healthcare personnel, regular maintenance protocols for CPAP equipment, and robust monitoring and evaluation frameworks to ensure clinical quality and safety (Dada et al., 2021). Such supportive systems are essential not only for the successful rollout of CPAP interventions but also for their long-term integration into neonatal care across diverse resource-constrained settings.

2.5. Barriers to Neonatal Respiratory Care in Resource-Limited Settings

2.5.1. Systemic and Infrastructure Challenges

Continuous Positive Airway Pressure (CPAP) and other respiratory support measures are critical for managing newborn respiratory distress, especially in environments with limited

resources. However, systemic and infrastructure issues frequently delay their effective implementation. According to Kinshella, Salimu, et al., they include inadequate oxygen supplies, unstable electricity, equipment maintenance delays, and a lack of monitoring instruments, all of which lead to less than ideal neonatal outcomes (Kinshella, Salimu, et al., 2020).

Even with clinical recommendations and CPAP's demonstrated effectiveness, implementation in LMICs remains inconsistent, largely due to shortages of qualified personnel and limited access to affordable respiratory equipment and consumables (Ekhaguere et al., 2019).

2.5.2. Frontline Experiences and Constraints

In environments with low resources, neonatal care personnel frequently face severe shortages of clinical infrastructure, trained personnel, and necessary equipment, which impede the provision of good healthcare services (Kaur et al., 2023). The efficient application of modern respiratory technology is further constrained by power outages and restricted availability of sterilized tools, with facilities having to reuse tools that are meant to be used as disposables (Wu et al., 2022). The introduction of bCPAP, though promising, is frequently impeded by logistical hurdles such as difficulty in procuring consumables and spare parts, especially in low-resource settings where finances are a challenge (Poletto et al., 2023). The COVID-19 pandemic has further exacerbated these constraints, diverting critical resources and leading to increased mortality even among non-COVID-19-infected neonates in affected regions (Klingenberg et al., 2021).

2.5.3. Leadership, Coordination, and Standardization Gaps

Neonatal respiratory care is further challenged not only by institutional weaknesses but also by material and infrastructure issues. Ineffective coordination and response are hindered by poor interdisciplinary team communication and weak leadership at the local, national, and community levels. Furthermore, the consistency and quality of care delivery are still constrained by the lack of standardized clinical guidelines (Moxon et al., 2015). To address these existent challenges, a number of targeted strategies have been proposed and tested in LMICs.

2.5.4. Strategies for Improving Neonatal Respiratory Care

In response to the systemic barriers outlined above, a range of context-specific interventions have emerged to improve neonatal respiratory care in low-resource settings. Mentorship programs, low-cost CPAP devices, and targeted, facility-based training have shown promising results in reducing neonatal mortality and improving care standards (Kinshella, Salimu, et al.,

2020). CPAP, in particular, continues to demonstrate effectiveness in enhancing neonatal outcomes when safely implemented with trained personnel and basic support systems.

However, sustainable success depends on addressing the operational conditions that support these interventions. Studies emphasize the need for targeted investments in equipment maintenance systems, human resources, and reliable infrastructure. Tailored training and mentorship programs, especially those designed for frontline workers, are crucial for improving practical competencies and confidence in managing respiratory distress (Kinshella, Walker, et al., 2020). Ultimately, integrated and locally adapted solutions are key to ensuring the safe, consistent, and long-term delivery of neonatal respiratory support across LMICs (Dada et al., 2021).

2.6. Training and Competency in Neonatal Respiratory Care

Improving neonatal outcomes in low-resource settings requires healthcare professionals to be adequately trained in managing respiratory conditions. However, persistent gaps in training access, instructional content, and supervisory support limit the quality and effectiveness of care delivery.

2.6.1. Gaps in Training

Training deficiencies significantly affect healthcare workers' ability to manage neonatal respiratory distress, especially in low- and middle-income countries. Key concerns include poor infection prevention and control practices, which contribute to healthcare-associated infections (Yee et al., 2021). Sharma et al. (2021) found that many neonatal and maternal health training programs in LMICs lacked hands-on skill-building opportunities, ongoing supervision, and critical clinical content. These limitations reduce the long-term impact of training interventions and hinder the development of emergency care skills (Sharma et al., 2021). Additionally, inadequate infrastructure and lack of essential resources further obstruct the practical application of evidence-based practices for managing respiratory distress syndrome (Ekhaguere et al., 2022). Digital innovations, including e-learning platforms and mobile apps, offer promising solutions, especially for neonatal resuscitation training. However, there are persistent challenges in assessing the long-term effects on healthcare provider performance and neonatal outcomes. Horiuchi et al. (2024) stress the need for updated training content, innovative delivery methods, strong post-training supervision, and effective training information systems to improve care quality and reduce neonatal mortality rates (Horiuchi et al., 2024).

2.6.2. The Impact of Training on Neonatal Outcomes

Training healthcare professionals in the use of continuous positive airway pressure (CPAP) can greatly improve neonatal survival in resource-limited settings. Effective training, often incorporating peer mentorship and train-the-trainer models, enhances the healthcare provider's knowledge, confidence, and practical skills in using CPAP safely. When implemented effectively, CPAP can be safely used in district-level hospitals, especially for managing prematurity and acute respiratory distress syndrome (Olayo et al., 2019).

In Ghana, Baiden & Wilson showed that targeted training enabled frontline staff to administer CPAP safely, resulting in a markedly lower mortality rate for children experiencing respiratory distress (Baiden & Wilson, 2021). Similarly, Silem et al., discovered that nurses' performance and comprehension of CPAP care greatly improved following the implementation of a focused educational strategy (Silem et al., 2019).

2.6.3. Innovative and Contextualized Training Methods

A recent study carried out in regional hospitals in Ghana assessed the effectiveness of two strategies for training in newborn resuscitation: classroom-based training (CBT) and simulation-based training (SBT). The assessment focused on the skills acquisition, knowledge retention, and practical application of techniques by healthcare workers. Although both approaches were shown to improve outcomes in neonatal care, simulation-based training (SBT) showed greater advantages in improving practical skills, boosting confidence, and ensuring long-term retention, especially in settings with limited resources. These findings highlight the necessity for training methods that are contextually relevant and practical as key elements in initiatives aimed at decreasing neonatal mortality (Brathwaite et al., 2020).

Training is essential for improving neonatal respiratory care in low-resource settings. Major gaps include outdated content, poor infrastructure, and limited follow-up. While digital tools offer potential, structured programs, especially those using CPAP and simulation-based methods, deliver better outcomes in skill-building and confidence. Tailored, practical training approaches remain central to improving neonatal survival.

2.7. Summary of Literature Review

The literature review highlighted the persistent challenge of neonatal mortality in low- and middle-income countries (LMICs), with respiratory distress syndrome (RDS) remaining a leading contributor, especially among preterm infants. Although CPAP has been shown to effectively improve outcomes, its application is still limited by challenges related to

infrastructure, training, and systemic factors. Training methods such as simulation-based and tailored to specific contexts have been identified as effective strategies for enhancing the skills of providers and the quality of care; however, there are still deficiencies in implementation, equipment access, and institutional backing. To further investigate these challenges from the perspective of healthcare personnel, the next chapter presents a phenomenological qualitative study exploring the lived experiences, training, and systemic constraints encountered by neonatal care professionals at the Greater Accra Regional Hospital.

3. Research questions and objectives

3.1. Research Questions

3.1.1. Experiences and Challenges Faced by Neonatal Care Personnel

What challenges do neonatal personnel in the Greater Accra Regional Hospital face performing their roles in respiratory care?

3.1.2. Training and Competency in Neonatal Respiratory Care

How do identified training gaps affect the performance of neonatal personnel at the Greater Accra Regional Hospital in managing respiratory distress?

3.1.3. Outcomes of Neonatal Respiratory Care

What is the impact of CPAP training programs on the ability of healthcare workers at the Greater Accra Regional Hospital to manage neonatal respiratory care?

3.2. Research Objectives

3.2.1. Experiences and Challenges Faced by Neonatal Care Personnel

To identify the challenges faced by neonatal personnel at the Greater Accra Regional Hospital in respiratory care.

3.2.2. Training and Competency in Neonatal Respiratory Care

To examine how training gaps affect the performance of neonatal personnel in managing respiratory distress at the Greater Accra Regional Hospital.

3.2.3. Outcomes of Neonatal Respiratory Care in Resource-Limited Settings

To assess the impact of CPAP training programs on the management of neonatal respiratory care by healthcare workers at the Greater Accra Regional Hospital.

4. Methodology

4.1 Introduction

This section outlines the research design, setting, sampling strategy, data collection process, and methods for ensuring data security and analysis.

4.2. Study Design

Semi-structured, in-depth interviews (see Appendix VI) were used to capture rich, descriptive narratives from healthcare professionals working in the neonatal unit of the Greater Accra Regional Hospital (GARH). This approach allowed participants to express their experiences in their own words, which enabled the researcher to identify recurring themes and shared meaning across cases. In line with Creswell, phenomenological research focuses on individuals' lived experiences of a phenomenon, aiming to distill the essence of those experiences through thematic analysis (Creswell, 2007).

While the initial analysis followed a phenomenological orientation, allowing the voices and meanings of participants to emerge inductively, the findings were subsequently interpreted through a multi-theoretical lens. Role theory helped clarify the expectations and challenges related to the duties of the healthcare workers (Li, 2022). Human Factor Theory contributed to the understanding of how environmental factors and equipment affect the delivery of care (Yamada et al., 2019). Social Cognitive Theory offered a framework for exploring self-efficacy, learning through observation, and training experiences (Islam et al., 2023). The combination of this theory-driven analysis added value to the depth of the research findings while maintaining the essential principles of the phenomenological approach.

4.3. Research Setting

The study was conducted in the Neonatal Intensive Care Unit (NICU) of the Greater Accra Regional Hospital. This study setting was chosen for the study because, as a secondary healthcare facility with some tertiary services, it serves as a referral centre for district hospitals and clinics throughout the Greater Accra Region, providing specialised care. The facility also serves as a referral centre for many maternal and child cases coming from the various districts within the region and beyond. However, it is not the primary tertiary hospital in Ghana. The NICU at the Greater Accra Regional Hospital is classified as a level III intensive care unit and hence manages newborns and preterm infants requiring regular nursery care, intensive care, and comprehensive care for seriously ill infants. The unit has a bed capacity of 60, with an average daily inpatient rate of 26 neonates. About 75–100 neonates are admitted to the unit per month. The total number of admissions recorded during the 2-month study period of

December and January was 368. The unit is managed by one neonatologist (supported by house officers), three paediatric residents under training, a medical officer, and 24 registered nurses, giving a permanent staff strength of 30. The nurses in the unit run a double shift system (day and night duties) with an average nurse-patient ratio of 1:10 for each shift.

4.4. Inclusion and Exclusion Criteria

To maintain the relevance and trustworthiness of the data, specific criteria for inclusion and exclusion were established for participant selection. The study targeted healthcare professionals—physicians, nurses, and clinical engineers—who had direct involvement in neonatal respiratory care. House officers were eligible if they had undergone training in the neonatal department, while nurses, medical officers, consultants, and clinical engineers were included if they possessed a minimum of one year of experience in neonatal care. These criteria ensured that participants were familiar with the challenges and practices associated with neonatal respiratory support.

Healthcare workers who were not directly engaged in neonatal respiratory care, as well as those who did not provide written informed consent, were excluded to maintain the integrity and focus of the study.

4.5. Sampling and Recruitment

Purposive sampling was used in the study, and participants were chosen based on their engagement in neonatal respiratory care and their professional roles. By using this method, the researcher was able to identify individuals who had practical experience and knowledge related to the goals of the study (Babaie et al., 2023). To ensure that the information acquired would be rich and contextually grounded, the inclusion criteria specifically targeted medical experts who actively worked in neonatal respiratory care. Two senior staff members, consisting of a doctor and a nurse, helped recruit participants by identifying eligible colleagues and sharing the study invitation. Their established connection with their colleagues made it easier to engage participants and guarantee efficient coordination. The researcher then gave participants an explanation of the study's goals and methods. The study's objectives were then described to healthcare professionals who showed interest in it during a one-on-one discussion. Those who agreed to participate signed a written informed consent form prior to the interviews (see Appendix V). The data saturation approach was used to determine the final sample size. As explained by Rahimi & Khatooni, in qualitative research, saturation is reached when no new information or themes emerge from further interviews. Data saturation was reached in this study during the fifteenth interview. when no new insights were found, and

the responses started to repeat. Thus, the sample size was deemed sufficient for a thorough examination of the phenomenon being studied (Rahimi & Khatooni, 2024).

Table 1. Demographics of Participants

PROFESSION	ROLE/RANK	NUMBER OF PARTICIPANTS	YEARS OF EXPERIENCE	GENDER
NURSING STAFF	Nurse in Charge	1	10+ years	Female
NURSING STAFF	Neonatal Nurse	1	2–5 years	Female
NURSING STAFF	Registered Nurse	3	1–6 years	Female (2), Male (1)
NURSING STAFF	Senior Nursing Officer	1	8+ years	Female
MEDICAL DOCTORS	House Officer	1	< 1 year	Male
MEDICAL DOCTORS	Medical Officer	1	1+ years	Male
MEDICAL DOCTORS	Resident (Pediatric Specialty Training)	3	1–3 years	Male (1), Female (2)
MEDICAL DOCTORS	Consultant Pediatrician	1	10+ years	Male
RESPIRATORY THERAPISTS	Respiratory Therapist	2	1–4 years	Male
CLINICAL ENGINEER	Biomedical/Clinical Engineer (NICU Support)	1	2+ years	Male

Source: Own Illustration

4.6. Data Collection Instrument

A semi-structured interview guide (see Appendix VI) was specifically developed for this study for the healthcare professionals. The data collection tool comprised four separate sections, namely, (1) introductory background information of the participants, (2) experiences and challenges in their daily practices, (3) training received in the area of neonatal respiratory care, and (4) outcome of management based on the training received. The questions were open-ended to accommodate probing to get in-depth information from the participants. The tool was subjected to validity procedures with expert review, followed by piloting on two healthcare

professionals who worked in an external healthcare facility in the Greater Accra Region. This process helped in the modification of the research questions.

4.7. Data collection procedure and techniques

The research was conducted according to the institutional ethical guidelines of the Ghana Health Service and the standard ethical practices for conducting research. Approval was initially obtained from the medical director as well as the consultant of the department. Potential participants were all given information on the overall aim of the study and the procedures involved before and during data collection. Questions by participants were addressed to their satisfaction, and those who expressed interest in the study were given written consent forms to sign as evidence of willingness to participate freely. Participants were recruited sequentially, and the interviews followed the same pattern within the period of December 2024 and January 2025 until the 15th participant was interviewed. All the interviews were conducted by the principal investigator. The interaction with the participants was done through in-depth interviews using open-ended questions. Nonverbal cues, gestures, and observations were noted and written in the field notes book. All interviews were recorded using an audiotape recorder. Each interview session lasted for 20-50 minutes.

4.8. Ethics approval and consent to participation

Ethical clearance was obtained from the Ethics Committee of the Hamburg University of Applied Sciences (see Appendix I) and the Ghana Health Service Ethical Review Committee (GHS-ERC) (see Appendix II) with the number GHS-ERC:042/09/24. The ethical approval from the GHS-ERC was sent to the study site for the author to undertake the study. The purpose of the study was explained to the participants, and their informed consent was sought through administering consent forms for them to sign. The consultant of the neonatal department permitted the use of the consultant's office for the in-depth interviews, and this was kept under lock and key to ensure confidentiality.

4.9. Methodological rigor

To ensure credibility, trust was built with all study participants right from the recruitment phase, which helped for successful interactions for in-depth information to be obtained. Field notes were taken, and information about members was checked to ensure that the data were not mixed. By maintaining a thorough record of every step taken and choice made during the study process, reliability, which is defined as the consistency of data under changing conditions, was ensured. A clear explanation of the study's methodology was given to assist replication in order to increase credibility. Avoiding any distortion of the participants' voices

was another way to prioritize confirmability. Interviews were transcribed immediately to preserve the data's integrity (Nowell et al., 2017).

4.10. Data Analysis

A multitheoretical framework, including role theory, human factors theory, and social cognitive theory, guided the iterative theme method used to analyze the data. This lens enabled exploration of role expectations, environmental influences, and self-efficacy in neonatal respiratory care. Interview transcripts (see Appendix VII) were imported into MAXQDA (version 24) to support systematic coding and data organization (Naeem et al., 2023). Open coding was used to find important patterns and themes after familiarization through repeated readings. These codes were continuously examined, improved, and categorized into more general groups.

During the data analysis, four main themes emerged, which reflected distinct but interrelated aspects of the participants' experiences. The themes emerged inductively from the data, ensuring alignment with participants' voices.

Reflexivity was maintained through the writing of memos and regular review to reduce bias. Data saturation was reached when no new themes emerged in the final interviews. This analytical approach supported a distinct understanding of the systemic, contextual, and individual factors that influence neonatal respiratory care.

4.11. Summary of Methodology

This research adopted a qualitative approach using a phenomenological design to explore healthcare workers' experiences in neonatal respiratory care. The study was conducted in the Neonatal Intensive Care Unit (NICU) of the Greater Accra Regional Hospital, a major referral center in Ghana. Participants were selected through purposive sampling and included doctors, nurses, and clinical engineers with direct experience in neonatal care. Interviews were conducted face-to-face using a semi-structured guide that allowed participants to speak openly about their daily experiences, challenges, and training. All interviews were audio-recorded with informal consent and subsequently transcribed for analysis. A total of 15 interviews were completed, with data saturation achieved when no new themes emerged.

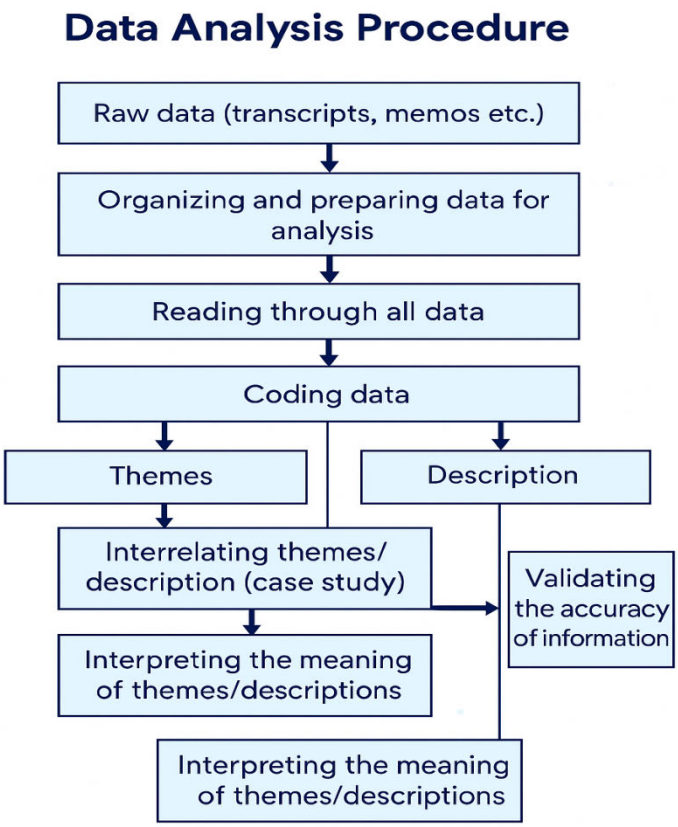

Figure 7. Process of data analysis in a qualitative inquiry.

Source: Own illustration based on Creswell 2007

The analysis was guided by three theoretical perspectives, which are role theory, human factors theory, and social cognitive theory. These helped frame the findings in relation to professional responsibilities, environmental and equipment challenges, and individual learning and confidence. Coding and thematic analysis were done using MAXQDA software, and care was taken to document the process clearly, maintain reflexivity, and ensure the data reflected participants' authentic voices. Ethical approval was obtained in both Ghana and Germany, and all necessary measures were taken to ensure confidentiality and voluntary participation. The findings from this analysis are presented in the next chapter, which explores the key themes and sub-themes that emerged from the interviews.

5. Results

5.1. Introduction

This chapter outlined the results obtained from fifteen semi-structured interviews carried out with nurses, doctors, respiratory therapists, and a clinical engineer engaged in neonatal respiratory care. The data were analyzed thematically with the aid of MAXQDA, in which codes were methodically created and refined. To provide clarity and explanation of the presentation, the results were categorized into four themes: (1) Structural and Systemic Constraints in Neonatal Respiratory Care, (2) Training, Competency, and Capacity Building, (3) Outcome on Neonatal Respiratory Care (4) Institutional Support and System-Level Coordination. Each part includes a variety of sub-themes that represent the different yet interconnected aspects of neonatal respiratory care in the facility. Direct expressions from the participants are included throughout to strengthen and provide a clear understanding of the theme while maintaining the originality of their voices.

5.2. Socio-Demographic Data

The study included 15 participants: six nurses, six medical doctors, two respiratory therapists, and one clinical engineer. All participants worked in the Neonatal Intensive Care Unit (NICU) at Greater Accra Regional Hospital (GARH), a leading tertiary facility that offers specialized neonatal care in Ghana. Among the nurses, one served as the nurse in charge, one as a neonatal nurse, three as registered nurses, and one as a senior nursing officer. These nurses had key roles in monitoring the neonates and managing the respiratory devices, as well as working with colleagues from other disciplines in the NICU. The medical doctors consisted of one house officer, one medical officer, three residents in training, and the consultant paediatrician with years of neonatal experience. Two respiratory therapists responsible for supporting the NICU team with the management of respiratory cases were also included. A clinical engineer assigned specifically to the NICU to provide technical maintenance and support was also interviewed. The experiences of participants ranged from three months to ten years plus, allowing the study to capture insights from freshly trained and experienced professionals within a busy neonatal referral center.

Table 2. Summary of Major Themes and Sub-themes.

THEME	SUB-THEME
1. STRUCTURAL AND SYSTEMIC CONSTRAINTS IN NEONATAL RESPIRATORY CARE	**1.1** Structural and Workforce Limitations in Neonatal Care **1.2** Equipment-Linked Complications and Resource Constraints **1.3** Adaptive Use of Diagnostics in Neonatal Respiratory Care **1.4** Underlying Clinical Drivers of Neonatal Respiratory Distress **1.5** Operational Demands and Referral Pressures in Neonatal Units 1.6 Psychosocial Aspects of Neonatal Care 1.7 Prioritizing Disability-Free Survival in Neonatal Care
2. TRAINING, COMPETENCY, AND CAPACITY BUILDING	2.1 Self-Directed Learning 2.2 Capacity Building Through Local Expertise 2.3 Structured Training Programs 2.4 Impact of Training on Confidence and Skills 2.5 Gaps in Training and Recommendations for Improvement
3. OUTCOME ON NEONATAL RESPIRATORY CARE	3.1 Clinical Management Strategies 3.2 Clinical Decision-Making Using Assessment Tools (e.g., RSS) 3.3 Team Collaboration in Care Delivery 3.4 Increased Autonomy and Role Expansion 3.5 Case-Based Respiratory Interventions
THEME 4: INSTITUTIONAL SUPPORT AND SYSTEM-LEVEL COORDINATION	4.1 Internal Institutional Investment and Needs

	4.2 External Institutional Support and NGO Collaboration
	4.3 Role Allocation and Support Systems (Engineering/Clinical)
	4.4 Strengthening the Neonatal Referral and Transport System
	4.5 Professional Motivation and Workplace Conditions

Source: Own

5.3. Theme 1: Structural and Systemic Constraints in Neonatal Respiratory Care

5.3.1. Sub-theme 1.1: Structural and Workforce Limitations in Neonatal Care

This theme explores the interconnected challenges related to infrastructure, workforce distribution, workflow, and delays in specialist responsiveness, factors that collectively hinder the quality and continuity of neonatal respiratory care. A recurring concern among participants was the uneven distribution of personnel, especially respiratory therapists, and the lack of nurses specialized in the management of neonatal cases.

As one therapist noted, "We are even 40 in Ghana, and about 20 of them have left. Most are in Korle-Bu or UGMC, and many are posted to adult settings. In Ridge, we are fortunate to have at least three in the NICU, but in many places, you'll only find one—if any." — R.T.-1

The frequent reassignment of general paediatric nurses to neonatal intensive care units, despite a lack of formal training in neonatology, intensified the problem, raising worries about the safety and suitability of the care provided.

A senior nurse remarked, "Yes, we have paediatric nurses, but they are not neonatal nurses... That's improvising... But let's be honest, will we ever get to 100% like that? This is not something you can take lightly. These are human lives." — S.N.O-1

Participants also noted the vulnerability of staffing pipelines and how elevated attrition rates, frequently caused by migration, resulted in units being understaffed. Nevertheless, a few proactive measures were shared. One respiratory therapist mentioned making an effort to find a solution by utilizing national service personnel, which resulted in increased shift coverage and enhanced continuity of care.

“I came here alone… Then I went to the university and asked them to send more national service personnel. Now we are five in the facility and can cover weekends, weekdays, and night duty. It’s becoming adequate.” — R.T.-1

Alongside workforce shortages, reliance on personnel who possess unwritten knowledge about equipment locations has introduced weaknesses in workflow. A resident illustrated how a nurse's deep understanding of the availability of limited yet operational devices could determine the success or failure of resuscitation attempts.

“Depending on the nurses… the ones that have been here for long know which ones are very functional, and because there are few, they know where they’ve hidden it. So as and when they are around, you now realise that your technique all of a sudden is yielding results—or not.” — R.D.-3

Personnel also expressed concerns about the unreliability of essential materials such as AMBU bags and face masks and were concerned as to who was responsible, particularly regarding uncertainty over who was responsible for assessing and replacing faulty equipment. Additionally, participants highlighted challenges related to structural design, which complicated routine maintenance and posed difficulties in adapting globally recommended practices to the local context. Especially concerning the use of donated respiratory devices.

You were given this beautiful facility… and you have the opportunity to learn from these people based on how they do their things… But we are back into old systems, though in a new building. But things will change.” — R.T.-1

These structural limitations were further intensified by deficiencies in specialist responsiveness. Participants reported examples where unclear referral expectations resulted in delays in clinical decision-making. One resident described a situation involving a hold-up in receiving ENT (ear, nose, and throat) specialist assistance:

“And I also think that the ENT was also not too sure. They had sent someone, a resident from their unit, who had come to assess and said that there was no upper airway obstruction. And the neonatologist here got frustrated: ‘We didn’t call you to confirm that—just look at the vocal cords!’ Eventually, we had to get their boss to come and review the baby herself.” — R.D.-3

Participants reported that these departmental gaps led to delays in clinical decision-making, especially in urgent situations requiring input from specialists. Their accounts often highlighted the need for workarounds and improvisation used to maintain care in the face of staffing shortages, equipment challenges, and unclear referral processes. These accounts

underscored the pressure experienced by both individuals and systems when structural support was viewed as insufficient.

5.3.2. Sub-theme 1.2: Equipment-Linked Complications and Resource Constraints

This theme examines the interconnected issues of inadequate equipment and the clinical complications that arise from it, especially in the treatment of neonatal respiratory distress. Participants often highlighted how restrictions in the quality, availability, and upkeep of equipment had direct impacts on patient outcomes, staff efficiency, and the overall quality of care provided.

Nasal septal injury was an important complication mentioned by most participants. Nasal prongs were reused in this setting. They became hardened due to the reagent used in sterilizing them. These nasal injuries were frequently due to repeated use of rigid or worn-out nasal prongs. A consultant disclosed the seriousness of this issue, stating:

“In the middle of last year, we gathered our data—60% of our babies were having nasal septum challenges, and that comes with poor care, right?” — C.S

Another attendee pointed out the seriousness of these injuries from a medical perspective.

“We have about two babies on the ward right now who have no nasal septum at all from long stays on the CPAP... They get a lot of cold air, and that becomes another problem.” — R.D.-1

These challenges in management were beyond just nasal septal injuries. They included a lack of diagnostic tools like arterial blood gas analyzers, which are needed for clinical accuracy and efficiency.

“If we had ABG, we would have known much earlier… If that baby had died, it would have been because of something like this.” — R.T.-2

Resource limitations also led to the prolonged manual bagging of neonates, the sharing of limited ventilators among patients, and delays in timely interventions. Lack of needed diagnostic tools led most clinicians to rely on their clinical judgment and instincts, increasing the risk of mismanagement of cases and suboptimal outcomes. These challenges, compounded by inconsistent maintenance practices and inadequate supplies, contributed to preventable complications and compromised the quality of neonatal respiratory care.

5.3.3. Sub-theme 1.3: Adaptive Use of Diagnostics in Neonatal Respiratory Care

Resource constraints spurred the use of lung ultrasound as a diagnostic tool. A participant shared,

“We had a term, baby... I put a probe there, and it was a diaphragmatic hernia... By day three, we were in the theater, and the baby survived” (C.S.).

Participants valued lung ultrasound for its diagnostic accuracy, particularly in light of limited access to X-ray services. Transporting neonates to the X-ray unit was often hindered by the absence of oxygen transport systems, making lung ultrasound a practical and efficient alternative. Reports suggested that it was often used to facilitate prompt clinical decisions in neonatal respiratory situations when alternative imaging methods were not readily available.

5.3.4. Sub-theme 1.4: Underlying Clinical Drivers of Neonatal Respiratory Distress

The leading causes mentioned were prematurity and its associated complications. A respiratory therapist stated,

“Most of the babies that come in are preterm... then sepsis, and the last one will be birth asphyxia” (R.T.-1).

A participant also confirmed this:

"The top cause of respiratory distress is respiratory distress syndrome, coupled with congenital pneumonia, meconium aspiration, and birth asphyxia" (C.S.).

Healthcare professionals often identified modifiable factors that often lead to neonatal respiratory distress, including poor prenatal care, delayed arrival from referral centers, and delayed resuscitation after delivery. Their insights highlighted these as recurring patterns in clinical presentations, especially in preterm and high-risk newborns.

5.3.5. Sub-theme 1.5: Operational Demands and Referral Pressures in Neonatal Units

This theme explores the dual pressures of a heavy clinical workload and a high volume of referrals—particularly from under-resourced or private facilities—on the day-to-day operations of neonatal care teams. Staff reported that internal clinical duties were already demanding, governed by strict protocols that required continuous coordination and timely intervention. These pressures were compounded by the frequent arrival of external referrals, many of which were unannounced and lacked adequate clinical documentation, making it difficult to prepare

effectively. Despite these challenges, care teams remained committed to established protocols involving routine monitoring, equipment checks, suctioning, FiO_2 adjustment, and thorough documentation. A participant illustrated the daily routine in the following way:

"Every morning, we start by checking bed availability—we have only 56 beds, including 6 NICU, 15 high care, and the rest low care, so space is tight. About 70% of our babies are inborn, and 30% are outborn. We review referral calls, speak with external facilities to assess which babies are suitable for admission, and liaise with the obstetric team for high-risk inborn deliveries. For the most critical cases, we're even present at delivery to receive the babies ourselves." — N.I.C.

Respiratory therapists, beyond managing technical devices, often participated in resuscitation in the delivery room and provided training for staff.

"I help with the management of respiratory devices... training staff and even preparing for resuscitations during high-risk deliveries." — R.T.-1

Although this clinical procedure is quite thorough, staff observed that it was often disrupted or strained due to the volume of unregulated referrals, many originating from private hospitals that did not have neonatal facilities. These transfers were typically uncoordinated, arrived without accompanying medical summaries, and competed for the limited NICU capacity alongside public-sector births. A consultant pointed out the inequity and the systemic disconnect:

"A top private hospital will refer an IVF baby... to compete for a space with a baby coming from a public hospital. It's not fair." — C.S.

"Our referrals mostly come from district facilities, public clinics, and some private hospitals. But there are major gaps—when a receiving staff member who is a nurse asks for the baby's RSS and the referring officer, even a senior one, doesn't know what that is, it shows how uneven the quality of care is across facilities." — R.D.-3

These referrals not only increased the clinical burden but also created ethical and logistical difficulties regarding prioritization and triage. The staff stated that most of these cases could easily have been handled at the referring hospital if they were adequately trained. Participants shared how the combination of internal clinical needs and numerous, often uncoordinated referrals added extra pressure to daily operations. These referrals, particularly from private facilities lacking neonatal resources, were noted to elevate workload, make triage decisions

more complicated, and test the capacity of available resources. Reports underscored the added challenges these referrals brought to the already stressed working environment.

5.3.6. Sub-theme 1.6: Psychosocial Aspects of Neonatal Care

This theme stressed the emotional and psychological stressors of neonatal respiratory care. It showed the interaction between the challenges faced by caregivers and the internal conflict experienced by healthcare providers.

Participants stated that insufficient health literacy, parental anxiety, and financial challenges often complicated clinical decision-making, especially when parents advocated for early discharge or misunderstood the purpose of CPAP.

“They want to take their children home, and you want to come and put oxygen on them... Some of them don’t even understand the saturation and all that.” — R.T.-1

“For some parents... the longer the baby stays, the more they’ll have to pay. That’s a big concern... If the baby is put on CPAP, they feel like it’s a death sentence.” — R.D.-1

Healthcare providers also faced their own emotional stress aside from dealing with communication with care providers. The demands of neonatal care, combined.

The demands of neonatal care, combined with limitations in infrastructure and results of management, left many staff psychologically burdened. These incidents were often seen as traumatizing, especially in instances where delays, poor communication, or systemic issues led to unfavorable outcomes.

A resident shared a particularly disturbing case that continued to trouble them:

“To this day, that’s one of the most challenging and unfortunate cases I’ve ever managed... and sadly, we lost the baby.” — R.D.-3

Participants' reports showed how the emotional stress of the job extended beyond caregivers to healthcare workers themselves. Several recalled experiences of helplessness, distress, and moral pressure. These narratives reveal an emotionally stressful working environment where both families and staff dealt with uncertainty, grief, and responsibility.

5.3.7. Sub-Theme 1.7: Prioritizing Disability-Free Survival in Neonatal Care

There was growing awareness that survival alone was insufficient; disability-free outcomes were prioritized. A participant noted,

"We *don't want them to become burdens for us... We need to improve survival, but crucially, disability-free survival." (C.S.).* Healthcare teams noted an increasing focus not only on survival but also on the long-term developmental health of newborns. Various accounts highlighted the importance of outcomes that maintain neurodevelopmental function, including requests for regular follow-ups and early intervention services for babies at risk.

5.4. Theme 2: Training, Competency, and Capacity Building

5.4.1. Sub-theme 2.1: Self-Directed Learning

This theme demonstrates that healthcare professionals commonly employ self-directed methods to address knowledge deficiencies in neonatal respiratory care, especially in situations where formal training is sparse or inconsistent. Staff often depended on observation, asking questions, personal curiosity, and online resources to enhance their clinical skills. Some participants pointed out that informal observation at the bedside during critical situations was a key learning resource.

"When I first came, I didn't know anything about it. I was just watching... So the next time a patient came in with that same presentation, I knew—I said, 'Oh, this one, we'll put on bubble CPAP,' and we actually did" (H.O.).

Some workers gained knowledge using online learning platforms, increasing their professional development despite restricted formal resources.

"There are a lot of online platforms… Icon Academy for respiratory therapists. We use that a lot to build ourselves... That is what we always use. We are not a lot, so we can't organize big events for training." (R.T.-1).

In many cases, self-directed learning was also driven by necessity, particularly in high-stakes situations:

"I got tired of watching babies die just because there was no one to intubate. So I asked myself, 'How hard can it be?' I decided to learn. They taught me, I practiced, and I did it. That's how I started." (S.N.O.).

Self-directed learning also took place during clinical rounds, discussions on the ward, peer-led study sessions, and through the use of open-access resources such as UpToDate and YouTube. Journal clubs and spontaneous teaching interactions with service engineers and colleagues further enhanced this learning culture. This illustrates a proactive and frequently

collaborative approach to self-directed learning among neonatal staff. While it highlights commendable individual initiative, it also emphasizes the system's reliance on informal methods due to a lack of structured institutional training.

5.4.2. Sub-theme 2.2: Capacity Building Through Local Expertise

The theme highlighted the role that the staff, especially respiratory therapists and nurses with years of experience, play in continuous training and solving issues in the neonatal care unit. Even in the face of limited formal or regular external training programs, internal capabilities have been steadily enhanced through models led by champions and peer-led refresh sessions. One nurse highlighted the development of initiatives led by nurses, describing how the initial efforts for CPAP implementation depended on local champions:

“We trained the group of nurses, and we turned them into champions. We call them nurse champions in the CPAP, and then they trained their colleagues... Before that, we were doing CPAP haphazardly” (C.S.).

Another participant emphasized the importance of utilizing internal knowledge:

“So we've gotten training on the respiratory support, and we've developed champions, people who are good in the training, like trainers of trainees, and then we have coaches who oversee the trainers of trainees and the other staff” (N.I.C.).

Local experts frequently addressed important needs by performing bedside demonstrations, tackling immediate equipment problems, and leading on-the-spot refreshers when new personnel joined. The involvement of respiratory therapists and experienced clinicians has therefore proven vital for upholding clinical standards in the absence of regular structured programs. In this theme, it was observed that trained primary staff, named as champions, and respiratory therapists served as the backbone for ongoing skill enhancement in neonatal respiratory care. Training sessions led by colleagues, mentoring from experienced staff, and refresher sessions were noted as foundations to capability-building initiatives.

5.4.3. Sub-theme 2.3: Structured Training Programs

Structured training programs were noted as the foundation for strengthening neonatal respiratory care. Participants across professional roles highlighted a variety of formal and informal training sessions, including user training, refresher courses, technical instruction, and externally led workshops, each contributing significantly to clinical preparedness and confidence. One clinical engineer described how training sessions were initiated in response to equipment arrivals and observed knowledge gaps:

"Yes, I remember when the CPAPs came in... Whenever we observe that the staff are not utilizing the machines properly, we ask, 'Are you familiar with this?' If we see there's a gap, we try to organize something" (M.E.).

The impact of these sessions was highlighted, especially noting the fact that they were rooted in practical, case-based methods: *"We brought in a resource person... it was hands-on. Very practical... They asked everything they needed, and they got answers." (M.E.).*

These sessions were seen as helpful for improving understanding and confidence in using respiratory devices. Both external facilitators and internal staff were recognized for their roles in conducting these training sessions, which comprised standard techniques and scenario-based learning.

5.4.4. Sub-theme 2.4: Impact of Training on Confidence and Skills

Training was noted as an important factor in boosting the confidence and independence of neonatal care providers, especially in emergency situations. Several participants described a change in their ability to rely on their own clinical judgment following practical case-based training sessions without waiting for a superior's approval before initiating a clinical action. One senior nursing officer shared how training helped her to have less doubt in making clinical decisions: *"So it has equipped me in knowing what to do at what time... whether there is a specialist around, whether there is a respiratory therapist around, it helps in the recovery process... the training has boosted my confidence" (R.N.-3).* Similarly, a resident reflected on the personal and professional growth experienced: *"It's given me a lot of confidence... I used to shiver whenever a new case came in... But now I feel so relaxed, so comfortable... I know what I'm supposed to do and when to do it... This has been the best training I've had so far." (R.D.-1).* Participants reported increased confidence in independently managing cases of respiratory distress, often without the need to wait for senior evaluation.

5.4.5. Sub-theme 2.5: Gaps in Training and Recommendations for Improvement

This theme underscores the various challenges hindering the consistent and effective delivery of neonatal respiratory care. Participants pointed out the weaknesses in the structure, frequency, and content of training programs. They emphasized how irregular and inconsistent training, together with limited technical expertise, undermines care quality. Additionally, the overreliance on a small and often overstretched workforce was a recurring concern. One participant noted that prolonged intervals between training sessions made it difficult to retain and apply essential skills in clinical practice.

“The first training session I had was when I started my house job. The next one was when I started the MO-ship. So you can imagine—almost a year, in fact, a year gap in between training. That’s one of the gaps, an actual gap.” (M.O.).

Another highlighted the challenge of simulation not matching real-life scenarios, showing a disparity between training environments and the realities of neonatal emergencies: *“The training, if done on a mannequin, is quite a gap from the actual, because you are intubating, there's blood all over the airway, the secretions... So the actual scene and the training are worlds apart sometimes” (R.D.-3).*

Furthermore, most health workers raised concerns regarding the irregular training sessions, resulting in an inability to maintain knowledge transfer. Turnover of staff, excessive workload, and the absence of refresher programs were stated as important factors resulting in the loss of skills.

"We do have that sort of refresher training thing... but then there are times when people will go on leave; it becomes a problem... It is very important that we do refresher courses so that we all keep up. Me too—I need refresher courses so I keep up” (R.T.-1).

Additional issues included insufficient simulation-based training, absence of protocols for onboarding new staff, and limited reach of training programs beyond select public hospitals. For instance, participants described a stark contrast between the training access in tertiary settings versus private or lower-tier facilities. There was a call to expand these programs to ensure uniform competency across the health system: *“It’s only the four hospitals that have this... Some percentage of [private facilities] give us babies, and they come in respiratory distress, and they don’t even know the RSS for us to get a ventilator available or a bubble CPAP ready” (N.I.C.).*

Gaps in training were frequently stated, with most participants citing unfavorable timing of training, ineffective delivery methods, and difficulty in access as major challenges. Numerous respondents pointed out the absence of structured onboarding programs for new employees, the gap between simulation training and real-world clinical scenarios, and the limited opportunities for refresher courses. The disparity in training opportunities between tertiary hospitals and other facilities was significant, prompting a call for wider access and consistency. These accounts together reflect systemic irregularities that shaped how personnel in different roles and institutions approached training for neonatal respiratory care.

5.5. Theme 3: Clinical Management and Decision-Making in Neonatal Respiratory Care

5.5.1. Sub-theme 3.1: Clinical Management Strategies

Neonatal respiratory care requires planned intervention and continuous monitoring. Participants stated the importance of early respiratory assistance, careful monitoring of oxygen saturation levels, and use of care protocols, especially during the critical early stages of life. One participant described how the use of the scoring system and adjustments to FiO_2 helped prevent complications like oxygen toxicity and retinopathy of prematurity. *"I mean, you need to make sure you check your RSS to make sure that whatever you are delivering is keeping these babies in the oxygen saturation target we've set for ourselves. We want to target 90 to 95 to make sure that we don't end up giving them too much* FiO_2." *(C.S.).*

In addition to ensuring proper oxygenation, healthcare professionals outlined a range of thorough early intervention strategies, especially during the initial hour of life, known as the "golden hour." This strategy encompassed maintaining an appropriate temperature, managing glucose levels, starting CPAP early, and minimizing physical handling.

"The earlier we start CPAP, the less we may not even need the surfactant that is so expensive. The teaching now is to start CPAP right from the delivery room, before we move these babies to the NICU... We have this concept we call the golden hour of newborn care... the first hour after birth; what you do definitely has a long-term implication." (C.S.).

Participants noted a consistent focus on achieving oxygen saturation goals, adjusting FiO_2 levels, and CPAP at the earliest suitable time. These steps were frequently directed by scoring systems and established protocols, indicating that systematic practices were commonly used to support neonatal respiratory stability right from admission.

5.5.2. Sub-theme 3.2: Clinical Decision-Making Using Assessment Tools (e.g., RSS)

Clinical decision-making has become a vital aspect of managing neonatal respiratory distress for all professional roles involved. Participants highlighted the significance of using structured assessment tools, especially the Respiratory Severity Score (RSS), to guide timely and appropriate interventions. Utilizing the RSS enables healthcare professionals to assess neonates, establish the required level of respiratory support, and track their progress or decline. Decisions regarding the initiation of bubble CPAP, escalation to mechanical

ventilation, or the use of additional therapies like caffeine citrate or surfactants were often influenced by RSS scores along with clinical indicators and bedside monitoring.

One resident demonstrated how RSS was systematically applied in the unit's daily routine: *"Okay, so respiratory distress syndrome, because we see a lot of premature babies. Typically, we would assess the RSS, and then most of the time, we start with the bubble CPAP for them. For the ones where the RSS is more than five, we'll start them on bubble CPAP. We try not to do too much with the FiO_2—just enough for the baby to make saturations. We're aiming for 90 to 95%, so just enough for the babies to hit that range and also relieve their distress a bit." (R.D.-2)*

Other participants reflected on the critical role that thoroughly implemented clinical judgement, informed by accumulated training and experience, played in providing effective care delivery. *"As in, we're able to identify danger signs and act. You see, when a baby comes in distress, I can tell who needs CPAP and who just needs oxygen. If a baby is already on oxygen and not doing well, I can assess the RSS and quickly decide to switch to CPAP so there's no delay in decision-making. And if the baby is on CPAP but still not doing well, I know when to move to the vent and when intubation is necessary. So it really makes everything easier." (R.D.-1)*

Furthermore, the precision and promptness of clinical choices were found to have a substantial impact on newborn outcomes. A number of participants pointed out that delays in starting CPAP or ventilator support, or inaccuracies in RSS scoring, could result in quick deterioration. On the other hand, timely and correct interventions frequently resulted in favourable recoveries.

"So when a baby is admitted, we usually score babies before we put them on the CPAP, the bubble CPAP. So we use something called the respiratory severity score, which is the RSS. So any baby that has a score greater than five goes on the bubble CPAP. We look at the chest movement, the lower chest, the xiphoid, subcostal retractions, nasal flaring, and grunting. That's how we score them. Then we can put the baby on the bubble CPAP." (R.N.-1)

"I think that, from what I've noticed, most of the babies would otherwise not have made it or survived. I think just a couple of days of support, respiratory support, goes a long way as to the outcomes. How soon we do it also counts a lot, I've noticed, and especially the referrals that come in. It's like, how soon they are able to get here impacts the long-term prognosis." (R.D.-3)

Reports of decision-making were often characterized by a dependence on structured assessment tools, particularly the Respiratory Severity Score (RSS), to inform the start and increase of respiratory support. Participants provided examples of how this scoring system, bedside monitoring, and clinical observations were used to determine actions such as starting bubble CPAP or advancing to mechanical ventilation. The timing and precision of decisions were mentioned as elements having an effect on clinical outcomes. Several participants added that early interventions helped with quick recovery.

5.5.3. Sub-theme 3.3: Team Collaboration in Care Delivery

Teamwork plays a crucial role in ensuring effective neonatal respiratory care. It was noted that this interdisciplinary management involving doctors, nurses, and respiratory therapists, with support from clinical engineers and external specialists, played a crucial role in making life-saving decisions in the NICU. Team members described a well-established routine where nurses performed initial assessments on neonates, calculated the Respiratory Severity Score (RSS), and prepared support equipment. Respiratory therapists helped by ensuring equipment readiness, while the clinical engineer assigned to the unit provided technical support. Doctors, following further assessment, determine the management plans and make the decision when escalation of care is necessary.

One participant demonstrated this well-coordinated teamwork effectively: *“So we do our assessments, our head-to-toe assessment. Doctors come in. They do the same, and the respiratory therapists... have already prepared the ventilator or bubble CPAP for us... So you see, they've done their work. We've done our work too... Then we have respiratory support available. They just shift and put the baby on it. Everyone knows what to do. So we don't waste time because with babies, especially if you waste time, it's just a whole lot.” (R.N.-2).*

In critical situations, collaborative decision-making was emphasized to avoid hold-ups and guarantee accountability. *“Okay, so when we review a baby... I’ll call a colleague, either a nurse or a doctor, to come and see—this is what I've seen. The baby has respiratory distress. I have to support the baby. Do you also agree? So this is what we do. We always call for a second person... before we step up or step down, or we put a baby on the respiratory supports” (N.I.C.).*

Reports from participants described teamwork as central to clinical processes in the NICU. Routines were reportedly organized so that nurses conducted initial assessments and equipment preparation, while doctors and respiratory therapists handled reviews and technical

support. In critical situations, participants explained that staff frequently consulted with one another to confirm decisions before initiating or escalating respiratory interventions. Some also described instances where multidisciplinary collaboration extended beyond the unit to include specialists from other departments or facilities.

5.5.4. Sub-theme 3.4: Increased Autonomy and Role Expansion

A significant result of organized training and hands-on clinical experience was a notable increase in independence and role growth among neonatal care staff, especially nurses. Almost all participants stated that focused skill development has not only enhanced their self-confidence but also empowered them to take on greater responsibilities in managing neonatal cases. The nurses further emphasized that they were more confident to initiate or start modifying interventions without the presence of a physician. The doctors stated they understood the reason why they carried out each action during management and did not second-guess themselves in their management approaches.
This increased capability was often associated with the regular use of the Respiratory Severity Score (RSS) and familiarity with the use of especially the CPAP devices, enabling staff to evaluate conditions and confidently alter support levels as needed. One nurse manager shared her thoughts on this transformation:

"Because when we talk about training, I think we, the staff, have gotten some level of training that we can operate the respiratory support without a doctor. We can do our RSS every morning or at every shift to be able to step up or to step down, to wean off, or to put a baby on respiratory support" (N.I.C.).

Another participant highlighted how they had been given full autonomy from their superiors to initiate decisions: *"You don't need someone in high authority to go like, 'okay, reduce FiO_2,' before you do… So when a baby comes in, sometimes before the MO even comes and sees the baby, the nurse has admitted, done RSS, and started support even before they arrive" (R.N.-3).*

Participants described a shift in clinical roles, especially among nurses, who increasingly managed respiratory support independently. These developments were frequently connected to the repeated use of the Respiratory Severity Score (RSS), familiarity with equipment, and the trust placed in them by supervising staff. Several respondents pointed out that nurses often took the initiative to start or modify respiratory treatments prior to physicians' arrival, relying on their evaluations and established protocols. This enhanced independence was

associated with ongoing training and a demonstrated confidence in applying their acquired skills in real-time situations.

5.5.5. Sub-theme 3.5: Case-Based Respiratory Interventions

Interesting clinical case stories provided needed clarity on how healthcare professionals handle different respiratory distress scenarios using clinical judgment and knowledge acquired over years of work experience. In addition to highlighting acquired technical skills, these reports focus on the importance of case-specific decision-making, real-time modifications, and interdisciplinary teamwork in the management of neonatal respiratory care.

Many respondents remembered specific instances where there was a need for a quick transition from non-invasive to invasive ventilation methods due to sudden declines in condition. These scenarios frequently involved premature infants, who are particularly susceptible to respiratory issues.
A medical officer shared a critical situation concerning a 27-week preterm infant:

“After our initial assessment, we decided to push the child on the non-invasive, positive pressure ventilation... After a while, the child became dusky and was getting cyanosed, so we had to make a quick decision to intubate. We administered surfactant... and respiratory distress resolved quite well” (M.O.).

Such managements, particularly when surfactant therapy was used alongside mechanical ventilation, frequently yielded favourable results, though they were not without risks or emotional challenges. In a separate instance, a full-term infant initially considered stable was subsequently identified as having partial vocal cord paralysis and tracheomalacia, which ultimately resulted in intubation and a scheduled tracheostomy. Unfortunately, the situation ended tragically in the operating room:

“We all came to the decision that the baby would need a tracheostomy... She went to the theater the next day... Around 4 p.m., they called me... the baby had passed in the theater. That’s one of the most challenging and unfortunate cases I’ve ever managed” (R.D.-3).

Although these experiences were emotionally challenging, they emphasized the importance of early scoring, proactive observation, and a collaborative response from various disciplines.
A nurse stated:

“In 98% of cases, we start the babies on bubble CPAP. They don’t even go to vents. If you do your assessment right and start early, most of the babies who do bubble don’t end up needing ventilation. Most of them do very well” (R.N.-3).

These cases show how structured protocols, like the use of the Respiratory Severity Score (RSS), together with quick clinical intervention, can improve neonatal outcomes. They also reflect the emotional and professional resilience required to navigate both success and failure in neonatal respiratory care. These case examples provided detailed accounts of how clinical teams responded to different forms of respiratory distress in neonates.

Participants reported both positive and negative results. They observed that conditions in some neonates changed quickly, often requiring a switch from noninvasive to invasive respiratory support. They also reported on the emotional weight and difficulty of managing critical cases in neonatal care settings.

5.6. Theme 4: Institutional Support and System-Level Coordination

5.6.1. Sub-theme 4.1: Internal Institutional Investment and Needs

Effective neonatal respiratory care in low-middle-income settings relies not only on individual capabilities but also on the organization's efforts to improve infrastructure, staff, and overall system coordination. Participants consistently highlighted the combined importance of institutional support and its challenges, bringing attention to both successful local initiatives and urgent needs that remain unaddressed.

One individual highlighted that the department had begun with proactive measures such as the implementation of a delivery room resuscitation team, yet persistent systemic deficiencies continued to threaten the sustainability and effectiveness of these initiatives. These issues included critical shortages of basic materials.

“Protocol? Yes… You can just see it and follow it. But for equipment, I think they need to do better… For a whole month, we haven’t had a purple cannula, and we can’t be using yellow cannulas on these tiny, tiny babies… Management really needs to up their game” (R.D.-1).

Workforce instability was also frequently mentioned by participants as a challenge. A significant number of trained nurses and doctors tended to leave for more favourable opportunities overseas. This resulted in difficulties in preserving institutional knowledge and ensuring consistent quality of care.

“The attrition rate... a lot of our nurses left the country… You train; they go. This makes it quite difficult to maintain consistent expertise… Our main aim is to develop a strong group of middle-level healthcare workers who are well-trained in neonatal and respiratory care.” (C.S.).

The need for parallel investment across referral systems was also underscored. Improvements made at central facilities risked being undermined if district or private hospitals, often the first points of care, lacked the capacity to stabilize neonates or communicate effectively during transfers.
The importance of parallel investment in referral systems was also highlighted. Improvements made at central facilities could be compromised if district or private hospitals, which often served as the initial points of care, were unable to stabilize neonates or communicate effectively during transfers.

“If we improve, let’s say, Ridge, and forget about the facilities that are sending the cases to us, we will just go back to square one” (R.D.-3). Participants noted various institutional strengths and weaknesses that impact neonatal respiratory care. Although the establishment of resuscitation teams was highlighted as a positive measure, challenges such as a lack of equipment, high turnover rates among staff, and variable access to training were frequently mentioned.
There were also concerns regarding the communication between the hospital and its referring facilities. These issues were identified as barriers that influenced the continuity and effectiveness of neonatal care within the institution.

5.6.2. Sub-theme 4.2: External Institutional Support and NGO Collaboration

Support from external institutions plays a crucial role in improving neonatal respiratory care, especially in settings with limited resources. Numerous participants underscored how collaborations with an international NGO have helped to address systemic deficiencies in training, equipment, and service provision. This assistance has not only strengthened local capabilities but also enabled the adoption of protocols and the expansion of nurse-led initiatives. A respiratory therapist pointed out the significance of these partnerships, noting:

“A bigger umbrella, an NGO came in to train four hospitals under the Med C 2.0 model. Respiratory support was one of the four key modules. From that, we developed champions who have continued training efforts across the facilities.” (N.I.C.).

Reliance on equipment provided by donors, however, presents its own difficulties, such as maintenance delays, shortages, or uneven availability. Participants emphasized the need to not only maintain but also expand these partnerships to guarantee ongoing care continuity. There was also a robust appeal to enhance inter-facility learning exchanges and establish national platforms for data sharing and multicenter training. As one participant mentioned:

"It's very important if we truly want to help the healthcare system… We should allow staff from other, smaller facilities to come and learn. That way, they can return to their hospitals and apply what they've learned." (S.N.O.-1).

Participants indicated that collaborations with external organizations—especially international NGOs and programs funded by donors—enhanced the availability of equipment and the delivery of training. An example, such as a support model that developed internal champions for further training of staff in neonatal care, was highlighted. However, there were also concerns about delays in the maintenance of equipment and the unequal allocation of resources. Some participants urged the spread of such training to smaller facilities, combined with knowledge-sharing initiatives to promote more uniform practices across various healthcare settings.

5.6.3. Sub-theme 4.3: Role Allocation and Support Systems

Successful respiratory care for newborns relies on both clinical proficiency and well-structured technical support frameworks, along with well-defined role assignments within the hospital. At Greater Accra Regional Hospital, the Clinical Engineering Unit has implemented a tiered supervisory model, designating specific engineers to different levels and wards throughout the hospital, including the NICU, maternity ward, and obstetric theatre.
This systematic approach guarantees a swift response to equipment malfunctions and encourages cooperation between units.

"We divide the hospital into levels… I'm the supervisor for level one, which includes the NICU, maternity, labor ward, and obstetric theatre. If there's an issue requiring more hands, all supervisors step in. We also have interns and service personnel who assist with checks." — M.E. External representatives manage internal machine components that are still under warranty, whereas non-invasive parts and regular system checks are conducted internally.

The unit's strong documentation and routine maintenance rounds serve as additional safeguards against system failure. With regard to maintenance, the engineering team works

together with external companies and internal users to ensure the safety and functioning of the CPAPs and ventilators. External machine components that are still under warranty are managed by external representatives, whereas non-invasive parts and regular system checks are conducted internally.

"When a machine is under contract… we handle external parts ourselves—things like inspiratory filters or circuits. But when it's something internal like a control valve, we call in the reps. We work alongside them to ensure everything is done correctly." — M.E.

The engineering team indirectly supported neonatal respiratory care through regular maintenance procedures, assigned supervisory structures, and coordinated vendor participation. Key characteristics that aided in this support were regular documentation, ward-level responsibility distribution, and cooperative efforts between clinical and technical staff. This approach helped improve communication with the neonatal unit and enabled equipment to be serviced on time.

5.6.4. Sub-theme 4.4: Strengthening the Neonatal Referral and Transport System

A needed yet underdeveloped aspect of neonatal care in Ghana is the system for referring and transporting sick newborns. Participants highlighted the immediate necessity for an organized, tiered model of neonatal care in which district hospitals are furnished with Level I NICUs where basic health care needs are provided to stable preterm neonates, while regional hospitals handle more complicated cases with Level II or III NICUs handling moderately to complicated cases related to neonatal care, respectively.

"Ideally, all regional hospitals should have a model NICU, and district hospitals should feed into this in terms of referral and training… Eastern Region, for instance, should have Koforidua Regional Hospital as the center with Level II or III care and all surrounding district hospitals equipped with Level I NICUs." — C.S.

One of the most urgent issues is the lack of a neonatal transport system, which frequently leads to critically ill neonates arriving at referral centers in worse states. The absence of transport incubators and skilled paramedics specializing in neonatal care during transport further reduces survival rates. The participant highlighted that even in regions with a national ambulance system, it is not properly equipped or ready to safely transport newborns.

“We have a lot of our babies reaching here already dead because the transport system for sick newborns is almost zero… Every region needs at least one transport incubator and trained paramedics who know how to move a sick newborn.” — C.S.

Moreover, an already overwhelmed tertiary NICU, such as the Greater Accra Regional Hospital, often receives a high number of cases from both public and private institutions that lack suitable neonatal care units. Numerous private hospitals in urban settings perform deliveries without the ability to stabilize or care for distressed neonates, resulting in emergency referrals that put added pressure on the hospital receiving them.

Participants described gaps in the current referral and transport system, including the lack of neonatal transport incubators, untrained ambulance personnel, and uneven distribution of NICU levels across regions. Some participants outlined their vision of a tiered neonatal care system with better linkage between district and regional facilities. They also emphasized the strain placed on tertiary centers receiving poorly stabilized referrals and described suggestions such as referral coordination platforms and regional supervision to address these challenges.

5.6.5. Sub-theme 4.5: Professional Motivation and Workplace Conditions

Motivation among neonatal care professionals has surfaced as a vital element affecting both the standard of care and the retention of staff, as well as the development of the workforce over time. Participants expressed a profound personal dedication to neonatal health, often inspired by personal experiences or a strong sense of purpose to protect vulnerable infants. One resident shared,

“I enjoy working with babies… It’s very rewarding. When they come in really bad and then get better, come back for review—it’s inspiring. We actually see a lot of results here. That’s what inspired me to work here.” — R.D.-2

Nonetheless, this internal drive was often hindered by institutional obstacles and work conditions that restricted chances for growth and impacted daily morale. Numerous staff members expressed that, even though they had undergone comprehensive hands-on training in specialized neonatal respiratory care, the absence of official certification hindered their recognition in terms of status or pay. This gap between skills and validation was a recurring source of dissatisfaction:

"*We've trained them on all this specialised care… But they are not neonatal nurses, and that is not fair. If someone undergoes training and practices for a year, they should receive a diploma, and that should be reflected in their salary. Otherwise, what's the incentive to specialize?" — C.S*

Beyond formal advancement, those involved pointed out the significance of small yet impactful workplace incentives. Small acts like expressing gratitude or providing essential amenities were regarded as important for boosting the morale of employees who worked in demanding healthcare settings.

A respiratory therapist elaborated on this point: *"We don't need food every day to feel motivated. At least buy us a coffee maker… We don't even have water to drink sometimes. These things can be done, and they know it—but still, nothing." — R.T.-1*

Despite these challenges, participants remained optimistic and dedicated to their responsibilities. A few proposed changes they thought could enhance their motivation, such as certification following in-hospital training, less strict rules for obtaining study leaves, and more chances to engage in decision-making processes. Their responses reflected a strong desire for both symbolic appreciation and practical improvements to their work environment.

5.7. Summary of Results

The results discussed in this chapter illustrate a highly interconnected framework of neonatal respiratory care within a tertiary hospital in Ghana. Healthcare providers faced substantial challenges across clinical, institutional, and interpersonal dimensions while showcasing resilience, creativity, and a strong dedication to patient outcomes. Issues such as inadequate equipment, gaps in training, an understaffed workforce, and emotional strain show the complexities of care in settings with limited resources. At the same time, examples of adaptive learning, interdisciplinary cooperation, and protocol-based interventions highlight areas of strength and potential for improvement. These experiences provide an important foundation for understanding how systemic structures, professional skills, and institutional resources interact to affect neonatal outcomes. The next chapter examines these results in connection with current literature and theoretical models, highlighting their relevance for practice, policy, and future research. It also considers the broader structural and contextual adjustments necessary to improve respiratory care for neonates across similar low-middle-income settings.

6. Discussion

6.1. Introduction

This chapter provides an important perspective on the study's findings by analyzing its theoretical framework, analytical methods, and methodological approach. It is grounded in three foundational principles of qualitative research: transparency, intersubjectivity, and scientific scope (Creswell, 2007).

Transparency was ensured through detailed documentation of the study design, the sampling strategy, and the theme analysis procedure. This approach enhanced the reliability and traceability of the research. Directly connecting findings to participant narratives and using a coding framework helped to mitigate inter-subjectivity and increased the credibility of the interpretations. The scientific scope was acknowledged as being specific to the context, aiming to provide transferable insights instead of generalisations.

The chapter is divided into three parts: a theoretical evaluation of the multi-framework technique used to interpret the results, a discussion of the findings in relation to existing literature, and a reflection on the methodology.

6.2. Methodological Discussion

This study aimed to explore the experiences, challenges, skills, and support systems in place for neonatal respiratory care at Greater Accra Regional Hospital (GARH) in Ghana. Guided by an interpretive phenomenological approach, this study aimed to reveal the lived experiences of healthcare providers dealing with respiratory distress in neonates within resource-limited settings.

Creswell points out that by focusing on people's individual experiences and collective interpretations, phenomenology gives academics insights into how people view a phenomenon. A sample size of between one and ten is suggested for phenomenological studies. A recruited study population of 15 healthcare professionals was therefore more than sufficient. Saturation was reached in the data since the last interview provided no new themes (Creswell, 2007).

Using thematic analysis, the study found recurrent themes that helped in the understanding of clinical practice, institutional problems, and coping strategies of departments. This method was useful in explaining aspects of neonatal respiratory care. These included emotional stress, adaptive techniques, and workflow modifications.

For example, studies in sub-Saharan Africa by Kinshella, Walker, et al., similarly employed the phenomenological technique to examine how neonatal nurses and clinicians adapt to equipment shortages and diagnostic challenges (Kinshella, Walker, et al., 2020). Their studies, similar to the current research, demonstrate that phenomenological investigations provided valuable insights into context-specific health practices limited by various factors.

Thematic analysis was guided by inductive coding, which ensured that significant issues emerged from the data rather than being predetermined. This analytical approach provided a solid yet adaptable framework for examining the interrelated factors influencing neonatal respiratory care delivery (Creswell, 2007).

In order to address intersubjectivity or analytic plausibility, codes and themes were methodically connected to field notes, reflective memoranda, and actual quotes. The validity of interpretations was strengthened by the iterative coding process, which was aided by thematic saturation and pilot-tested interview aids. Feedback loops, including discussions with medical professionals with expertise in neonatal care, also helped to improve interpretations and increase their legitimacy.

In terms of scientific scope, this study does not aim for statistical generalization but rather focuses on the transferability of insights to comparable clinical situations. Creswell states that qualitative research offers insightful information that is rich in context yet helpful for guiding practice and policy elsewhere (Creswell, 2007). The findings are therefore situated within the specific realities of GARH but have broader relevance to neonatal care in other low-resource settings.

The use of a multi-theoretical framework, including role theory, human factors theory, and social cognitive theory, helped in explaining the findings of this study. While phenomenology guided the descriptive analysis of lived experiences, the theoretical lenses provided interpretive depth.

Finally, ethical approval was obtained from both the Ghana Health Service Ethics Review Committee (GHS-ERC) and the Ethics Committee of the Hamburg University of Applied Sciences. All participants provided written informed consent. Safeguards were maintained to ensure anonymity. Participation was voluntary, and data was securely handled. These ethical measures strengthened the credibility and reliability of the research process.

To summarize, this study fulfills the scientific standards for qualitative investigation by ensuring methodological transparency, intersubjective credibility, and relevance within this specific

context. The combination of phenomenological insights and theoretical viewpoints offers both a detailed account and an in-depth analysis of how neonatal care providers respond to systemic limitations while working to provide effective respiratory care to vulnerable newborns.

6.3. Discussion of the Results

6.3.1. Structural and Systemic Constraints in Neonatal Respiratory Care

The Human Factors Theory offers important insights into the multifaceted influences of environmental, equipment-related, and organizational elements on the delivery of healthcare. Some employees felt unprepared to handle tasks on their own, especially in high-pressure situations when cooperation and clear communication were necessary. Other participants in the study expressed a significant reliance on informal knowledge from coworkers, such as knowing where functional equipment was ‘hidden,’ as being valuable in the management of critical cases and shaping their ability to provide effective care. These findings are consistent with the work of Yamada and Halamek, who argue that deficiencies in ergonomic design and poorly defined workflows in neonatal units lead to higher cognitive demands and safety hazards (Yamada & Halamek, 2023).

The similarities between this research and the existing literature show the systemic nature of these issues. They stress the pressing need for enhanced onboarding processes, ergonomic workflow design, and targeted training interventions in low-resource environments. Workflow inefficiencies were also caused by the neonatal units' design, improper equipment storage, and repair delays. Staff efficiency and care continuity could be significantly increased by implementing structured onboarding, interprofessional communication protocols, and ergonomic workflow redesign. In particular, the integration of clinical engineers within care teams, as seen at the study site, appeared to be a promising model for rapid equipment troubleshooting and support.

The study also revealed concerns about the excessive strain placed on the NICU of this tertiary institution, particularly from private hospitals lacking the capacity to manage neonatal respiratory cases. Integration of public and private care systems through shared standards is essential to address current disparities in NICU access and referral burdens.

6.3.2. Training, Competency, and Capacity Building

Structured training emerged as an important element for effective neonatal respiratory care. Participants from a range of professional backgrounds highlighted the significance of both formal and informal training in enhancing clinical preparedness and confidence, especially

regarding the use of equipment and adherence to respiratory protocols (Moxon et al., 2015). These findings are consistent with studies demonstrating that hands-on and scenario-based training improve neonatal resuscitation and non-invasive ventilation outcomes in low-resource settings (Lee & Lee, 2022). The study, however, identified shortcomings in the frequency, consistency, and sustainability of training.

Reports indicated irregular refresher courses, dependence on self-directed learning, and restricted access to training in non-tertiary settings, reflecting wider issues in the healthcare system, including a lack of skilled clinical personnel to rightly train these healthcare workers as well as the lack of locally relevant standardized guidelines (Kaur et al., 2023). Participants often noted that training opportunities were not well-aligned with staff schedules and rotations, making it challenging to maintain skill retention among the workforce. This situation led to a reliance on informal peer-led sessions and observational learning, which, while resourceful, lacked standardization and reproducibility. Social cognitive theory added another layer of depth; overreliance on experiential learning and peer-to-peer knowledge transfer has the disadvantage of resulting in inconsistency and mismanagement of these cases, with observational learning emerging as a crucial tool. Likewise, Haaland et al., point out the reliance on informal knowledge-sharing networks among personnel in under-resourced neonatal units, implying that while such adaptations are essential, they may undermine standardization and accountability (Haaland et al., 2025) .

Through this study, the importance of training methodologies, the development of self-efficacy, and the role of peer modeling were noted. It was realized that this healthcare system could benefit from implementing structured, recurring training modules, mentorship programs, and accessible e-learning platforms. According to previous research, neonatal teams can build long-lasting skills by instituting Continuous Professional Development (CPD) using digital tools and simulation (V. Shukla & Carlo, 2019). In addition, the continuous integration of local champions, especially experienced nurses and respiratory therapists, into training delivery could enhance sustainability through reducing dependence on external facilitators.

6.3.3. Outcome on Neonatal Respiratory Care

The use of structured tools such as the Respiratory Severity Score (RSS) enhanced timely and appropriate clinical decision-making among healthcare team members. Through the use of this systematic scoring system, staff members were able to independently initiate and adjust patient care strategies, particularly with Continuous Positive Airway Pressure (CPAP) therapy, based on clearly defined scoring criteria. This ability to make independent decisions not only

improved the overall quality of care but also created a collaborative environment where team members could share responsibilities (Nzinga et al., 2019). This decentralization of decision-making shows a growing shift towards empowered task-sharing. This model is supported in global neonatal care frameworks that encourage multidisciplinary teams to take initiative in clinical settings (Deller et al., 2015). Participants frequently talked about their experiences with self-directed learning, scenario-based practice, and instant feedback, which helped them gain confidence.

The use of point-of-care diagnostics, particularly lung ultrasound, also played a critical role in this setting by guiding respiratory interventions when access to X-ray or arterial blood gas (ABG) was limited. This diagnostic technique played a crucial role in minimizing delays in patient care and enabling the timely identification of critical conditions such as diaphragmatic hernia and pneumothorax. The ability to carry out lung ultrasound directly at the bedside allowed healthcare providers to make informed decisions quickly, which is important for patient outcomes in emergencies. Moreover, this trend toward utilizing portable diagnostic tools is particularly beneficial in resource-limited settings, where diagnostic infrastructures may be lacking or less accessible. The findings from Stewart et al. support this approach, highlighting the important advantages of integrating such technologies into routine clinical practice. By doing so, healthcare systems can improve their responsiveness and enhance the quality of care delivered to neonates facing respiratory challenges (Stewart et al., 2022) .

Systemic constraints such as the high costs of surfactant therapy and a lack of monitoring equipment were, however, noted as barriers to optimal care. Many participants stated surfactant therapy was life-saving; however, access was limited to those who could pay out of pocket, underscoring the persistent inequities in clinical outcomes. Policy-level solutions such as subsidy schemes for essential therapies and investments in point-of-care technologies remain essential to achieving equitable delivery of care.

6.3.4. Institutional Support and System-Level Coordination

The research revealed significant disparities between internal capacity-building efforts and external support mechanisms. It was found that while collaborations with non-governmental organizations (NGOs) and donors—such as those outlined in the Med C 2.0 framework—have notably improved local training initiatives, the development of standardized medical protocols, and access to critical medical equipment, there remained pervasive concerns regarding the sustainability of these advancements among the participants involved in the study.

These results align with the findings of Iqbal et al., who investigated the involvement of the private healthcare sector in reproductive, maternal, newborn, child, and adolescent health in specific Eastern Mediterranean nations. Their research emphasizes the significant role that public-private partnerships (PPPs) play in enhancing access to maternal and neonatal care in low- and middle-income countries (LMICs). However, an important point raised is the risk associated with an overreliance on donor-led initiatives. Such dependence can potentially ruin the long-term viability of care systems unless there is a corresponding increase in internal investments that bolster the local healthcare infrastructure. These concerns align with the opinions of study participants, who stated that the continuity of neonatal respiratory care services was at risk due to the reliance on externally funded training and equipment initiatives that were not backed by strong local planning and procurement (Iqbal et al., 2022).

Iroz et al., carried out a systematic review that further supports this point by emphasizing that public-private partnerships (PPPs) in LMICs frequently face sustainability issues, particularly when internal capacities are not continuously strengthened (Iroz et al., 2024). The study emphasizes that the advantages of donor-driven projects can be temporary and may affect the efficacy and continuity of healthcare services if local infrastructure, leadership, and data systems are not developed in parallel. The research highlights that if local infrastructure, leadership, and data systems are not developed concurrently, the advantages of initiatives funded by donors might be temporary, which could jeopardize the continuity and effectiveness of healthcare services.

Another key structural barrier identified was the lack of a reliable neonatal referral and transport system. Delays, lack of trained paramedics, and the unavailability of transport incubators frequently resulted in preventable deaths. These findings align with Okai et al., who conducted a systematic review of neonatal transport practices throughout Sub-Saharan Africa and discovered that inadequate transport logistics, restricted access to qualified personnel, and a shortage of properly equipped ambulances pose serious risks to neonatal survival (Okai et al., 2024). Participants suggested implementing a tiered NICU concept with regional supervision centers with centralized referral platforms. Transportation protocols were also proposed by participants with paramedic staff trained in neonatal resuscitation. This approach would ensure suitable triage and efficient care pathways.

Care delivery is also restricted internally by issues with staffing, equipment availability, and budgetary planning. Participants advocated for a comprehensive institutional investment strategy that includes maintenance systems and training broadened to a district-level hospital. Encouraging professional development training for nurses in neonatal respiratory care, who

serve as the backbone of the healthcare system, and assistance for respiratory therapists were advised.

Essential supplies like cannulas, nasal prongs, and filters were found to run out during crucial times due to inadequate planning and postponed procurement cycles. This is in line with the World Health Organisation's (WHO) 2023 report, which calls for coordinated, multi-level strengthening of the neonatal system. It draws attention to the need for improved relationships between external donors and internal hospital management. Such cooperation is important to ensure that improvements to the neonatal care system are not only consistent but also sustainable over the long term (WHO, 2023).

Despite significant systemic gaps, participants showed a strong sense of motivation to deliver quality care for neonates with respiratory needs. Nevertheless, many expressed their frustration due to the absence of formal recognition for specialised tasks, inadequate compensation, and constrained opportunities for professional development. These issues correspond with role theory, which highlights that gaps between role expectations and organisational recognition often lead to role strain and reduced job satisfaction. As noted by Li, when healthcare practitioners are assigned advanced clinical duties like managing ventilatory devices or intubation of babies without suitable certification, a disconnect arises between actual responsibilities and perceived institutional value (Li, 2022).
This theoretical perspective helps explain the tension experienced by health workers, especially nurses, in this study, many of whom undertook expanded roles in critical care without formal recognition in staffing configurations or pay scales. The stories shared by participants reveal not only a dedication to their profession but also a sense of burnout triggered by the absence of structural support.

Furthermore, participants often mentioned that even minor morale-boosting initiatives such as the provision of drinking water, acknowledgement ceremonies, or paid study leaves could have an unexpectedly positive impact on workplace culture and staff retention. These insights align with the work of Willis-Shattuck et al., who performed a systematic review regarding motivation among healthcare workers in developing nations (Willis-Shattuck et al., 2008). The results showed the importance of both monetary and non-monetary incentives, such as acknowledgement, supportive leadership, opportunities for further training, and enhanced working conditions, in boosting staff motivation and decreasing turnover in under-resourced healthcare systems.

The interpretive strength of this study was supported by its multi-theoretical lens. By drawing on role theory, human factors theory, and social cognitive theory, the study revealed how personal behaviours, institutional structures, and technical systems jointly shaped the delivery of neonatal respiratory care. These theoretical foundations were present throughout the findings, providing an integrated understanding of both systemic constraints and individual coping strategies.

Table 3. Understanding Neonatal Respiratory Care in Resource-Limited Settings Using a Multi-Theoretical Framework.

THEORY	LEVEL OF FOCUS	CORE CONSTRUCTS	APPLICATION IN NICU SETTING
ROLE THEORY	Individual/Interpersonal	Role ambiguity, role conflict, and role strain	Nurse performing beyond formal scope without recognition.
HUMAN FACTORS THEORY	System/Environmental	Equipment usability, workspace design	Poor NICU layout, lack of CPAP usability.
SOCIAL COGNITIVE THEORY	Individual/Training	Observational learning, self-efficacy	Staff learning through peer observation and simulation-based training

source: Own

7. Strengths and limitations

The contributions of the study to the field of neonatal care are strengthened by a number of methodological and conceptual advantages. The use of a phenomenological approach, which is based on thematic analysis, enabled a deep understanding of the real-life experiences of neonatal healthcare workers operating in a setting with limited resources. This approach captured the practical and emotional aspects of these professionals' daily practices and challenges in providing neonatal respiratory care. The findings were credible and reliable due to the research design's clarity. This was demonstrated by a purposeful sampling method in which certain participants were chosen based on their backgrounds and experiences until data saturation was reached.

The use of theoretical frameworks such as role theory, human factors theory, and social cognitive theory strengthened the interpretive view of the study. A deeper understanding of how the personal experiences of healthcare workers interact with general structural injustices and behavioural patterns was made possible by this multi-theoretical approach. This helped to clarify the conditions at work in neonatal healthcare settings. The research also demonstrated strong ethical adherence, having obtained approval from both the Ghana Health Service Ethics Review Committee and the Hamburg University of Applied Sciences Ethics Committee. This process ensured that the study upheld ethical standards, particularly concerning participant confidentiality, informed consent, and the assurance of voluntary involvement throughout the research process.

Despite these strengths, several limitations must be noted. The study was carried out in a single tertiary healthcare centre in Accra, Ghana, which limits the generalisability of its findings to other settings, especially those with different resources or geographic locations. Even though the researcher made an effort to maintain reflexivity and openness during the analysis process, researcher bias still has the potential to affect data interpretation, as is the case with many qualitative investigations. Some participants may have found it difficult to express their experiences due to language constraints. Mimics and expressions from participants could not be fully incorporated in the results. All these could have impacted the richness of the data gathered. Furthermore, limitations in funding and time resources restricted the opportunity for multiple data collection rounds or follow-ups. These could have offered deeper insights and validation of the results. The exclusion of non-clinical stakeholders, such as healthcare administrators, policymakers, or family caregivers, further narrowed the study's focus, preventing a more comprehensive understanding of the institutional ecosystem surrounding neonatal care.

8. Recommendations

This study identified various structural, operational, and professional obstacles to the provision of neonatal respiratory care at the Greater Accra Regional Hospital (GARH). Based on the results, a number of strategies are suggested to improve the quality, sustainability, and equity of neonatal respiratory care, especially in settings with limited resources.

First and foremost, there is an urgent need to enhance the infrastructure and equipment supply systems. Recurrent issues of equipment shortages, delayed maintenance, and faulty devices were common. It is important to implement reliable maintenance protocols backed by dedicated technical staff, like clinical engineers, to ensure prompt repairs and ongoing equipment readiness.

Furthermore, the study pointed out significant gaps in referral and neonatal transport systems. Transportation delays, lack of trained paramedics, and the absence of transport incubators often led to preventable complications and fatalities. Thus, creating a coordinated neonatal referral system is crucial. This system should involve the establishment of tiered NICU networks with centralized referral hubs and ambulance personnel trained in neonatal resuscitation. Implementing such a framework would facilitate more effective triage and continuity of care.

In addition to these infrastructural issues, the sustainability of external support mechanisms was questioned. Despite the valuable contributions of collaborations with non-governmental organizations and donor-funded initiatives for training and equipment supply, participants raised concerns about the temporary nature of these benefits. Public-private partnerships (PPPs) need to be aligned with internal hospital strategies and national health planning frameworks to ensure long-term viability. Steps should be taken to lessen dependence on donor cycles by enhancing internal capacity and fortifying local procurement, leadership, and monitoring systems.

Capacity building and workforce development were also recognized as critical areas for intervention. Training was found to be infrequent, inaccessible for some staff categories, and poorly synchronized with clinical schedules. To address this issue, hospitals should create structured, ongoing training programs tailored to their specific context. These programs should feature simulation-based learning, mentorship opportunities, and user-friendly digital platforms to support continuous professional growth. Notably, experienced neonatal nurses and respiratory therapists should be included as peer mentors to foster knowledge retention and skill advancement within the workforce.

Closely related to training is the matter of role acknowledgement. The findings showed that numerous nurses and allied health professionals take on advanced clinical tasks, such as managing ventilators and performing neonatal intubation, without formal institutional recognition. This disconnect between their actual responsibilities and institutional acknowledgement leads to role strain, decreased motivation, and professional stagnation. Hospitals should address this issue by formally recognizing expanded roles through updated job descriptions, revised compensation structures, and certification opportunities specific to roles. Such acknowledgement would not only validate staff contributions but also boost morale and decrease burnout.

From a wider policy standpoint, there is a necessity for the establishment of national neonatal respiratory care guidelines that are relevant to local contexts. These guidelines should reflect the experiences of frontline workers and be integrated into broader child health strategies and procurement frameworks. Additionally, neonatal respiratory care must be prioritized in district and national health budgets to ensure consistent funding for supplies, equipment, and training programs.

Lastly, the emotional and occupational well-being of healthcare personnel should not be ignored. Participants observed that even minor morale-boosting measures, such as access to drinking water, public recognition of efforts, and opportunities for study leave, significantly enhanced staff motivation. Initiatives focused on workplace wellness and participatory leadership structures that involve frontline workers in decision-making should be promoted to encourage ownership, mitigate burnout, and improve retention.

In summary, the recommendations presented above highlight the necessity for a coordinated, multi-faceted approach to enhancing neonatal respiratory care. These interventions, ranging from investments in infrastructure and training to institutional recognition and support for emotional well-being, can collectively contribute to establishing a more resilient, equitable, and effective neonatal care system in resource-limited settings like GARH.

9. Conclusions

This research investigated the experiences, challenges, training, and institutional support mechanisms influencing neonatal respiratory care at the Greater Accra Regional Hospital in Ghana. Through the use of a phenomenological approach and thematic analysis, the study showed the complex realities faced by healthcare professionals in resource-constrained environments in the provision of neonatal respiratory care. The interaction with nurses, doctors, respiratory therapists, and a clinical engineer provided an understanding of both the barriers and drivers of effective respiratory care for newborns. Key findings revealed systemic issues such as shortages of equipment, uncoordinated referral processes, inconsistent training opportunities, and a lack of sufficient investment in neonatal healthcare. Nevertheless, participants exhibited strong intrinsic motivation, adaptability in their professions, and a dedication to providing high-quality care despite these challenges. The research indicated that organized training, timely protocol-driven interventions, interdisciplinary collaboration, and improved workflow management can significantly enhance neonatal outcomes.

By using a multi-theoretical framework, the study looked beyond simple descriptions to contextualize the findings. While human factor theory explained how inefficiencies in systemic designs and workflows hindered the delivery of care, role theory explained how gaps in institutional recognition led to professional strain. Social cognitive theory highlighted the importance of self-efficacy and observational learning in acquiring skills amidst training shortages. Although the study was limited to a single facility, its insights may be relevant to other similar low-resource settings. Filling the gaps in institutional support, encouraging sustainable public-private partnerships, and endorsing standardized, role-sensitive training programs are essential measures to enhance neonatal respiratory outcomes.

Finally, further investigation is required to develop a more integrated, human-centered, and systems-oriented approach for resilient neonatal care frameworks in Ghana and beyond.

Declaration of Academic Honesty

Hereby, I declare that I have composed the presented master's thesis independently on my own and without any resources other than the ones indicated.
All thoughts taken directly or indirectly from external sources are properly denoted as such.

Hamburg, 13.06.2025

Hannah Sackeyfio

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Appendix

I. Ethical approval from the Ethics Committee of University of Applied Sciences Hamburg

II. Ethical Approval from the Ghana Health Service-Ethics Review Committee

III. Permission Letter to GARH (Greater Accra Regional Hospital)

IV. Participation Information Sheet

V. Consent Form

VI. Interview guideline for healthcare professionals

(Doctors, Nurses, respiratory therapists, clinical engineers)

VII. Transcript from all 15 Interviews (on CD)

Appendix I

Mrs. Hannah Sackeyfio

ETHIKKOMMISSION

DR. CHRISTIANE STANGE
Geschäftsstelle
Ethikkommission

Healthcare Professionals' Training, Experiences, and Management Outcomes in Neonatal Respiratory Care in Ghana : A Qualitative Investigation

vom/of 10.04.2025 – Antrag 2025-13 (Amendment zu Antrag 2024-16)

Hamburg, 22.04.2025

Antragstellerin/Applicant: Hannah Sackeyfio, MA-Stud
Betreuer/Supervisor: Prof. York Zöllner

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HOCHSCHULE F ANGEWANDTE WISSENSCHAFTEN HAMBURG
Forschung und Transfer
Steindamm 103
20099 Hamburg

HAW-HAMBURG.DE

Sehr geehrte Frau Sackeyfio,

das o.g. Vorhaben wurde nach Prüfung durch die Ethikkommission der HAW Hamburg als grundsätzlich „ethisch unbedenklich" bewertet.

Mit freundlichen Grüßen

Dear Mrs Sackeyfio,

the above-mentioned project was assessed by the Ethics Committee of Hamburg University of Applied Sciences as "ethically acceptable".

Best regards

[redacted]

Dr. Christiane Stange

(Koordination Ethikkommission / Coordinator Ethics Committee)

Appendix II

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Digital Address: GA-050-3303
Mob: +233-50-3539896
Tel: +233-302-960628
Email: ethics.research@ghs.gov.gh

My Ref. GHS/RDD/ERC/Admin/App/24/578
Your Ref. No.

26th November 2024

Dr. Hannah Sackeyfio
Hamburg University of Applied Sciences
[redacted]

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC: 042/09/24**
Study Title	Exploring Experiences, Level of Training, and Outcome of Management in Neonatal Respiratory Care in Ghana: A Qualitative Study Involving Neonatal Care Personnel
Approval Date	26th November 2024
Expiry Date	25th November 2025
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of a 6-monthly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why.
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

You are kindly advised to adhere to the national guidelines or protocols on the prevention of COVID -19

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....[redacted].....
Mr. Kofi Wellington
(GHS ERC Chairperson)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

Appendix III

Dr Hannah Sackeyfio
[redacted]
22nd October 2024

The Medical Director
Greater Accra Regional Hospital
P.O.BOX GP 473
Accra, Ghana

Dear Sir/Madam,

Subject: Request for Permission to Conduct Research Study in the Neonatal Department

Protocol ID NO: GHS-ERC 042/09/24

I am Dr. Hannah Sackeyfio, a Master of Public Health student at the Hamburg University of Applied Technology, Germany. I am writing to seek permission to conduct a research study in the neonatal department of the Greater Accra Regional Hospital as part of my MPH thesis project.

Study Title: Exploring Experiences, Level of Training, and Outcome of Management in Neonatal Respiratory Care in Ghana: A Qualiatative Study Involving Neonatal Care Personnel.

Study Purpose: The main objective of this study is to investigate the experiences and training of healthcare workers in using ventilation devices for neonatal care, along with examining the outcomes of neonatal management.

Study Design: This research will employ a qualitative approach, including semi-structured interviews. The study will involve healthcare professionals, including doctors and nurses in the neonatal department.

Data Collection Period: The data collection period is scheduled between December 2024 to January 2025, with a duration of 2 months, contingent upon obtaining ethical approval from the GHS-Ethics committee.

Study Significance: The insights gained from this study are expected to contribute significantly to the enhancement of neonatal respiratory care practices in resource-limited settings, thereby reducing neonatal mortality rates and improving overall care quality.

I kindly request permission to conduct my study within the neonatal department of your esteemed hospital. I also request a confirmatory letter granting permission to undertake this study in your institution, which I will need to submit to the Ethical Review Committee of the Ghana Health Service. The support and cooperation of the Greater Accra Regional Hospital will be instrumental in the success of this research.

The data collected will be handled with strict confidentiality, and the results will be shared with the hospital administration to inform future practices and policies. I

Appenidx IV

PARTICIPANT INFORMATION SHEET

Title of Study

Exploring Experiences, Level of Training and Outcome of Management in Neonatal Respiratory Care in Ghana: A Qualitative Study Involving Neonatal Care Personnel.

Introduction

My name is Dr. Hannah Sackeyfio. I am a Master's student in Public Health at the Hamburg University of Applied Sciences in Germany and I am conducting this research study as part of my thesis work.

Background and Purpose of Research

Neonatal respiratory care is critical for improving outcomes for newborns, particularly in resource-limited settings like Ghana. This study aims to understand and enhance neonatal respiratory care practices at Greater Accra Regional Hospital(GARH).

Nature of Research

This study aims to conduct semi-structured interviews with healthcare workers, maintenance teams, and procurement staff at Greater Accra Regional Hospital (GARH) to obtain comprehensive insights into current practices, training adequacy, and challenges associated with neonatal respiratory care. Approximately 20-25 participants will be involved, and the research will be situated within the neonatal department of GARH. The study targets healthcare professionals directly engaged in neonatal respiratory care, including physicians, nurses, and medical technicians. Specifically, House Officers are preferred to have completed a minimum of 3 months of training in the pediatric department, with either a completed or ongoing rotation in the neonatal unit. Additionally, Nurses, Medical Officers, Specialists, Consultants, and Medical Technicians should possess at least 2 years of professional experience in neonatal care. Administrative and technical staff involved in equipment procurement, maintenance, and management, with a minimum of 2 years of relevant experience, are also invited to participate.

Participants' Involvement

Duration / What is Involved: Participants will be asked to take part in a face-to-face interview lasting approximately 30-60 minutes. The interview will explore your experiences, training, and challenges related to neonatal respiratory care.

Potential Risks: There are minimal risks involved in participating. However, you may experience minor emotional discomfort discussing your experiences and challenges.

Appendix V

Semi-Structured Interview Questions for Doctors

Introduction

1. Experience and Role: Can you describe your experience and role in neonatal respiratory care in this facility?

1. Motivation: What inspired you to specialize in neonatal care, particularly in respiratory management?

Section 1: Clinical Experiences and Challenges

1. Daily Responsibilities: What are your primary responsibilities in neonatal respiratory care?

2. Clinical Conditions: What are the most common neonatal respiratory conditions you encounter, and how do you approach their management?

3. Case Study: Can you share a challenging case involving neonatal respiratory distress? What decisions were critical to the outcome?

4. Overarching Challenges: From your perspective, what are the main challenges in managing neonatal respiratory care using CPAP?

5. Resource Differences: How do resource limitations in this facility impact neonatal respiratory care?

6. Case Burden: How does the volume and complexity of neonatal respiratory cases here compare to larger facilities?

Section 2: Training and Competency

1. CPAP Training: Have you received specialized training in CPAP use for neonates? If so, what was the focus, and how has it influenced your practice?

2. Gaps in Training: Do you feel current training programs adequately prepare doctors for neonatal respiratory care? What specific areas need improvement?

3. Training Accessibility: If specialized training is not available, how do you learn to manage CPAP or other respiratory care devices?

4. Learning Strategies: How do you stay updated on advancements in neonatal respiratory care, particularly for CPAP management?

Section 3: Strategic Impact of Training

1. Effectiveness of Training: How has CPAP training impacted your ability to manage respiratory distress in neonates effectively?

Semi-Structured Interview Questions for Nurses

Introduction

1. Experience and Role: Can you share your experience and role in neonatal respiratory care at this facility?

2. Motivation: What inspired you to pursue a career in neonatal care, especially in respiratory management?

Section 1: Practical Experiences and Challenges

1. Daily Responsibilities: Can you describe your routine in the neonatal unit, especially regarding respiratory care and the use of the different ventilatory modalities?

2. Operational Challenges: What challenges do you face when using respiratory devices in your daily work?

3. Case Study: Can you provide an example of a case where you managed a neonate with respiratory distress? What were the key challenges and how did you address them?

4. Team Collaboration: How does collaboration with doctors and other staff influence neonatal respiratory care?

5. Resource Constraints: How do resource constraints, such as equipment availability or maintenance, impact your ability to deliver effective neonatal respiratory care?

6. Experience Reflection: How has your experience with neonatal respiratory care evolved since you started working in this unit?

7. Team Dynamics: How does teamwork or mentorship within the neonatal unit help you manage respiratory care challenges?

Section 2: Training and Competency

1. CPAP Training: Have you received training in respiratory device usage? What specific aspects were most beneficial to your role?

2. Gaps in Training: Do you think current training programs address the practical challenges you face in using respiratory devices? What areas need more focus?

3. Training Barriers: What challenges have you faced in accessing training programs for respiratory care, and how have you adapted to these limitations?

4. Self-Learning: If you haven't had formal CPAP training, how have you developed the necessary skills to manage neonates with respiratory distress?

Semi-Structured Interview Questions

Neonatal Respiratory Therapists

Introduction

1. Can you tell me about your role and experience as a neonatal respiratory therapist?

2. What motivated you to specialize in neonatal respiratory care?

Section 1: Experiences and Challenges Faced by Neonatal Care Personnel

1. Could you describe your typical responsibilities in the NICU related to managing respiratory care for neonates?

2. What are the most common respiratory conditions or challenges you encounter when caring for neonates?

3. Can you share a specific case where you had to manage a neonate with severe respiratory distress? What challenges did you face, and how did you resolve them?

4. What technical or operational challenges do you encounter with respiratory equipment such as CPAP machines or ventilators?

5. How do you typically collaborate with other healthcare team members, such as neonatologists and nurses, in managing neonatal respiratory care?

Section 2: Training and Competency in Neonatal Respiratory Care

1. Have you received specific training on the use of CPAP and ventilators in neonatal respiratory care?

- If yes, what did the training include, and how has it influenced your practice?

2. Do you feel your training prepared you well for the challenges you face in neonatal respiratory therapy?

- Are there areas where you feel additional training is needed?

3. How do you stay updated on the latest advancements in neonatal respiratory care techniques and technologies?

4. How often do you participate in refresher training or professional development programs related to neonatal respiratory care?

5. Have you had to educate parents or other staff about respiratory equipment, and how do you approach that?

Section 3: Impact of CPAP Training on Neonatal Respiratory Care Management

1. How has training on CPAP devices influenced your ability to manage respiratory distress in neonates?

Semi-Structured Interview Questions

Biomedical Engineers

Introduction

1. Can you tell me about your role and experience with maintaining respiratory equipment, specifically for neonatal care?

2. What motivated you to work in the field of biomedical engineering, particularly in neonatal respiratory care?

Section 1: Experiences and Challenges Faced by Neonatal Care Personnel

1. Could you describe your typical responsibilities related to maintaining neonatal respiratory equipment, such as CPAP machines?

2. What are the most common technical challenges you encounter with neonatal respiratory devices?

   - For example, equipment malfunctions or difficulties with spare parts availability.

3. Can you share a specific situation where you faced a significant challenge with neonatal respiratory equipment? How did you address it?

4. How often do you communicate with healthcare practitioners about equipment issues or troubleshooting? What is usually discussed in these interactions?

Section 2: Training and Competency in Neonatal Respiratory Care

1. Have you received specific training related to maintaining CPAP and other neonatal respiratory devices?

   - If yes, what did the training cover, and how has it helped you in your role?

2. Do you feel that your training prepared you well for managing challenges with neonatal respiratory equipment?

   - Are there any gaps you think should be addressed?

3. How do you stay updated on advances in technology and best practices for neonatal respiratory equipment?

4. How frequently do you undergo refresher courses or receive new training on respiratory device maintenance?

Appendix VII: Transcripts and memos of all 15 interviews.

Please refer to the CD for the transcripts and memos in the electronic version