

# Factors influencing implementation strategies regarding environmental design in neonatal intensive care units

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## PREFACE

The article format has been selected for this study. The *Magister Curationis* (M.CUR) student, Ms MME Rakheta, conducted the research and wrote the article under the supervision of Dr Welma Lubbe.

The references of each chapter are kept separately, as the referencing style of the article is done according to author guidelines and therefore differ from the rest of the document which was prepared according to the North-West University's references guideline.

As yet, no permission has been obtained from the editor of *Curationis* to include the article as chapter 3 of this dissertation, but such permission will be requested when the article has been accepted for publication.

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I, Ms MME Rakheta, ID 7504180281085, student number: 21988773 hereby declare that I have read the North-West University's "Policy on Plagiarism and other forms of Academic Dishonesty and Misconduct" (NWU, 2011).

I did my best to acknowledge all the authors that I have cited and I tried to paraphrase their words to the best of my ability, while still portraying the correct meaning of their words.

I also acknowledge that by reading extensively about the topic, some information may have been internalised in my thinking, but I tried my best to give recognition to the original authors of the ideas.

I declare that this dissertation is my own work, although I respect the professional contribution made by my supervisor, Dr Welma Lubbe, and I would like to give due recognition to her.

Ms MME Rakheta

Date: November 2015

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# ABSTRACT

## Key terms

Extra-uterine environment, neonatal intensive care unit, neurodevelopmental supportive care, preterm neonatal care

## Background

Nurses working in neonatal intensive care units (NICUs) in South Africa's public hospitals might be familiar with the guidelines regarding the optimal environment for preterm infant development. However, a selected NICU in the Free State Province of South Africa did not seem to implement the best practice guidelines. The purpose of this study was to explore factors that influenced the implementation strategies regarding the environmental design in NICUs.

The following aspects are discussed as background information: foetal developmental stages to provide a guide as to what happens from conception till the birth of the baby; an ideal NICU design to ensure an intra-uterine nurturing environment for the preterm infant; and to anticipate and understand the challenges that this preterm infant might face in the extra-uterine environment. The researcher explored the factors influencing the implementation of best practice guideline one: 'environmental design implies creating an environment conducive for preterm infant development, similar to the intra-uterine environment' in an NICU in South Africa.

## Objectives

- To explore and describe factors influencing the implementation of the neurodevelopmental care of preterm infants in one NICU in South Africa;
- To describe suggestions made by registered nurses for the implementation of the best practice guideline regarding the NICU environment in the participating public sector hospital in the Free State.

## Method

The researcher utilised a descriptive qualitative research approach to guide this study to explore and describe the factors that influenced the implementation of environmental design guidelines to facilitate neurodevelopmental supportive care in one NICU. This study was guided by Als' Model of the Synactive Organisation of Behavioural Development (Als, 1982:229-243). Four focus group interviews were conducted with professional nurses working in a NICU, and data were analysed using Tesch's approach. Three themes emerged from the data: current practices

of the best practice guidelines; reasons for not implementing these best practice guidelines; recommendations to implement best practice guidelines.

## **Results**

Best practice guidelines and training were available to nurses working in the NICU in a selected public hospital. However, the environmental design guideline was not implemented due to shortages of staff, poor maintenance plans, financial constraints and lack of resources, as stated by the professional nurses during the focus group interviews.

## **Conclusion**

The environmental design guideline was not implemented, implying that babies in the NICU might not have received optimum care.

# OPSOMMING

## Sleutelterme

Ekstra-uteriene omgewing, neonatale intensiewe sorg eenheid, neuro-ontwikkelings ondersteunende sorg, vroeg gebore neonatale sorg

## Agtergrond

Verpleegkundiges, wat in neonatale intensiewe sorg eenhede (NISE) in Suid-Afrika se publieke hospitale werk, kan bewus wees van die riglyne aangaande die optimale omgewing vir vroeg gebore babas se ontwikkeling. Desnieteenstaande het dit geblyk dat ,in geselekteerde NISE, in die Vrystaat Provinsie van Suid-Afrika, die beste praktyk riglyne niege-implementeer het nie. Die doel van die studie was om die faktore te verken wat die implementeringstrategieë van die omgewingsontwerp in NISEs beïnvloed.

Die volgende aspekte is bespreek as agtergrond inligting: fetale ontwikkelingstadiums om as ,in riglyn te dien aangaande gebeure vanaf bevrugting tot die baba se geboorte; in ideale NISE ontwerp om ,in intra-uterus versorgende omgewing vir die vroeg gebore baba te verseker; en om die uitdagings te verwag en te verstaan wat die vroeg gebore baba mag ervaar in die ekstra-uterus omgewing. Die navorser het die faktore wat die implementering van die beste praktyk riglyn een: ,in omgewingsontwerp impliseer die skepping van ,in omgewing wat bevorderlik is vir die vroeg gebore baba se ontwikkeling, soortgelyk aan die intra-uterus omgewing in een NISE in Suid-Afrika, ondersoek.

## Doelwitte

- Om die faktore te ondersoek en te beskryf wat die implementering van die neuro-ontwikkelingsorg van vroeg gebore babas in een NISE in die Vrystaat, Suid-Afrika beïnvloed;
- Om voorstelle te maak vir die implementering van die beste praktyk riglyne aangaande die NISE omgewing in die deelnemende publieke sektor hospitaal in Suid-Afrika.

## Metode

Die navorser het ,in beskrywende, kwalitatiewe navorsingsontwerp benut om die studie te rig om faktore te ondersoek en te beskryf wat die implementering kan beïnvloed van die omgewingsontwerp riglyne om neuro-ontwikkeling ondersteunende sorg in een NISE te bevorder. Die studie is gerig duer Als se Model van Sinaktiewe Organisasie en Gedragsontwikkeling (Als, 1982:229-243). Vier fokusgroep onderhoude is gevoer met professionele verpleegkundiges wat in 'n NISE gewerk het, en data is ontleed deur Tesch se

benadering te gebruik. Drie temas het uit die data te voorskyn getree: huidige praktyke van die beste praktyk riglyne; redes waarom die beste praktyk riglyne nie geïmplementeer was nie; aanbevelings om die beste praktyk riglyne te implementeer.

### **Resultate**

Beste praktyk riglyne en opleiding was beskikbaar vir verpleegkundiges wat in die NISE in 'n publieke sektor hospitaal gewerk het. Desnieteenstaande was die omgewingsontwerp riglyn nie geïmplementeer nie as gevolg van personeel tekorte, swak onderhoud planne, finansiële beperkinge en 'n tekort aan hulpbronne, soos gestel duer die professionele verpleegkundiges tydens die fokusgroep onderhoude.

### **Gevolgtrekking**

Die omgewingsontwerp riglyn was nie geïmplementeer nie, wat moontlik daarop kon dui dat die babas in die NISE nie optimale sorg gekry het nie.

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## **ABBREVIATIONS**

BPG'S	Best practice guidelines
EBP	Evidence based practice
EDD	Expected date of delivery
ELBW	Extremely low birth weight
FG	Focus group
KMC	Kangaroo mother care
NDSC	Neurodevelopmental supportive care
NHCU	Neonatal high care unit
NICU	Neonatal intensive care unit
NWU	North-West University
SANC	South African Nursing Council
SFR	Single family room
UNICEF	United Nations International Children's Emergency Fund
VLBW	Very low birth weight
WHO	World Health Organization

# CHAPTER 1: OVERVIEW OF THE STUDY

## 1.1 INTRODUCTION

Chapter one provides an outline of the study. The researcher will introduce background information that led to the problem statement of this study, followed by the aim, objectives and the research question. Thereafter, the research design and methods, rigour and ethical considerations applicable to this study will be discussed.

## 1.2 BACKGROUND INFORMATION

Preterm births comprise 12.4% of all births in South Africa (UNICEF, 2014). These infants are often cared for in the neonatal intensive care units (NICUs) or neonatal high care units (NHCUs), which might be very different from the intra-uterine environment. The intra-uterine environment provides protection from both unwanted and potentially harmful stimulation and at the same time supports the unborn foetus to reach maturity which is crucial for survival outside the uterine environment. The intra-uterine environment further supports the critical development that takes place within the foetus during pregnancy. The NICU environment, although critical for survival, might not be the most appropriate environment to support 'normal' development, especially at the neurological level (Als, 1982:125), due to its high level of technology.

### 1.2.1 Challenges faced by preterm infants

The preterm infant is defined as a baby born before 37 completed weeks' gestation (Kaneshiro, 2014:1-2). This infant is born into the world with an immature sensory system and might also be physically ill, due to the prematurity. The NICU is a stressful, unsupportive environment that is very different from the supportive environment of the uterus (Als & Gilkerson, 1997:179). Intra-uterine the sensory system develops in a set sequence where one system's development depends on the maturation of the previous sensory system. The literature review (Chapter 2) will expand on this phenomenon. However, Als and Gilkerson (1997:180) described the extra-uterine sensory environment as an "unexpected challenge" for the preterm infant during a very sensitive period of brain growth. The extra-uterine environment causes stress to the infant born prematurely, such as increased oxygen needs, poor thermoregulation centres, poor respiratory control and immature digestive tract functioning (Als, 1982:129). In addition, inappropriate sensory stimulation, such as sounds or noises can impact negatively on the preterm infant. Loud or sharp sounds can cause physiological changes such as tachycardia, tachypnoea, apnoea, oxygen desaturation and a sudden increase in mean arterial blood pressure; disturbed

sleep, startles and possibly intracranial haemorrhage in a very low birth weight (VLBW) infant (Nair, Gupta & Jatana, 2003:93; Perlman, 2007:1343). Inappropriate stimulation of a preterm infant's senses can have negative effects. Although the NICU is regarded as being the best place to care for the fragile preterm infant, it might not be the most appropriate environment for supporting sensory development (Als, 1982:125). Research has demonstrated that caring for the preterm infant in a NICU environment, applying neurodevelopmental supportive (NDSC) care as a comprehensive model of care, improved both the short and long term outcomes of these infants at different levels, including medical, growth and development, and cost (Hendricks *et al.*,2002:40). To expand on this care modality, researchers, under the leadership of Robert White (2007), developed 'Recommended standards for newborn intensive care unit design', which specifically address the environmental design of the NICU to support preterm infant development, during this critical period. White (2007) further emphasised that a consistent set of standards is needed so that health care professionals, architects, interior designers and health care regulators can have a base for the critical design of current and future neonatal intensive care units.

### **1.2.2 Model of the Synactive Organization of Behavioural Development**

Als (1982:125) coined the term 'Synactive Organisation of Behavioural Development' which refers to a model where the infant's functions comprise continuous intra-organism subsystem interactions. The maturation of the behavioural organization is linked to the sensory development of the foetus and the preterm infant. The extra-uterine environment contributes to or may negatively influence this maturation. The synactive model was used as a guide in the development of the best practice guideline (BPG) under investigation and will be discussed in more detail in chapter 2.

### **1.2.3 Development of best practice guidelines (BPGs)**

In the South African arena, researchers contextualized the work from international researchers. As a result Lubbe (2009:258) developed best practice guidelines (BPGs) for NDSC to be implemented in the South African setting, which would be in line with the current drive towards evidence based practice (EBP). Best practice guidelines were conceptualized by Lubbe (2009:251) for South Africa as "systematically developed statements, based on the best evidence available, to assist practitioners" decisions about appropriate health or disability care (NDSC) for the preterm infant in the public sector hospitals in South Africa. "BPGs are based on results from an integrative literature review, comprising both theoretical and empirical studies

findings". For the formulation of the BPGs, researchers, reviewers and clinical practitioners participated in developing the guidelines.

Lubbe (2009:276) developed a set of 18 guidelines of which the first BPG speaks to the NICU environment and was formulated as follows: 'BPG 1 – Environmental design: create an environment conducive for preterm infant development, similar to the intra-uterine environment' (Lubbe, 2009: 276; Lubbe, Van der Walt & Klopper, 2012: 251-9). This BPG suggests structuring the NICU environment for the preterm infant, to support optimal development, and it provides evidence supporting this recommendation. Furthermore, it addresses specific actions with regard to auditory and visual stimulation, cycled light and quiet times as well as olfactory inputs, that the bedside practitioner should implement (Lubbe, 2009:276).

These guidelines were developed and healthcare practitioners, working in the NICU environment, were aware of the NDSC model. However, it was unknown whether the first BPG on 'environmental design' had been fully implemented in a selected hospital in the Free State Province of South Africa.

### **1.3 PROBLEM STATEMENT**

In South Africa, professional nurses are practitioners registered with the South African Nursing Council (SANC) (Weller & Wells, 1990:336). It falls within their scope of practice to apply clinical judgement in the provision of care of preterm infants to maintain, improve and support optimum health recovery. However, nurses need guidelines to support their actions and guide their decision making. BPGs, such as the ones developed by Lubbe (2009:276-300; Lubbe *et al.*, 2012: 251-259), contribute to the standardisation of care and provide guidelines for nurses concerning the nursing activities of each neonatal unit (Registered nurses association of Ontario: 2003). These BPGs provide direction to practising neonatal nurses and midwives to improve the care of preterm infants, and could help to combat neonatal morbidity and mortality rates in South African government hospitals. This might even contribute to policy-making and resource allocation, based on evidence which might ultimately lead to improved preterm outcomes.

Healthcare professionals were aware of NDSC as a model of care and some had received training to implement this model of care. However, the environmental design in the selected NICU was not conducive to preterm infant development, as it was not similar to the intra-uterine environment. The research problem could be stated as what are the factors that influence environmental design guidelines in neonatal intensive care unit (NICU) to promote implementation of the best practice guidelines for neurodevelopmental supportive care of preterm infants?

## **1.4 RESEARCH QUESTION**

This study attempted to answer the following question: What factors influenced the implementation of environmental design guidelines to promote neurodevelopment supportive care for preterm infants in the NICU unit of a selected hospital in the Free State Province of South Africa

## **1.5 AIM OF THE STUDY**

This study forms part of a larger project exploring the implementation of BPGs for NDSC of preterm infants in the South African context. The main aim of the current study was to explore the factors influencing the implementation of the guideline concerned with environmental design: “creating an environment conducive for preterm infant development, similar to the intra-uterine environment’ (Lubbe, 2009:276-279; Lubbe, *et al.*, 2012: 251-9) within a selected level three, public hospital in the Free State Province of South Africa, to ensure improved developmental outcomes for preterm infants in public sector hospitals.

## **1.6 OBJECTIVES**

The objectives of the current study were to:

- explore and describe factors influencing the implementation of best practice guidelines for NDSC of preterm infants in one NICU/NHC aligning South Africa with regard to the NICU environment;
- suggest strategies for enhancing the implementation of the BPG regarding the NICU environment in one public sector hospital in the Free State, in South Africa.

## **1.7 DEFINITIONS OF KEY CONCEPTS**

### **1.8 BEST PRACTICE GUIDELINE (BPG)**

Best practice guidelines are systematically developed statements, based on the best available evidence, to assist practitioners’ and clients’ decisions concerning appropriate healthcare in specific clinical circumstances (RNAO.2003:21).

### **Environment**

The environment, in the context of the current study, refers to concepts/stressors, such as light, noise and odours to which the preterm infant might be exposed during his/her stay in the NICU. The most supportive environment for the preterm infants in the NICU would be similar to the intra-uterine environment (White, 2010:3).

### **Focus group interview (FGI)**

An interview with a group of individuals assembled to discuss a given topic (Polit & Hungler, 1997:457) to obtain in-depth, descriptive information on a selected topic is known as a focus group interview.

### **Neurodevelopmental supportive care (NDSC)**

Neurodevelopmental supportive care (NDSC) is the approach that uses a range of evidence-based nursing and medical interventions that aim to decrease the stress of the preterm infant in a NICU (Nair *et al.*, 2003:9).

### **Neonatal high care unit (NHCU)**

This is a unit that provides a basic level of newborn care to low-risk infants, ensuring that high dependency care is rendered to infants who do not need to be admitted to intensive care units (training in Neonatal medicine, 2000:59), but who nevertheless require a more complex level of care (White, 1999 [on line]).

### **Neonatal intensive care unit (NICU)**

This is a unit that specializing in the care of ill or premature newborn infants, is a unit that cares for infants throughout the region who requires specialized care (training in Neonatal medicine, 2000:59). It provides specialised intensive care to neonates. Hence is regarded as the best extra-uterine environment where the infants can receive all the required support, including NDSC (White, 1999[on line]). Throughout this dissertation, any reference to NICU implies both NICU and NHCU, unless otherwise specified.

### **Preterm infant**

A preterm infant is an infant born before he/she could reach term, or before 37 completed weeks from the first day of the mother's last normal menstrual cycle until the day of birth (Woods, 1996:17).

### **Public hospitals**

Hospitals that render medical services to people who do not have access to private medical insurance, are known as public hospitals. These hospitals are categorised into level 1, 2 and 3 facilities in South Africa. Level 3, or tertiary level hospitals, are relevant to this study as these facilities provide specialised services for the sick and most fragile infants, such as neonates requiring assisted ventilation. A level 3 hospital is usually a teaching hospital affiliated to a medical school and its staff comprises nurses with advanced training in midwifery and/or neonatal care, midwives, professional nurses, enrolled nurses and enrolled nursing assistants (South Africa, 2008:15).

## **1.9 RESEARCH DESIGN AND METHODS**

This section provides an overview of the research methods and procedures followed to answer the research question.

### **1.9.1 Research design**

A research design focuses on the logic of the research process to determine what kind of evidence is required to address the research question adequately. This study employed a qualitative design as described by Sandelowski & Barroso (2003:334-340). The nature of the current qualitative study complied with that specified by Burns and Grove (2005:641) as: “The intent of a qualitative research report is to describe the flexible, dynamic implementation of a research project and the unique creative findings obtained”.

#### **1.9.1.1 Qualitative research design**

The qualitative research design is often associated with a naturalistic inquiry as defined by Polit and Hungler (2013:14-15). The researcher followed qualitative design to obtain a deeper understanding of the factors that could influence the effective implementation of the environmental design in one NICU in the Free State Province. By so doing, the researcher wanted to explore the factors influencing the implementation of the suggested NICU environmental design guideline as formulated by Lubbe (2009:276-279; Lubbe, *et al.*, 2012: 251-9) to facilitate neuro-developmental supportive care of preterm infants. Burns and Grove (2011:4-5) and Klopper (2008:62) stated that this type of qualitative research is an approach that attempts to understand the phenomenon under investigation by means of the analysis, integration and synthesis of non-numeric narrative data. This study was also explorative, descriptive and contextual in nature.

#### **1.9.1.2 Explorative research design**

An exploratory design is used to explore the dimensions of a phenomenon (Polit & Hungler, 2013:457). This enabled the researcher to utilise and explore the factors influencing the implementation of the BPG related to the environment of the preterm infant in the NICU and this was done by conducting focus group interviews with nurses who were working in the NICU participating in the current study.

#### **1.9.1.3 Descriptive research approach**

A descriptive research approach was adopted to enable the researcher to gather information about nurses' perceptions, regarding factors that could influence the implementation of the

environmental design in the NICU that could enhance the preterm infants' neurodevelopment. A literature review was conducted to obtain insight into what others were doing in similar situations (Burns & Grove, 2009:248). Since the researcher was interested in a South African government hospital's NICU, this approach enabled her to gather rich information, descriptive in nature. This was done by means of conducting a comprehensive literature review, to identify factors that might influence BPG implementation, and confirmed by well-described, rich data obtained during focus group interviews conducted with nurses working in a NICU.

#### **1.9.1.4 Contextual research design**

This study was contextual in nature due to the interest of the researcher in immersing herself in the events, actions and processes (factors influencing NDSC implementation) rather than merely the study's outcomes and results. The researcher aimed to understand which factors influenced the implementation of BPG 1, addressing the environmental design of a NICU, as perceived by participants from one selected tertiary hospital in the Free State Province of South Africa, and without aiming to generalise these findings (Schurink, 2000b:281; Babbie & Mouton, 2002:272).

#### **1.9.2 Population**

A NICU is a speciality unit, staffed mostly by nurses who have been trained for NICU or have had some form of special training and/or experience enabling them to function, as expected, in this unit (Directorate, 2008:15). Neonatal nurses are further registered with the South African Nursing Council (SANC) in the capacity of having done neonatal sciences (Weller, 1990:336). The current study's population included the 20 neonatal nurses working in one selected NICU and in one neonatal high care unit NHCU in a selected tertiary (level 3) hospital in the Free State Province of South Africa. These nurses were perceived as having specific knowledge about factors influencing the implementation strategies regarding the environmental design in NICUs (Burns & Grove, 2011:159). The hospital was purposively selected; since it claims to practise NDSC and some of its staff members had received training in providing NDSC for preterm infants. Furthermore, the previous study by Lubbe (2009:220-225), which was performed to formulate the BPGs, also included this site.

#### **1.9.3 Sample**

The participants were selected by means of purposive, non-probability sampling (Polit & Hungler, 2004:294), where participants were regarded to be typical of the population in question or particularly knowledgeable about the issues under study. Participants were selected, based on their assumed knowledge of the supportive NICU designed environment and BPGs related

thereto. Consequently they were expected to provide rich data (Burns & Grove, 2005: 353-354). Participants were professional nurses working in a NICU, and thus guided by the code of conduct by the SANC and had similar characteristics which would enable them to be comfortable talking to the interviewer and to each other during focus group interviews (Searle & Pera, 1992:249-250).

### **1.9.3.1 Inclusion criteria**

Neonatal trained and experienced professional nurses with at least two years' clinical experience in the NICU; registered with the SANC and working full-time in the NICU/ Neonatal high care (NHCU) of the selected hospital, were included in the study sample. It was assumed that these nurses would have had sufficient knowledge and experience about NDSC as part of preterm infant care, and would therefore be able to provide the researcher with rich information about factors influencing the implementation of the BPG related to environmental design in a NICU. These nurses were also expected to be fluent in English since this is the professional language used in the NICU. The other inclusion criteria included that the neonatal nurses agreed to participate in focus group interviews and were willing to be voice recorded during these interviews.

### **1.9.3.2 Exclusion criteria**

Nurses who had recently, been appointed as professional nurses, thus having less than a year working in NICU, enrolled nursing assistants, enrolled nurses and nurses completing their community service year, as well as registered nurses not working permanently in the NICU were excluded. Any of the nurses who did not match the inclusion criteria were also excluded.

### **1.9.3.3 Recruitment and sampling**

Recruitment preceded the sampling process. Ethical clearance and permission to conduct the study was first obtained from the North-West University (NWU), Health Research Ethics Committee, Free State Department of Health and the hospital's chief executive officer (more details are presented later in this chapter and also in chapter 3 of this dissertation). The researcher contacted the unit manager telephonically and followed up with an e-mail to explain the purpose of the study and to address any questions. This was done to provide an audit trail of written proof of consent to conduct the study. The unit manager acted as mediator, since she identified the professional nurses who were eligible to participate in the study and she explained the purpose of the study on behalf of the researcher. The researcher attended a staff meeting, where she had the opportunity to introduce herself, inform the professional nurses about the study's purpose, answer questions and invite the nurses (meeting the inclusion criteria) to

participate in focus group interviews. Informed consent forms were handed to potential participants who were requested to return these to the unit manager within 24 hours. The unit manager provided the names and contact details of eligible participants who had signed consent forms. The researcher contacted the potential participants and arranged a suitable time and place for the focus group interviews during the nurses' off-duty hours. The NICU professional nurses who were available during the scheduled times were requested to participate in focus group interviews at a scheduled time and date and place.

## **1.10 DATA COLLECTION**

Polit and Beck (2008:36) define data collection as pieces or parts of information that the researcher gathers that are relevant to the purpose of the study. The actual steps of collecting data are specific to each study depending on the research design (Burns & Grove, 2009:542). This qualitative study focussed on factors influencing the implementation of environmental design guidelines to promote NDSC for preterm infants in the participating NICU. Data were collected by means of four focus group interviews, conducted at different times and with different participants, facilitated by the researcher. Five professional nurses participated in each focus group interview, totalling 20 participants in this study.

According to Krueger (1994:3) a focus group is a technique involving the use of in-depth interviews within a group setting. They are group interviews that form social relationships, intended to exchange opinions and experiences simultaneously between the researcher and the participants (Botma *et al.*, 2010:205; Greeff *in De Vos et al.*, 2005:360). Focus group interviews involve a three-way verbal communication between researcher and the participants as well as between the participants themselves (Greeff, 2005:300). It provides a means for better understanding how people think about an issue and it is useful when multiple viewpoints or responses on a specific topic are needed. The focus group allows stimulation of thoughts by the responses from the participants (Greeff *in De Vos et al.*, 2000:360), as the researcher directs the flow of the discussion by asking open-ended questions and using non-verbal cues to extract greater depth of meaning, or richer information.

### **1.10.1 Focus group interviews**

The reason why the researcher opted to utilise focus group interviews, as a data collection method, was to ensure that participants' perceptions of a particular NICU setting could be conveyed in a socially non-threatening environment. Group dynamics could assist participants to express and clarify their views in ways that were less likely to occur during a one-to-one interview (Burns & Grove, 2005:542), and thus provide access to richer and deeper expressions of opinion (Polit & Beck, 2008). Participants were likely to share different experiences, opinions

and feelings on the NICU environment in the presence of other NICU nurses, as they could share and compare their experiences and knowledge (Polit & Hungler, 1997:255). The uniqueness of a focus group interview is its ability to generate data based on the synergy of the group interaction (Burns & Grove, 2005:542). The members of the group, therefore, felt comfortable with each other and engaged in discussions about their beliefs, perceptions and experiences of factors influencing the implementation strategies regarding the environmental design in the participating NICU.

### **1.10.2 Researcher's role during focus group interviews**

The researcher formulated the central question to direct the focus-group interviews and structured probing questions, as shown in table 1.1. A suitable venue on the hospital grounds was secured to conduct the focus group interviews. All required pieces of equipment, including chairs arranged in a semi-circle, audio voice recorder, extra batteries, note book and pen, drinking water and glasses, were assembled. The researcher notified potential participants regarding the date and time of the focus-group interviews and emphasised that focus group interviews would be conducted during off-duty time, to ensure that their nursing duties would not be compromised.

### **1.10.3 Focus group interview process**

The researcher identified 20 professional nurses who met the inclusion criteria, with the assistance of the NICU unit manager, as potential participants for specific focus group interviews. Five professional nurses participated in each focus group interview. Data saturation was reached after the second focus group interview had been completed, implying that no new data emerged and that the same themes were repeated (Babbie & Mouton, 2002:288). However, the third and fourth focus group interviews were conducted to ensure that no new information became available. Provision was made to address possible drop-outs by inviting more than five participants for each scheduled focus group interview, since too few people could limit group interaction by not offering enough stimulation (Babbie & Mouton, 2002:288), while larger groups could produce more varied responses, particularly when less information is needed from each participant.

The focus group interviews lasted approximately twenty to thirty minutes each and were conducted in a quiet setting within the premises of the participating hospital. Participants were informed about the expected time commitment before accepting the invitation. The researcher was the only moderator for all focus group discussions, which facilitated the flow of information. As all focus group interviews were audio-recorded, the credibility of the transcribed data could be checked.

The researcher used interview skills such as being an effective group leader, by facilitating the focus group interviews. The researcher welcomed and thanked every participant. Then she requested the group participants to introduce themselves to the group to establish rapport with the entire group. Thereafter the purpose of the focus group interview was clarified. The researcher also promoted meaningful discussions by using probing questions as recommended by (Polit & Hungler, 1997:258), where further clarity was required to guide the discussion towards a meaningful conclusion. She also utilized her group facilitation skills, such as her active listening skill, to interpret the needs and feelings of specific participants during the focus group interviews (Greeff *in De Vos et al.*, 2005:360). The facilitator ensured that all participants contributed to the discussion by encouraging the more quiet ones to render their contributions and by requesting the more vocal ones to allow others to voice their opinions. The researcher conducted the focus group interviews and was also the recorder of field notes. All focus group interviews were audio-recorded and transcribed verbatim by the researcher prior to the commencement of data analysis (coding, independent coding and consensus).

The researcher utilised a semi-structured questionnaire format. The researcher started with some general questions to allow the participants to tell their stories in a narrative fashion. Probing questions, as shown in table 1.1, based on the reviewed literature, offered the researcher flexibility in gathering the information from the research participants.

**Table 0-1: Interview protocol**

<b>Interview Protocol</b>	
Description of project:	The purpose of this study is to determine the factors influencing the implementation of environmental design guidelines to facilitate NDSC in NICUs.
<b>Questions:</b>	<b>Field Notes</b>
<b>Main question:</b> What influenced the implementation of the environmental design BPG to promote NDSC in your NICU?	
<b>Probing questions:</b> Please elaborate more on the barriers that you encountered to implement NDSC in your NICU.	
Are there any other issues in conjunction with the environment in NICU that we have not touched upon that you would like to discuss?	
What do you suggest can be done to improve the implementation of NDSC in your NICU?	

**1.10.4 Field Notes**

The researcher compiled field notes which were written immediately after each focus group interview. Field notes included body language, as well as the verbal and nonverbal conversations between the interviewer and the interviewees, including tone of voice. Field notes recorded unstructured observations made during the focus group interviews and their interpretations (Polit, *et al.*,2004:642). Field notes are written accounts of the things the researcher heard, saw, thought and experienced in the process of collecting or reflecting on data obtained during the study (Botma *et al.*, 2010:218). Field notes were written by the researcher to serve as an analytical base for the collected data on the perception of the NICU nurses, and as a written record for future publication of the research results (Polit & Beck, 2008:36). According to Polit and Hungler (1997:273) field notes should focus on the following categories, which were included in the field notes taken by the researcher:

**1.10.4.1 Observational notes**

These notes reflected the researcher’s thoughts about the meaning of the observations made during the focus group interviews, about the observed group dynamics, how the group sat and

the ways in which they interacted with each other and important issues that emerged during the specific focus group discussion.

#### **1.10.4.2 Methodological notes**

This reflected on the strategies and methods used during the focus group session. Reports on the portraits of description of participants, the physical setting, and the interviewers account of particular events that occurred and of activities that took place during the interview and the reconstruction of dialogue (Polit *et al.*, 2004:307).

#### **1.10.4.3 Personal notes**

The researcher reflected on her own feelings and perceptions during the focus group interviews and tried to make meaning out of emerged themes. This involved the researcher's personal thoughts such as speculation of incidents, feelings, problems encountered during an interview, ideas generated during the process, as well as hunches, impressions and prejudices (Botma *et al.*, 2010:218).

### **1.11 DATA ANALYSIS**

Data analysis commenced while transcribing the interviews verbatim and while typing the field notes. Numbers were assigned to each focus group (Polit & Beck, 2008:38) to ensure anonymity. The researcher then used Tesch's (1990) approach during coding and made use of an independent co-coder using the same technique to verify the data (Creswell, 2003:191-197; Poggenpoel, 2000:343-344). This approach required that eight steps were considered while analysing the data.

- **1<sup>st</sup> step:** The researcher read all the transcriptions and field notes carefully to get a sense of the whole and wrote down some ideas as they came to mind. And then by reading and re-reading, identified critical processes and developed insight into the foundation or essence of the content (Creswell, 2003:191-197).
- **2<sup>nd</sup> step:** The researcher selected one interview and jotted down thoughts about the meaning of the information as ideas emerged. Major categories were identified about the phenomenon under investigation.
- **3<sup>rd</sup> step:** A list of topics was compiled and similar topics were clustered together into groups.
- **4<sup>th</sup> step:** The researcher identified descriptive words for the topics and assigned these words to the appropriate sections.

- **5<sup>th</sup> step:** The topics were grouped together and relationships were identified to reduce the total number of categories.
- **6<sup>th</sup> step:** The researcher made the final decision on the categories and alphabetised the codes.
- **7<sup>th</sup> step:** The information belonging to each category was assembled and a preliminary data analysis was performed.
- **8<sup>th</sup> step:** The existing data were then re-coded as necessary.

On completion of these steps, the researcher had three columns pertaining to field notes, direct quotations from the transcriptions and derived themes. Copies of the transcriptions were sent to the co-coder who followed the same process to ensure the consistency of the coding process, according to Tesch's approach (Creswell, 2003:191-197). After the co-coder also independently coded the data, she and the researcher compared their findings and there were no discrepancies.

## **1.12 MEASURES TO ENSURE RIGOUR**

Rigour in research refers to the establishment of confidence in the truth (credibility) of the findings of the study and the criteria through which this credibility was established (Lincoln & Guba, 1985:290). Trustworthiness of qualitative research was established by using four strategies, namely credibility, transferability, dependability and confirmability (Krefting, 1991:1).

### **1.12.1.1 Trustworthiness**

Burns and Grove (2005:749) define trustworthiness as obtaining the same or comparable results every time the method is used on the same or comparable participants. Although English might not have been all participants' home language, this was not deemed an important factor. Only registered nurses participated in the focus group interviews and they communicated in English while working in the participating NICU. Credibility

### **1.12.1.2 Credibility**

Lincoln and Guba (1985:298) refer to credibility as confidence to the truth of the data and they pointed out that the credibility of an inquiry involves two aspects. Firstly, carrying out the investigation in such a way that the believability of the findings is enhanced and, secondly, taking steps to demonstrate the credibility. Credibility establishes how confident the researcher is regarding the truth of the findings and that the results of qualitative research are credible or

believable from the perspective of the participant, researcher or reader of the research (Creswell, 2003:195; Denzin & Lincoln, 2003:69; Miles & Huberman, 1994:278,279). The researcher conducted all focus group interviews. In cases where participants wanted to reflect on the group discussion, the recorded interview was re-played to the group immediately after the focus group session. This enabled participants to feel that their contributions were important.

The researcher ensured credibility by means of prolonged engagement (Klopper & Knobloch, 2009:5), building a trusting relationship with the participants and by working in the field of neonatal care for an extended period of time. Transcriptions of the focus group interviews were also provided to participants to ensure the correctness of the recorded data. Triangulation of data sources was obtained by using of an in-depth literature review, focus group interviews and field notes to produce a thick description of the data (Klopper & Knobloch, 2009:5).

#### **1.12.1.3 Transferability**

Lincoln and Guba (1985:297) refer to transferability as the extent to which the findings could be transferred to other settings or groups, that is the extent to which the process can be applied to other contexts or to other participants (Miles & Huberman, 1994:279; Schurink *et al.*, 2000:331, 349; Klopper & Knobloch, 2009:7). This study did not intend to generalise the findings beyond the NICU that participated in this study, but a detailed and thorough description of methods, processes and results throughout the study were provided (Babbie & Mouton, 2001:277; Miles & Huberman, 1994:279; Klopper & Knobloch, 2009:7). This information should enable the reader to decide to what extent his or her context is similar to or different from the study's site and whether the findings of this study might be applicable for deciding whether the BPG might be appropriate in another setting.

The obligation to demonstrate transferability therefore rests on those who wish to apply it to the receiving context (the reader of the study), but the researcher enhanced transferability by thoroughly describing the research context and the assumptions underlying the study (De Vos, 2005:345-346).

#### **1.12.1.4 Dependability**

Dependability refers to the stability of data over time and over conditions (Lincoln & Guba, 1985:298). It also refers to the degree to which the research instrument can be depended upon to yield consistent results if used repeatedly over time on the same persons, or if used by different investigators under the same conditions (Polit & Hungler, 2001:304). One threat anticipated on the data interpretation phase was the tendency to positively evaluate the

research that was congruent with the reviewer's own experiences and beliefs and negatively evaluate and interpret the data by her own understanding. Therefore, the researcher enhanced dependability by employing an independent reviewer, a peer following the process and procedures used by the researcher to determine whether they were acceptable; counter checking throughout the focus group interviews, to indicate to which extent independent administrations of the same instrument would provide similar results if used in comparable conditions.

#### **1.12.1.5 Confirmability**

According to Polit and Hungler (2001:307), conformability refers to the objectivity or neutrality of the data, in such that there will be an agreement between two or more independent people about the data's relevance. Confirmability is the criterion of neutrality (Poggenpoel, 2000:350), and refers to the degree to which the findings of an inquiry are determined by participants and could be confirmed by others and are not biased, influenced by the researcher, other motivations and perspectives (Miles & Huberman, 1994:278; Schurink *et al.*, 2000:331). The researcher made use of an independent co-coder for data analysis and peer examination of the findings was done by the supervisor of the study.

To ensure rigour in a focus group interviews, the researcher systematically considered the elements of conducting such interviews. This required that the research problem and purpose were clearly defined and clearly tabulated and the problem statement was guided by a conceptual and theoretical framework.

### **1.13 ETHICAL CONSIDERATIONS**

All forms of the research were subjected to codes of ethics for the protection of human participants. The research was done on the basis of ethical and scientific acceptability.

#### **1.13.1 Informed and voluntary consent**

Permission to conduct the study was obtained from the Health Research Ethics Committee, Faculty of Health Science of the North-West University (Ethics number NWU 00010-14-S1, see ANNEXURE 4), as well as from the head of the Department of Health of the Free State Province(ANNEXURE 7). The researcher then obtained permission from the management of the tertiary hospital in the Free State Province, where the study was conducted (ANNEXURE 3). A consent form was handed to every potential participant who could decide independently whether or not to participate as the signed consent forms were collected at a later date (ANNEXURE 1).The unit manager of the selected NICU was contacted to identify the participants who met the inclusive criteria. She was well informed about the nature and purpose

of the study and informed potential participants. She provided the contact details of professional nurses who met the study's inclusive criteria and who indicated their interest to participate in this study.

Voluntary informed consent was obtained from each potential participant who met the inclusion criteria and who was willing to participate in a focus group interview. The researcher contacted all available participants telephonically and invited them to participate in a focus group on one of set dates. Information about the focus group was sent to participants via e-mail or another arrangement as made between the researcher and invited participant.

### **1.13.2 Confidentiality and anonymity**

The fact that the participants in the study knew each other was respected. Due to the nature of the study, confidentiality and anonymity might have become problematic (Guba & Lincoln, 1994:115; Mouton & Marais, 1996:157). For this reason, participants were purposively selected and the researcher attempted to establish the best possible interpersonal relationship with the participants (Mouton & Marais, 1996:157).

A private room that accommodated up to 12 people seated in a U-shape was used for conducting the focus group interviews. Participants attended focus group interviews during their off-duty time at the venue not in the proximity of the NICU. Colleagues were therefore unable to know who were participating in the study and participants did not fear being overheard by their colleagues in the NICU.

Anonymity occurs when even the researcher herself or anyone else cannot trace or link a participant with the data provided by that person. Partial confidentiality was provided during focus groups interviews, since participants knew each other, but their identities were kept confidential in all reports. Participants were made aware of confidentiality issues and requested to agree to not sharing any information outside the focus group interview to ensure anonymity. In this study anonymity was further maintained by removing names and assigning code numbers to each participant/transcription. This ensured the protection of the participants' right to privacy (Brink *et al.*, 2006:30-43). The researcher further ensured that no information provided by the participant would be publicly reported or made accessible to parties except those involved in the study.

Digital recordings were stored on a password protected computer and erased from the original recording device. It was transcribed verbatim and the transcripts would be kept under lock and key in a locked cupboard inside a locked office for a period of six years at the School of Nursing Science, North-West University, Potchefstroom campus.

Other documentation, such as field notes, would be dealt with in the same way as the verbatim descriptions.

### **1.13.3 No harm principle - beneficence**

This researcher did not intend to do any harm. Participants could benefit from this study by sharing different NICU experiences with their colleagues in a structured manner. This led to understanding challenges encountered in the implementation of guidelines of environmental design leading to strategies to enhance preterm infants' neurological development (Lubbe, 2009:85). If suggestions were implemented it could lead to an improved quality of care for preterm neonates with improved infant outcomes. The findings of this study could increase the body of knowledge regarding a NICU's ideal environmental design to ensure quality care of preterm infants.

### **1.13.4 Right to withdraw**

All participants had the right to withdraw from participating in the focus group interviews at any time and they were in no way penalised for withdrawing.

### **1.13.5 Autonomy**

A participant's autonomy refers to his/her right to self-determination (Burns & Grove, 2001:196). All participants in the current study could decide independently, without any coercion whatsoever, whether or not they wanted to participate in the focus group interviews. Some potential participants, who did not want to participate in English focus group interviews, because they insisted on using their own home languages, were allowed to withdraw without incurring any negative consequences whatsoever.

### **1.13.6 Justice and respect**

This refers to the equal distribution of risks and benefits between communities. The researcher respected the ethics of justice, fairness and objectivity in respecting the dignity of participants and by not exposing them to intentions and motives not directly related to the research project, its methodology and objectives (Babbie & Mouton, 2002:528; Benetar *et al.*, 1993:1, 5, 6).

As explained by Polit and Hungler (1997:137), the researcher ensured justice by honouring all the prior agreements made between her and the participants, such as non-prejudicial treatment of people who declined to participate and/or who withdraw from the study after agreeing to participate in the study. Furthermore, all professional nurses working in the NICU of the selected hospital had an equal chance to participate in the focus group interviews.

### 1.13.7 Dissemination

The researcher will share the research results that would be obtained from the focus group interviews as a way of contributing to the body of nursing knowledge (Brink *et al.*, 2006:30-43). This would further be distributed by means of submitting articles to journals in the relevant research field, presenting conference papers and workshops. All participants will be informed individually about the results of the study after completion of the project. By implementing the BPGs, the South African community and government together with relevant stakeholders could benefit from this study's findings.

### 1.13.8 Misconduct

The researcher acted honestly. No results were disguised and all contributors were acknowledged. The researcher complied with the North-West University's code of conduct. Plagiarism was avoided by acknowledging and referencing the work of other people used in this study. The study was reported as clearly as possible to provide an honest reflection of the whole research process (Brink *et al.*, 2006:30-43).

## 1.14 OUTLINE OF THE DISSERTATION

The dissertation comprises the following four chapters:

**Chapter 1:** Overview to the study

**Chapter 2:** Literature review

**Chapter 3:** Article – titled: Factors influencing implementation of the environmental design guidelines for facilitating NDSC in neonatal intensive care units will be submitted to *Curationis* (The study's results and methodology will be discussed in this chapter).

**Chapter 4:** Limitations, conclusions and recommendations

### 1.15 SUMMARY

This chapter introduced the problem to be addressed in this dissertation, namely enhancing NDSC of preterm infants in NICUs. The study's aim as well as objectives and the research question that were addressed as well as the research design and methods, rigour and ethical considerations applicable to this study. The next chapter will provide an overview of the reviewed literature relevant to the research phenomenon

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1 INTRODUCTION**

In this chapter a literature review, in relation to the topic of interest, will be discussed.

Preterm infants are born into a stressful, unsupportive environment that is very different from the supportive environment of the uterus (Als, 1982:230). The uterine inner walls and amniotic fluid provide the foetus with a calming sensation including rhythms of being awake and of sleeping. It also provides sound and light stimulation appropriate to the foetus' developmental stage. In contrast, the extra-uterine environment causes stress for the infant born prematurely, since the infant encounters stressors like an increased oxygen need. Research has emphasized that the NICU or NHC environment is a totally new world for a preterm infant although it is regarded as being the most supportive extra-uterine environment for the preterm infant (Als, 1982:230).

Therefore, the NICU should be adapted to resemble an environment similar to that of the uterine environment that will be calming and supportive so as to decrease stress and support growth and development of the preterm infant. Hence Lubbe (2009:276-300) developed the best practice guideline (BPGs) for neurodevelopmental supportive care (NDSC) of preterm infants to ensure their optimal development, and the reason why NICU design need to compensate for this challenges.

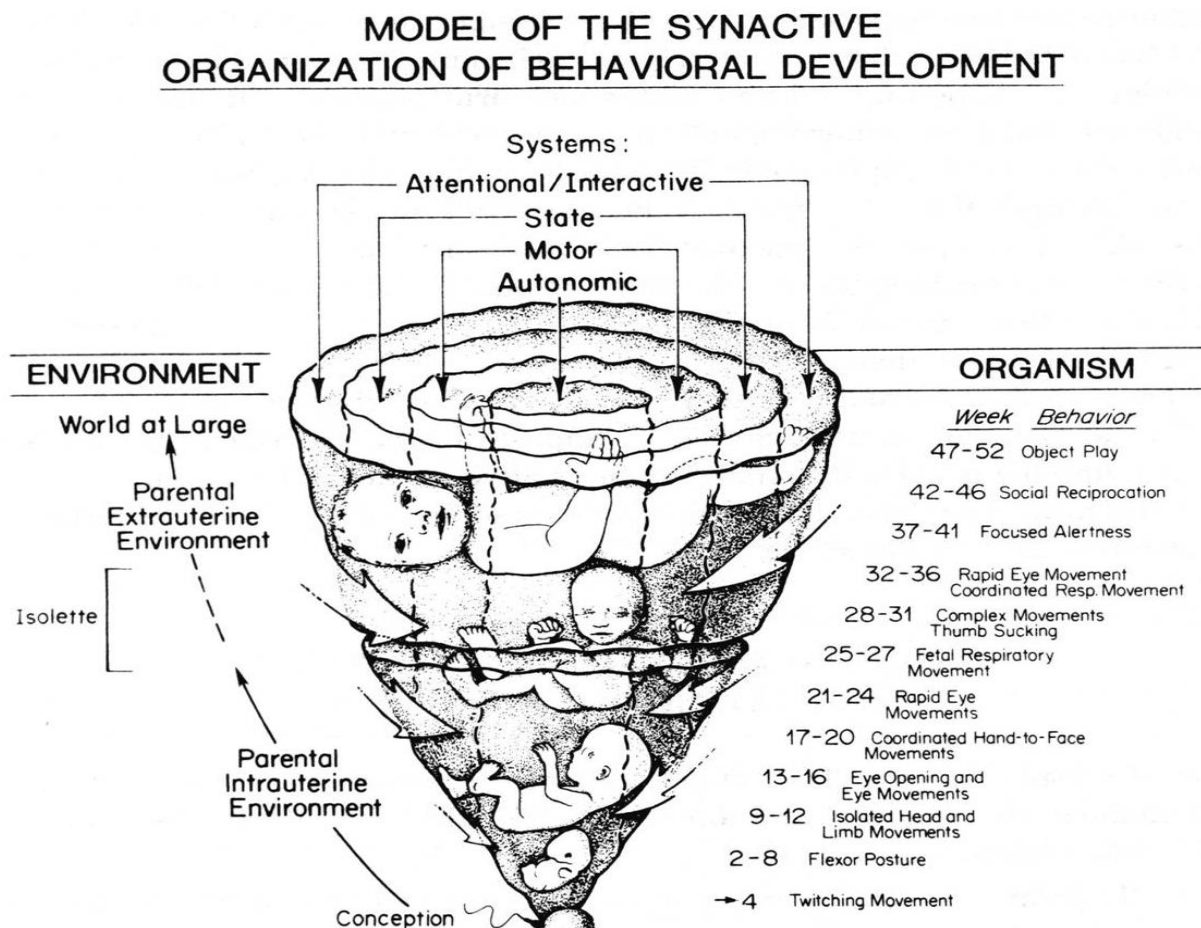
The following section will provide information about foetal development, and the challenges faced by the preterm infant as well as the current status of the BPG with regard to the newborn/NICU environment within the government hospitals in South Africa.

### **2.2 THE IMPORTANCE OF FOETAL DEVELOPMENT**

The foetal environment is important for normal development of the foetus, but in the case of a preterm birth, foetal development might be compromised. The development of different subsystems, as well as the sequence of sensory development, and the function of the uterus will be explained to provide an overview of the foetal environment, and the reason why NICU designs need to compensate for this challenge.

## 2.2.1 Subsystem development

During the gestational period all the different body systems develop and become mature enough to enable the infant to thrive outside the uterine environment when born at term. From conception to delivery of an infant, the foetus goes through organizing five distinct but interrelated subsystems. These subsystems are: (1) autonomic, which governs basic physiological functioning, (2) motor, which governs posture and movement, (3) state, which governs ranges of consciousness from sleep to wakefulness, (4) attention/interaction, which governs the ability to attend to and interact with people and (5) self-regulation, which governs the ability to maintain balanced, relaxed, and integrated functioning of all subsystems. These subsystems intertwine by continuously reacting with and influencing each other, referred to as synactive (Als, 1982:230-234).



**Figure 2-1: Model of the Synactive Theory of Development. Toward a synactive theory of development: Promise for the assessment of infant individuality (Als, 1982), (reproduced with permission from Als,)**

### **2.2.2 Importance of the sequence of sensory development**

The sensory development follows a specific sequence (Als, 1982:230). This sequence starts at eight weeks of pregnancy with the tactile system which includes touch, pain and temperature, followed by the vestibular and proprioceptive systems. Thereafter the olfactory (smell) and gustatory (taste) systems follow which are important for survival, since the infant depends on taste and smell to find the mother's breast and to feed. Research affirms that the human foetus is able to detect and memorize odour information received from a mother's prenatal diet (Browne & Graven, 2008:181) The next system to be fully developed by 24 weeks of gestation is the auditory system but the visual system only develops during the eighth month of pregnancy. However according to Glass (2002:3-4), overstimulation of the visual system before birth might cause a delay in other sensory systems' development. Hence, chronologically the auditory system needs to mature before stimulation of the visual system commences (Glass, 2002:2). The neurological system develops and matures throughout pregnancy and continues developing after birth.

The importance of this specific sensory developmental sequence is evident after birth. The development of vision is delayed, to provide the olfactory and auditory systems with the opportunity to develop, since the infant needs these two systems immediately after birth to feed on the mother's breast and, more specifically, to smell the location of the breast and taste the breast milk.

### **2.2.3 Tactile system**

The tactile system develops from eighth weeks' gestation and the development is completed by fourteen weeks. The importance of the tactile system relates to the development of bonding between mother and infant, the development of feeding skills, as well as self-soothing and protection against pain. The tactile system also plays a role in temperature regulation of the newborn.

### **2.2.4 Vestibular and proprioceptive system**

This is the first system that is fully developed six months after conception. It allows the foetus to perceive body movement and a degree of balance (Elliot, 1999:146). And it controls the sense of movement and balance. The vestibular and proprioceptive sensory system is considered to have the most important influence on the other sensory systems and on the ability to function every day in life. It is a unifying system in an infant's brain that modifies and coordinates information received from other systems similar to a traffic light that detects when one should go

or stop. At 15 weeks' gestation, all the different types of movements are present that the foetus will eventually require.

### **2.2.5 Olfactory system**

The olfactory system starts to develop at six weeks' gestation and the foetus is able to smell at 28 weeks' gestation (Browne & Graven, 2008:181). This system offers the infant a sense of the mother's scent (Browne & Graven, 2008:181) as a chemical sense. As such, it is one of the most important senses for survival after the infant's birth. The sense of smell enables the infant to trace its mother's nipple, to breast feed, whilst reinforcing bonding between the infant and its mother. Later in the infant's life this system enables the infant to detect food and also influences social behaviour. Although the olfactory neuron develops early, the ability to smell is present at about 28 weeks' gestation (Browne & Graven, 2008:183). However, plug like tissues fill the nasal cavity between the second and the sixth months of gestation disabling certain orders from reaching the relevant receptors to prevent their premature stimulation (Elliot, 1999:163).

### **2.2.6 Gustatory system**

The gustatory system is the sensory system of taste. The taste buds emerge from the eighth week of gestation and mature by the end of the twelfth week, when the foetus is expected to have developed sucking and swallowing reflexes. Its role is to allow the infant to distinguish between safe and harmful food (Lubbe, 2008:9).

### **2.2.7 Auditory system**

The human cochlea and peripheral sensory end organs complete their normal physical development by 24 weeks' gestation (Lecaaneut & Schaal, 1996:4). Hence the foetus can show active listening skills from 19 weeks' gestation (Hepper & Shahidullah, 1994:71) while the maturation of the auditory pathways of the central nervous system occurs up to normal gestation of 40 weeks. Thus the auditory system is one of the last to fully mature. Thus if the infant is born prematurely, this system will still be developing after birth. The auditory system helps the infant to identify its mother's voice. As a result it reassures the infant whilst offering a self-soothing mechanism to the infant. Stimulations offered by the auditory environment play an important role in the emotional development and in the development of the infant's auditory perception.

### **2.2.8 Visual system**

The visual system develops at about the fourth week of gestation. However, it is the physical structure of the eye that develops early, whereas the neurological components and the

connections develop later at around 32 weeks' gestation (Browne & Graven, 2008:194). The development of the visual system involves genetic coding, endogenous brain activity, exogenous visual stimulation after birth at full term, and protected sleep cycles, particularly rapid eye movement sleep. After 38 to 40 weeks' gestation, the visual system is activated by light and requires visual experience for continued development. For healthy visual development in infants after birth at 40 weeks' gestation, the visual experience requires (1) light on objects, not direct light; (2) focus; (3) attention; (4) novelty or change; (5) movement; and (6) after two to three months in full term infants, colour. Premature stimulation might lead to aberrations of brain development (Glass, 2002:2) The mother's face is of prime importance to the infant hence the role of the visual system is to enable the infant to recognise its mother's face visually. Focal distance for an infant is 25.4cm to 30.48cm and gradually increases with age and the improved ability to focus.

### **2.2.9 Neurological system**

The neurological system is the body's information processor. Without this highly advanced information and communication system, the body cannot function. Infants born at full term have completed the maturation of these subsystems to the degree that they are able to communicate with their caregivers via expression of approach, stress and self-regulatory behaviours emanating from the other subsystems. This neurobehavioral approach as advocated by Als (1984, 1985, 1992, 1997a, 1997b), implies that the infant's behaviour provides information continually attuning its caregivers to the infant's needs. Thus each infant has his own unique behaviour story to tell, a story that speaks directly to its unique needs, wants and developmental agenda.

### **2.2.10 The function of the uterus**

From conception to delivery of the infant, the uterus serves as an incubator to the foetus, together with the placenta, which provides a link between the foetus and the mother during the nine months of intrauterine life. Both are capable of nourishing growth of the foetus till term (Sellers, 2005:10; Beischer, Mackay & Colditz, 1997:47). The uterus is perfect for the foetus to grow and develop, as it is designed to protect, support and stimulate the foetus to develop optimally (Beischer *et al.*, 1997:47). It also has the following characteristics to fulfil this important function. Inside the uterus, the amniotic sac filled with amniotic fluid serves to:

- Provide temperature control to the foetus,

- Provide a gravity free environment: suspension from gravity enabling the foetus to move freely, which is important for development/maturation of the vestibular system (Als & Gilkerson,1997:179)
- provide protection from harmful light and sound stimuli
- Protect the foetus physically as it cushions the foetus from impact to the maternal abdomen
- Protect the foetus from infections
- Provide an ongoing supply of nutrients

### **2.2.11 The amniotic sac/uterine wall**

- Support muscle, posture, tone and movement development: This is done by the uterine wall that provides firm but flexible boundaries allowing movement of the limbs whilst providing a boundary with resistance and support to enhance the development of physiological flexion.
- Provide physiological flexion: important for breathing, lowering the heart rate, improved oxygen saturation levels.
- Support and develop self-calming: as the uterine environment assists the foetus to remain in a curled up foetal position (Als, 2001:4).

When the foetus is born too early, the protection of the uterus is removed abruptly and the preterm infant has to face challenges in the extra-uterine world

## **2.3 THE PRETERM INFANT'S CHALLENGES**

### **2.3.1 The importance of gestational age**

For the normal development of its systems, the infant has to complete its gestational age (duration of pregnancy) which is measured in weeks from the first day of the mother's last normal menstrual period (LNMP) to the expected date of delivery (EDD). The normal gestational age ranges from 37 weeks (259 days) to 42 weeks or 294 days (Sellers, 2005:45). Infants born at normal gestational age are called term (or full term) infants and generally have the lowest risk for developing problems during the perinatal and neonatal phases of their lives. Babies born at term had the opportunity to develop optimally, protected intra-uterine from the harsh extra-uterine environment of the NICU where constant bright lights, loud sounds and harsh smells are might be ever present.

### 2.3.2 Definition of preterm infant

Although the preterm infant is defined as the delivery of a baby before 37 completed weeks' gestation (Gorski, 1982:256) it can further be defined according to the infant's birth weight. Woods (1996:17) maintains that prematurity diagnosis can be derived from the infant's birth weight when referring to the maturity of the organs/systems, as tabulated in the table 2.1.

**Table 2-1: Definitions of prematurity and low birth weight**

<b>Definitions of prematurity and low birth weight (Woods, 1996:17)</b>	
Premature	Any baby born before 37 weeks of gestation, with 40 weeks being considered "full term"
Very premature	Any baby born before 32 weeks of gestation
Low birth weight(LBW)	Under 2,500 g
Very low birth weight(VLBW)	Under 1,500 g
Extremely low birth weight(ELBW)	Under 1,000 g

Als (2009) defined preterm infants as foetuses, who developed in extra-uterine settings at a time when their brains are growing more rapidly than at any other time throughout their lives. Preterm birth implies that an infant was removed from the mother's uterus. As preterm infants' organs and anatomical systems are immature they require care available only in the specialized NICUs.

### 2.3.3 Prevalence of prematurity

The incidence of preterm births has increased globally (Als, 1994:853), and in almost all countries with reliable data, preterm birth rates are more than 60% of preterm births occur in Africa. In south Africa more than 8 out of 100 babies are premature infants (saving babies 2010-2011) Browne and Graven (2003:366) maintains that the younger the infant, the smaller the chance of survival. However, due to improved medical and technological intervention, infants born at 23–26 weeks, who usually weigh between 500 and 750 grams, have a 40%–60% chance of survival. Babies born at 27–28 weeks (about 750–1000 grams), have approximately an 85% chance of survival. As the pregnancy progresses, survival rates increase dramatically, so that almost all infants, born at 34 weeks' gestation or later, survive (Gorski, 1994:256). Although these infants survive, they require additional support until they reach full term. Therefore preterm infants should be cared for in NICUs which are the best places for survival, but might pose challenges to preterm infants.

### **2.3.4 The ideal extra-uterine environment**

In this section an ideal NICU will be described according to the literature and compared to a typical NICU in South Africa. Focus will be on the physical layout of the NICU, equipment and human resource to clarify how these issues could benefit the infants in NICUs. The extra-uterine environment of the NICU replaces the supporting uterine environment when the infant is born preterm. The ideal extra-uterine environment that supports preterm development will thus be discussed.

White (2007:197) developed standards for the design of the NICU in order to support preterm development, although these standards present the optimal ideal environment, NICUs in the South African public sector faced challenges concerning physical resources, such as limited space and NICUs situated next to operating theatres.

White (2007:197) developed standards for NICUs that would create an ideal extra-uterine environment with specific reference to sensory stimuli, also addressed by Lubbe's (2009:276) BPGs about environmental design. White (2007) believed in single family rooms (SFR) for accommodation of the infant's family, for this provides individualized lighting, sounds and smells, reducing the incidence of harmful stimulations by noises, lights and noxious smells. White (2007) also regarded this as a natural extension of the foetal environment rich with sources of natural stimuli, by providing the infant with gentle pleasant scents of the mother's breast milk with calming effects on the preterm infant. In SFRs, an infant's sleep is usually not disturbed by excessive noise and light, and staff members can communicate and work without high noise levels. He believed that a NICU should be adapted to an environment similar to that of the womb; it should be calming and supportive in order to decrease the stress and support the growth and development of the preterm infant. This aspect is vitally important as this stage is a crucial period of brain growth and development in the preterm infant's life. Hedlund & Takarka (1998:12) reported that many infants discharged from hospital NICUs continued to lack well organized central nervous system coordination which resulted in less control of sleep, arousal, alertness, attention, focussing and feeding due to uncontrolled levels of noise in NICUs. It was significant that many of these preterm infants failed to attain a minimal degree of physiological homeostasis (Als & Gilkerson, 1997; Gorski, 1994) until three to six months after hospital discharge when these infants' neurological organizational abilities began to stabilize. These preterm infants might have continued to encounter challenges with their NDSC in the extra uterine environment.

White (2007) also stated that, intense light might be unpleasant and harmful to the developing retina and every effort should be made to prevent direct light from reaching the preterm infant's

eyes. Procedure lights with adjustable intensity, field size, and direction could help protect the infant's eyes from direct exposure. Therefore the next section will address the current status of the NICU environment as perceived by the researcher.

### 2.3.5 The current extra-uterine environment in South African neonatal intensive Care units (NICUs)

In the South African public sector NICUs, these standards are not necessarily met, due to resource constraints, such as inadequate physical space and the location of NICUs close to operating theatres or delivery rooms. These differences are highlighted in Table 2.2.

**Table 2-2: Possible differences between the ideal extra-uterine environment and the neonatal intensive care unit (NICU) in South Africa**

	IDEAL NICU	South African NICU
Physical lay out	The NICU should be in close and controlled proximity to the area of the hospital where births occur (maternity unit)	NICU not always in proximity to maternity wards
	Provision of family transition room(s) Offers patients private rooms	Open plan Rooms have multiple beds
	There should be noise criteria. The noise reduction coefficient requirement has been increased from 0.9 to 0.95.	NICUs have constantly high levels of noise, bright lights, and chemical odours
	High-gloss flooring is prohibited.	There is high gloss flooring
	An airborne infection isolation room shall be available for NICU infants.	There is an isolation corner within the unit with some screening.
Equipment	Specialized equipment like digital operating monitoring systems are available.	Some equipment, including some monitoring systems, still need to be operated manually.
Human resources	Specialized staff, like neonatal nurses, paediatricians, neonatologists are available 24/7	Not always specialized personnel available in NICUs

It is important to note that, creating an ideal NICU that will be conducive to the optimal survival of the preterm infant involves changing the culture of the traditional NICUs as well as changing the physical characteristics. Changing is a long term, complex and socially difficult process that requires multiple disciplines' involvements focussing on the preterm infants' needs. The ideal

extra-uterine environment and that found in South African NICUs are far apart from each other, presenting challenges for the preterm infants in NICUs in South African public hospitals (saving babies reports, 2011-2012).

## 2.4 CHALLENGES FOR THE PRETERM INFANTS

Due to the improved technological support, preterm infants have an excellent chance of survival if born after 28 weeks' gestation (National Institutes of Health in Gorski, 1982:256). Since preterm infants' systems have not yet matured, they are at greater risk of developing complications than term infants. As a result, preterm infants experience a number of short and long-term problems, requiring frequent hospitalizations and therapy during the first year of life. The short and long term morbidity experienced by preterm infants, directly related to an unsupportive environment, are listed in Table 2.3.

**Table 2-3: Morbidity experienced by preterm infants due to an unsupportive environment**

<b>SENSORY SYSTEM</b>	<b>NORMAL DEVELOPMENT/ STIMULATION IN UTERO</b>	<b>ENVIRONMENTAL STRESSOR</b>	<b>SHORT TERM CHALLENGES</b>	<b>LONG TERM CHALLENGES</b>
Visual system		Bright lights	Oxygen desaturation Disturbed sleep-awake cycles Prolonged rapid eye movement sleep(REM)	Chronic lung disease Retinal damage Delayed milestones like crawling hence delayed walking Blindness
Auditory system	Continuous, rhythmic sounds < 72 decibels(dB), caused by vibration in water, body muscle and the mother's skeleton	Incubator motor noise (100dB) care giving equipment including ventilator and suction tubing noise from the neonate itself (Harris 2006:1) Multi-bed unit design (beds close to each other/small bed spaces)	Tachycardia Tachypnoea Apnoea Sleep disturbance Intracranial haemorrhage	Deafness
Olfactory		Harsh smells of detergents used to	Reduced suckling	Sinusitis

<b>SENSORY SYSTEM</b>	<b>NORMAL DEVELOPMENT/ STIMULATION IN UTERO</b>	<b>ENVIRONMENTAL STRESSOR</b>	<b>SHORT TERM CHALLENGES</b>	<b>LONG TERM CHALLENGES</b>
system		wash the incubators and alcohol solutions sprayed on their hands for infection control.	reflexes Difficulty in latching Difficulty in bonding with the mother	Smell disorders
Gustatory system		Passing of orogastric tubes Rubber teats and pacifiers Cleaning detergents on face	Feeding problems Failure to thrive	Feeding aversion
Tactile system		Losing heat due to conduction Painful touch	Using energy to generate heat / maintain temperature hypothermia	
Neurological systems		Prolonged exposure to loud constant sounds either occupational or mechanical sounds in the NICU	Lack of coordination Intracranial haemorrhage Desaturation Apnoea Tachycardia	Seizures
Sources:	Bowne & Graven, 2003:4; White 2006:1; Als 2006			

The importance of a conducive environment in the NICU has been discussed, but the challenges arise as to how this information should be implemented in practice. Lubbe (2009:276-300) suggested BPGs for NDSC, as discussed in section 2.5 of this dissertation.

## **2.5 BEST PRACTICE GUIDELINES (BPGs)**

Nurses might know about the importance of changing the NICU environment to support optimal development of preterm infants. However, they might experience difficulties in the actual implementation of interventions to support this environment. Hence they need guidelines to support their actions. Therefore BPGs enhance standardization and provide a source of guidance for the nurses. The BPGs provide inputs into the nursing activities of each neonatal unit (Booyens, 2001:28) and aim to provide direction to practising neonatal nurses and midwives to improve the care of the preterm infants, and combat neonatal morbidity and mortality rates in South African public hospitals. These PBGs might contribute to policy making

and resource allocation based on evidence and ultimately lead to improved preterm infants' outcomes.

Lubbe (2009:276-300) developed BPGs for enhancing NDSC as a way to provide direction to practising nurses to improve the care of the preterm baby, based on the best available evidence. In her study, Lubbe (2009:276) identified the environment as the first BPG. This BPG1 suggest that the NICU should be designed in a way that will be conducive for the preterm infant's development, similar to the intra-uterine environment. She further explains that environmental design implies creating an environment similar to the intra-uterine environment. In her study she recommended the following stimulations to assist preterm's' development with regards to the NICU environment.

- Auditory stimulation
- Visual stimulation
- Cycled light and quite times
- Olfactory inputs

Although practitioners might be aware of the environment that is most conducive to the development of the preterm infant, this environment might not be easily created, emphasising the current study's research problem: although BPGs are available, the implementation of the BPG1 for providing a supportive extra-uterine NICU environment for preterm infants in South Africa's public hospitals has not been evaluated.

## **2.6 SUMMARY**

Professional nurses need guidelines to support their actions. Best practice guidelines ensure the standardisation of care and provide a source of guidance for professional nurses (Lubbe; 2009:252; Lubbe *et al.*, 2012: 251-9). BPGs provide nurses with inputs into the nursing activities of each neonatal unit (Registered nurses association of Ontario:2003) aiming to provide direction to practising neonatal nurses and midwives to improve the care of preterm infants, and to combat neonatal morbidity and mortality rates in South African public hospitals. These aspects could contribute to evidence-based policy-making and resource allocation contributing to improved premature infants' outcomes.

## **CHAPTER 3: ARTICLE**

Manuscript prepared for submission to Curationis

### **Factors influencing implementation strategies regarding environmental design in a neonatal intensive care unit in South Africa**

**Authors:**

Mmbatho Rakheta

Welma Lubbe

## Permission to submit this article for examination purposes

I, the supervisor, hereby declare that the research done by MME Rakhetsla reflects her input and the effort on this topic.

I hereby grant permission that she may submit this article (Factors influencing implementation strategies regarding environmental design in a neonatal intensive care unit in South Africa) for consideration for publication in Curationis. This article is based on research conducted for the degree Magister Curationis at the North-West University, Potchefstroom campus.



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Supervisor: Welma Lubbe

Date: 10 November 2015

### **Declaration by the researcher**

I hereby declare that this research 'Factors influencing implementation strategies regarding the environmental design in a neonatal intensive care unit is my own work and that all sources have been fully referenced and acknowledged.



---

MME Rakheta

---

Date: 10 November 2015

**Declaration by the language editor**

I hereby confirm that I have edited the article titled: "Factors influencing implementation strategies regarding the environmental design in a neonatal intensive care unit in South Africa".

**Valerie Janet Ehlers**

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08 Novemberr 2015	<b>I hereby certify that I have edited master's dissertation of Ms M Rakhetla:</b>  <b>FACTORS INFLUENCING THE IMPLEMENTATION OF ENVIRONMENTAL DESIGN GUIDELINES TO FACILITATE NEURODEVELOPMENTAL SUPPORTIVE CARE (NDSC) IN A NEONATAL INTENSIVE CARE UNIT IN SOUTH AFRICA</b>
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Thank you



Prof VJ Ehlers

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"I have participated sufficiently in the conception and design of this work, the data analysis, and the writing of this article to take public responsibility for it. I have reviewed the final version of the article and approve it for submission for possible publication".

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## **Title page**

**Title: Factors influencing the implementation of environmental design guidelines in a neonatal intensive care unit in South Africa**

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Dear Editor

#### **SUBMISSION OF ARTICLE FOR CONSIDERATION FOR PUBLICATION IN Curationis**

Please find attached our manuscript entitled: "Factors influencing the implementation of environmental design guidelines in a neonatal intensive care unit in South Africa".

The authors, Ms M Rakhetla and Dr W Lubbe, have read and approved the paper. Dr Welma Lubbe is the corresponding author.

Ms M Rakhetla conceptualised, drafted and designed the manuscript as well as its technical preparation for submission. Dr W Lubbe was the supervisor of the study, assisted Ms Rakhetla throughout all the phases of the research from conception of the research idea and proposal writing to the conclusion of the study. Dr W Lubbe was the co-author and critical reviewer of the manuscript. Both authors read and approved the final manuscript. Prof VJ Ehlers edited the final version of the article.

The paper discusses the current available best practice guidelines in environmental design for enhancing the neurodevelopmental supportive care of preterm infants in neonatal intensive care units. Based on a literature review, semi-structured questions were compiled and focus group interviews were conducted with professional nurses working in the neonatal intensive care unit of one tertiary hospital in the Free State Province of South Africa.

We believe that our findings could contribute to the available evidence. Such evidence could help to enable nurses to make informed decisions with regard to the implementation of environmental design guidelines to facilitate neurodevelopmental supportive care in a neonatal intensive care unit.

Suggested reviewers for this field include – Dr Nils Bergman - MBChB, Consultant on Neuroscience in newborns, South Africa, email [nils@kangaroomothercare.com](mailto:nils@kangaroomothercare.com), tel 021 5315819

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We hope that you will find our contribution and its implications for the clinical setting as interesting as we do, and that you will send the paper to reviewers. We look forward to your reply.

Yours sincerely



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# Factors Influencing the Implementation of Environmental Design Guidelines to Facilitate Neurodevelopmental Supportive Care in a Neonatal Intensive Care Unit in South Africa

## Abstract

Nurses working in neonatal intensive care units in South Africa's public hospitals might be familiar with best practice guidelines regarding the optimal environment for preterm infant development. However, the environment observed in a selected neonatal intensive care unit in the Free State Province did not seem to implement the suggested best practice guidelines made by the participants.

This study aimed to explore and describe factors influencing the implementation of environmental design guidelines to facilitate neurodevelopmental supportive care in neonatal intensive care units in a South African public hospital and to describe recommendations for the implementation of these best practice guidelines made by the participants.

A qualitative design, explorative, descriptive and contextual in nature was used. The Model of Synactive Organization of Behavioural Development was used as a guiding framework. Data were collected by conducting four focus group interviews with 20 professional nurses working in a neonatal intensive care unit and analysed using Tesch's eight step approach. Three themes emerged, namely: current practices regarding the best practice guidelines, reasons for not implementing best practice guidelines and recommendations to implement best practice guidelines.

Best practice guidelines were available for neonatal intensive care professional nurses in a selected hospital. However, these guidelines were not implemented due to shortages of staff, poor maintenance plans, financial constraints and lack of resources. These aspects need to be addressed for the best practice guidelines to be implemented and sustained.

## **Introduction**

The foetus develops in the supportive and protective uterine environment, until maturation is reached at term (Perlman, 2007). During this period a specific sensory developmental sequence is followed which is well supported by the intra-uterine environment at critical developmental stages. Optimal development of each sensory system depends on the maturation of the previous system. This sensory developmental sequence has been described as 'the Model of the Synactive Organization of Behavioural Development' (Als, 1982: 234), where the infant's functioning comprises continuous intra-organism subsystem interactions.

## **Problem statement**

BPGs have been developed for adapting NICUs to mimic the intra-uterine environment to support the optimal development of preterm infants (Lubbe, 2009). However, the NICU in a selected tertiary public hospital in South Africa's Free State Province did not implement the suggested BPGs related to NICU environmental design to support neurodevelopmental care of premature infants.

## **Aim of study**

The current study aimed to explore factors influencing implementation of environmental design guidelines one in Neonatal intensive care unit (NICU) to promote neurodevelopmental supportive care by: "creating an environment conducive for preterm infant development, similar to the intra-uterine environment' (Lubbe, 2009; Lubbe, Van der Walt & Klopper, 2012: 251-9) in a selected tertiary public hospital in South Africa. Based on the findings, recommendations could be suggested to enhance developmental outcomes for preterm infants in public hospitals.

## **Background**

The BPG document was available in the selected unit and some nurses had received training on neurodevelopmental supportive care, but the BPG1 was not implemented.

This study aimed to explore and describe factors influencing the implementation of the BPG1 to facilitate neurodevelopmental supportive care in NICUs in South Africa and to suggest recommendations for implementing this first BPG in this NICU.

### **Trends**

To address the implementation challenges, Lubbe (2009: 276-300) developed BPGs for NICUs in South African public hospitals. These BPGs ensure the standardisation of care and provide a source of guidance for professional nurses (Lubbe; 2009: Lubbe *et al.*, 2012: 251-9). The BPGs provide nurses with inputs into the nursing activities of NICUs (Registered nurses association of Ontario guidelines:2003) and provide direction for practicing neonatal nurses and midwives to improve the care of preterm infants, and to combat neonatal morbidity and mortality rates in South African public hospitals. Successful implementation of the BPG1 might further contribute to evidence-based policy-making and resource allocation and could enhance preterm infants' treatment outcomes.

### **Research objectives**

The objectives of the study were to explore and describe factors influencing the implementation of the neurodevelopmental care of preterm infants in NICU within the South African context with regard to the NICU environment; and to describe all the methodological aspects by formulating and making recommendation based on participants suggestions towards the implementation of the BPGs 1 regarding the NICU environment in public sector hospitals in South Africa.

### **Definitions of key concepts**

#### **Best practice guideline (BPG)**

Best practice guidelines are systematically developed statements, based on the best available evidence, to assist practitioners' and clients' decisions concerning appropriate healthcare in specific clinical circumstances (RNAO, 2003:21).

## **Environment**

The environment, in the context of the current study, refers to concepts/stressors, such as light, noise and odours to which the preterm infant might be exposed during his/her stay in the NICU. The most supportive environment for the preterm infants in the NICU would be similar to the intra-uterine environment (White, 2010:3).

## **Focus group interview (FGI)**

An interview with a group of individuals assembled to discuss a given topic (Polit & Hungler, 1997:457) to obtain in-depth, descriptive information on a selected topic is known as a focus group interview.

## **Neurodevelopmental supportive care (NDSC)**

Neurodevelopmental supportive care (NDSC) is the approach that uses a range of evidence-based nursing and medical interventions that aim to decrease the stress of the preterm infant in a NICU (Nair, et al., 2003:9).

## **Neonatal intensive care unit (NICU)**

This is a unit that provides specialised intensive care to neonates. It is regarded as the best extra-uterine environment where the infants can receive all the required support, including NDSC (White, 2007).

## **Preterm infant**

A preterm infant is an infant born before he/she could reach term, or before 37 completed weeks from the first day of the mother's last normal menstrual cycle until the day of birth (Woods, 1996:17).

## **Contribution to the field of study**

Based on the findings of this study, recommendations will be suggested for nursing education, practice and research to enhance the implementation of BPG1 for providing improved neurodevelopmental supportive care of preterm infants. Enhanced

neurological development could benefit the preterm infants and their families for the rest of their lives.

### Literature review

To address and support the implementation challenges, Lubbe (2009:276-300) developed BPGs for NICUs in South African public hospitals. These BPGs ensure the standardisation of care and provide a source of guidance for professional nurses (RNAO,2003) and (Lubbe: 2009:252; Lubbe *et al.*, 2012: 251-9). The BPGs provide nurses with inputs into the nursing activities of NICUs (Booyens, 2001:28) and provide direction for practicing neonatal nurses and midwives to improve the care of preterm infants, and to combat neonatal morbidity and mortality rates in South African public hospitals. The BPGs might further contribute to evidence-based policy-making and resource allocation and could enhance preterm infants' quality of care.

Many infants are born prematurely, before reaching optimal maturity to survive on their own in the extra-uterine environment (Richard & Andrienne, 2007:1). Most premature infants require care in neonatal intensive care units (NICUs). Although NICUs are the best places to care for these immature infants (Als, 1982), they are very different from the supportive intra-uterine environment. Hedlund & Takarka (1998:12) reported that many infants, discharged from NICUs, might not have well-organized central nervous systems, portraying symptoms such as a lack of control of sleep, arousal, alertness, attention, focussing and feeding due to uncontrolled levels of noise in NICUs and neonatal high care units (NHCUs). Many preterm infants reportedly fail to attain a minimal degree of physiological homeostasis until three to six months after discharge when their neurological organizational abilities begin to stabilize (Als & Gilkerson, 1997; Gorski, 1994).

White (2007) developed standards for NICUs that could create an ideal extra-uterine environment pertaining to sensory stimuli, also addressed by Lubbe's (2009:276-279) best practice guideline (BPGs) about environmental design. White (2007) stated that a

NICU should provide an environment similar to that of the intra uterine environment; it should be calming and supportive in order to decrease stresses and provide support for the growth and development of the preterm infant. White (2007) suggested single family rooms (SFR) regarded as a natural extension of the foetal environment rich with sources of natural stimuli. Such stimuli provide the infant with gentle pleasant scents of the mother's breast milk to support calming effects and providing individualised lighting, sound and sleep preservation. Staff members can communicate and work without the stress of high noise levels.

White (2010) also stated that, intense light might be unpleasant and harmful to developing retinas. Procedure lights with adjustable intensity, field size, and direction could help to protect the infant's eyes from direct exposure. Although this evidence is available, its implementation in practice seems to encounter challenges.

## **Research method and design**

A qualitative, explorative, descriptive and contextual research approach, as described by Sandelowski (2007:101), was utilised to understand the factors that influence the implementation of environmental design guidelines in a selected NICU, to enhance the neurodevelopmental supportive care of preterm infants. Burns and Grove (2001:56-57) stated that this type of qualitative research is an approach that attempts to understand the phenomena under investigation by means of analysis, integration and synthesis of non-numeric narrative data.

## **Population**

All 20 professional neonatal nurses working in the NICU of one selected tertiary hospital in the Free State Province comprised the population of the study, as they were knowledgeable about factors influencing the implementation of environmental design guidelines in NICUs (Burns & Grove, 2005:159). This selected hospital is a referral hospital caring for 35-40 preterm infants per month. Some nurses, working in this NICU, attended training on BPGs regarding neurodevelopmental supportive care

(NDSC) of preterm infants and the NICU was considered to be implementing Lubbe's (2009) BPGs to promote NDSC of premature infants.

### Sample

The participants were selected by means of purposive sampling (Polit & Hungler, 1997:229), where participants were regarded to be experienced in regard to the population in question and knowledgeable about the studied phenomenon. Participants who were experienced were expected to provide rich data, based on their knowledge of the supportive NICU design environment (Burns & Grove, 2005: 353-354).

### **Inclusion criteria**

Professional nurses registered with the South African Nursing Council who were either trained as NICU nurses or experienced in NICU care, with at least two years' NICU experience. Participants had to be fluent in English willing to participate in voice-recorded focus group interviews.

### **Exclusion criteria**

Community service year nurses or nurses with less than two years' NICU experience; enrolled nursing assistants and enrolled nurses were excluded as well as registered nurses not working in the NICU.

### Data collection method

Data were collected through four focus groups with five members each, as recommended by (Polit & Beck, 2008), using a pre-set interview schedule as portrayed in table 4 (Stewart & Shamdasani, 1990). More questions emanated from the discussion as participants' beliefs, perceptions of and experiences with factors influencing the implementation of environmental design in the NICU were explored. This happened as a result of the uniqueness of the focus group and its ability to generate data based on the synergy of group interaction (Burns & Grove, 2005:542). Focus group interviews

were audio recorded, whilst field notes and observational notes were written by the first author immediately after the completion of every focus group interview.

**Table 4: Interview schedule**

<b>Interview schedule</b>		
<b>objectives</b>	<b>Description of project</b>	The purpose of this study is to understand factors influencing the implementation of environmental design guidelines to facilitate neurodevelopmental supportive care (NDSC) in the NICU.
<b>Objective 1</b>	<b>Questions</b>	<b>Field Notes</b>
	<b>Main question:</b>  What influenced the implementation of the environmental design BPG1 to promote NDSC in your NICU?	
	<b>Probing questions:</b>  Please elaborate on the barriers that you faced with the implementation of NDSC guidelines.	
	Are there any other issues in conjunction with the environment in NICU that we have not touched upon that	
<b>Objective2</b>	What do you suggest can be done to improve this	

### Data analysis

The interviews were transcribed verbatim and the handwritten field notes were typed. Numbers (FG1, FG2, FG3, and FG4) were assigned to each focus group (Polit & Beck, 2008) to ensure anonymity. The researcher used Tesch’s (1990) eight step approach during data analysis and an independent co-coder verified the data analysis (Creswell, 2003:191-197).

**1<sup>st</sup> step:** The researcher read all the transcriptions and field notes carefully to get a sense of the whole and wrote down ideas as they came to mind. By reading and re-reading critical processes were identified and insight into the foundation of the content developed (Creswell, 2003:191-197).

**2<sup>nd</sup> step:** The researcher selected one interview and looked for quotations from the participants that could indicate categories and themes to keep the analysis firmly grounded in the data. Major categories were identified about the phenomenon under investigation.

**3<sup>rd</sup> step:** A list of similar topics were compiled and clustered by marking identified quotations and organising them in a table format according to similarity of responses.

**4<sup>th</sup> step:** The researcher identified descriptive wording for specific topics and assigned them to the appropriate sections.

**5<sup>th</sup> step:** The topics were grouped and relationships drawn to reduce the total number of categories.

**6<sup>th</sup> step:** The researcher made the final decision on the categories and alphabetised the codes.

**7<sup>th</sup> step:** The information belonging to each category was assembled and a preliminary analysis was performed.

**8<sup>th</sup> step:** The existing data was then re-coded as deemed necessary.

On completion of these steps, the researcher ended up with three columns of categories and themes based on sources, namely personal notes, transcriptions and identified categories.

Anonymised Copies of the transcriptions were sent to the co-coder who followed the same process to ensure the consistency of the coding process, according to Tesch's approach (Creswell, 2003:191-197). The data analyses were compared and were no discrepancies.

## **Results**

Three main themes were identified which addressed current practices regarding BPG1, reasons for not implementing BPG1 and recommendations to implement the BPG1. Sub-themes are displayed in table 2.

Table 2: Categories, Themes and sub themes

<b>Category 1: Current practices of BPG1</b>	<b>Category 2: Reasons not implementing BPG1</b>	<b>Category 3: Recommendations to implement BPG1</b>
<b>Theme 1.1: Noises/sounds</b>	<b>Theme 2.1: Shortages</b>	<b>Theme 3.1: Resources</b>
<b>Aspects that support a conducive intra-uterine environment</b>	<ul style="list-style-type: none"> <li>• Staff</li> <li>• Equipment</li> <li>• Facilities</li> <li>• Financial resources</li> </ul>	<ul style="list-style-type: none"> <li>• Shortage of staff</li> <li>• Poorly maintained equipment</li> <li>• Facilities</li> <li>• Budget constraints</li> </ul>
<ul style="list-style-type: none"> <li>• Staff members wearing soft soled shoes</li> <li>• Doing daily safety checks</li> </ul>		
<b>Factors posing barriers towards creating an intra-uterine environment</b>		
<ul style="list-style-type: none"> <li>• Loud sounds from ward routine</li> <li>• Noisy equipment and monitors</li> <li>• Multi-disciplinary team members' talking</li> <li>• Emergencies, transfers and admissions</li> </ul>	<b>Theme 2.2: Maintenance</b>	<b>Theme 3.2: In-service training/advanced education</b>
<b>Theme1.2: Smells</b>	<ul style="list-style-type: none"> <li>• Poorly maintained/broken monitors</li> </ul>	

Category 1: Current practices of BPG1	Category 2: Reasons not implementing BPG1	Category 3: Recommendations to implement BPG1
<ul style="list-style-type: none"> <li>Using sterile gauze and water, not alcohol wipes</li> <li>Cleaning material used for cleaning floors are strongly scented</li> <li>In emergencies, not enough time is allowed for hands to dry after alcohol application</li> </ul>	<ul style="list-style-type: none"> <li>Long delays to fix faulty equipment</li> </ul>	<ul style="list-style-type: none"> <li>Training required on new policies and BPGs</li> <li>More trained NICU nurses required</li> </ul>
<p><b>Theme 1.3: Lights</b></p> <ul style="list-style-type: none"> <li>Staff abide to low lighting most of the time</li> <li>X-rays lights do cover eyes of babies</li> <li>Lights are put on during ward routines</li> </ul>	<p><b>Theme 2.3: Ward routine</b></p> <ul style="list-style-type: none"> <li>Expectations from management</li> <li>Policies and guidelines not always feasible</li> <li>Visitors and inter-professional team members do not honour NDCS care practices</li> <li>Emergencies - due to conditions of babies, resuscitations, transfers and</li> </ul>	<p><b>Theme 3.3: Ward routine</b></p> <ul style="list-style-type: none"> <li>Do same activities at set times, e.g. suctioning of infants, ward rounds, doing sonars and x-rays.</li> <li>adhering to ward routine</li> </ul>

<b>Category 1: Current practices of BPG1</b>	<b>Category 2: Reasons not implementing BPG1</b>	<b>Category 3: Recommendations to implement BPG1</b>
	admissions	

## Category 1: Current practices of BPG1

The participants indicated that they had access to BPGs but these BPGs were not implemented.

### **Theme 1.1: Noise/sounds**

Participants stated that they wore soft soled shoes in the ward to minimize noise. They did daily routine safety. However, different sounds came from ward routines, x-rays machines, sonars, suctioning, telephones, visitors' and nurses' voices. Sound controlling devices were not used, the volume of monitors were not titrated, due to staff shortages. High nurse-patient ratios necessitated setting alarm levels high and to talk loudly, especially when calling for help, to be heard throughout the NICU. Mobile monitors, used to transfer infants, are noisier than stationary ones. When medical representatives demonstrate the use of new equipment and monitors they tend to be noisy. Noises also arise from banging and from closing infusion pumps and incubators. During the mornings most noise is caused by multi-disciplinary teams' ward rounds and the performance of procedures.

- *"Most of the time we wear this kind of shoes (participant pointed to the rubber soled shoes she was wearing) high heels are not allowed." (FG1)*
- *"Monitors sound? The reason not to titrate their volume? Let me say if you're listening to babies and you are busy with the other one you would not be aware that the other one needs your attention. So it boils back to shortage of staff." (FG1)*
- *"The main problem is the noise from the equipment. Again from the sound of the monitors, even when the medical representatives come to showcase their equipment they test them with the babies." (FG2)*
- *"... the x-ray will be taken from bed one to bed 14. In the morning. All the multidisciplinary team come at the same time every day." (FG2)*
- *"There is a lot of noise when babies are supposed to be transferred to high care... Or when there is admission, " (FG2)*

- *“The noise is a problem from the machines that are used by the cleaners... And monitors themselves for they got their ranges, the moment they reach the set alarm or goes above those ranges they alarms most of the time.” (FG3)*
- *“The report we take it next to the babies, but we try to talk softly. However in cases of emergencies as we work to the ratio of 1:5 we have to shout like ‘call the doctor ‘sometimes we look like we are crazy for we have to shout for help.” (FG3)*
- *“... As there are a lot of people coming in the ward, so is very difficult to keep the voice level down. TV is actually off but sometimes the night staff actually put it on... Even though most of the time is during the morning hours during routines but after that it calms a lot.” (FG4)*
- *“On the monitors we do not set the alarms on the soft note we set them to the high levels due to the shortage of staff so that even if it’s a few of you on duty you can hear it when it alarms... However, we try to respond to the alarms as quick as possible. But if it’s only the two or three of you on duty and busy with the babies you cannot just leave the baby you’re working on to run to the monitor so you finish what you’re doing.” (FG4)*

### **Theme 1.2: Smells**

Participants indicated limited challenges in controlling strong smells. They reported the use of alcohol-based hand sanitizers for disinfection. When dealing with the infants for hygienic routine purposes they used sterile gauze and water, not wipes. However, in cases of emergencies, hands cannot dry from the alcohol hand spray. The cleaning material used for cleaning floors also has an offending smell. There was no evidence of stimulating the olfactory system by provision of mothers’/breast milk scents in the NICU.

- *“The smell, also we bide, however, the cleaning material, however we use biocide to clean the area, but we never realized that they are affecting the babies when we are cleaning that.” (FG1)*
- *“I can say sometimes when you are in a hurry to handle the baby you don’t have time to allow it dry.” (FG1)*

- *“We do not use the wipes for the babies we only use the gauze and water, ...” (FG2)*
- *“Yes, we still wash our hands and use the hand sanitizers between patients and allow it to dry, like (chlorhexidine). Even when you allow drying, it still smells...” (FG2)*
- *“There was one disinfectant that we used to use, I could not even use it on myself, was this (G something), however others are a little bit soft. We are also using the hand sanitizer that is automated one and this one doesn’t smell.” (FG3)*
- *“Smells that’s your alcohols, and the wipes like (proicetine) it’s not ideal, but if you dry it nice before handling the baby and not too close to the baby whilst still drying off. But then your alcohol swabs, hibiscrub and skin preps are the one that we are using and they smell, yes is not ideal, but I prefer using them, that rather than damaging the baby’s skin, when you weigh the benefit against the risks.” (FG4)*

### **Theme 1.3: Lights**

Participants reported that the lights were dimmed most of the time, except during the multi-disciplinary team rounds in the mornings and during procedures, such as inserting intravenous infusions. There was light in the immediate preterm infants’ bed spaces, open incubators were used mostly, allowing some overhead light and photo therapy lights to shine on preterm infants’ faces. Even though closed incubators had incubator covers to minimise the light’s intensity, it still reached the infants. Preterm infants under phototherapy lights had their eyes covered with eye shields. Cycled light was implemented and minimised ambient light was also used, due to the use of dimmer lights and closing some curtains. Some infants were nursed in closed incubators without covers or titration of lights and overhead fluorescent lights were also used.

- *“With the light we abide, we only switching on the light when we clean.” (FG1)*
- *“Our lights are always dim; we only switch them on when there is procedure that needs to be done. We only put on lights during routine care of the babies and during emergencies only. We have the spot lights but they are being used at night” (FG2)*

- *“Our lights are forever dim, we are trying, however in the morning due to multidisciplinary teams when they come to do the routine they all come at once, So in the morning we are struggling to dim. With the light, with the sound. But from 12 noon then we can dim the lights when everyone is done...” (FG3)*
- *We have a challenge for most of the bed lights don't work, sometimes even the head lights the little lights on top/spot lights, are faulty, they take ages to replace them. So sometimes the babies are really sick and you don't really see their veins, so one just has to put on the main lights, like when you have to put on a drip even though you don't want to traumatize them by harsh lights.” (FG4)*

Participants' responses indicated that they tried to control lights according to the BPG. However, circumstances beyond the nurses' control posed challenges for its maintenance. These circumstances, contributing to non-compliance with the BPGs, included the ward routines and failure of maintaining equipment. As a result, the light stimulation was not conducive to the optimal care of preterm infants and they might have suffered from sleep deprivation. Some participants felt it would be better if ward routines could be done at same time.

*“...to do the routine yes at the same time once and for all. So for me is better for they are doing everything at the same time and is done.” (FG2)*

## **Category 2: Reasons not implementing BPG1**

Guidelines could help to address clinical problems and to improve the quality of patient care. Lubbe (2009:251) developed BPGs, based on available evidence, to assist practitioners' to render appropriate NDSC for the preterm infants in public hospitals in South Africa. Some participants were aware of the BPGs but admitted to not implementing them due to challenges within their working environment.

## **Theme 2.1: Staff shortages**

Participants in all four focus groups emphasised that staff shortages as well shortages of equipment and facilities, posed barriers for the implementation of the BPG regarding a NICU's environmental design to enhance preterm infants' NDSC.

- *"Yes financial constraints from the department." (FG1)*
- *"Are the machines and shortage of staff." (FG1)*
- *"NB shortage of staff is a big problem." (FG2)*
- *"... However another big challenge is financial constraints from the department." (FG1)*
- *"Yes, shortage of staff is a big challenge." (FG3)*
- *"Main problem is shortage of staff that is leading to many challenges, and financial constraints, ..." (FG3)*
- *"The environment also is a challenge for if there is not enough space. We are forced to take a high care baby to low care, sometimes we are even forced to admit 18 babies instead of 16 babies. Mind you, are only two sisters at night, we once having six meco's (over head radiators) in our high care babies that are ICU cases?" (FG3)*
- *"Shortage of staff is really the main issue. It really puts much burden on everything." (FG4)*
- *"Monitors are not really the best; we have sent in the requisition for the new monitors, but are still waiting for the approvals. Previously we got a donation from Carte Blanche on the monitors; however those monitors could not pick on neonatal values could not pick on the babies saturation. It was a hassle, so we had to use complementary saturation monitors to back up the main ones." (FG4)*

## **Theme 2.2: Maintenance of equipment**

Participants expressed different views on the availability of maintenance of equipment in the unit.

- *"There was a time when we had a problem by fused light, but they came, even though they do not maintain it regularly, but sometimes when you call them they come." (FG1)*
- *"We have a challenge for most of the bed lights don't work, sometimes even the head lights, the little lights on top/spot lights, are faulty, they take ages to replace them." (FG4)*

- *Maintenance always comes on time, but there was a time that they took long to come and fixes a fused light. They do not maintain it regularly; the unit manager ensures that in the morning the safety managers like checking of working lights, suction are maintained. We have the privilege where we can titrate the lights to be lighter or dim them.” (FG1)*

### **Theme 2.3: Ward routine**

Participants were expected to follow some ward routines as each ward has a daily routine, and nurses are essential for providing good quality care. Ward rounds are a crucial aspect of acute care, but nurses’ involvements varied. Most participants indicated that multi-disciplinary teams cared for neonates but that their responsibilities varied. However, most duties were performed during the mornings to ensure that core activities of the neonates’ care, decisions made were made and tasks allocated to facilitate the daily operation of the NICU.

- *“It depends on the viscosity of the secretions, or let’s say we do our routine three hourly but now we have changed to 6 hourly, you can imagine that noise coming from suctioning of the babies...” (FG2)*
- *“Babies they need a close monitoring by the time you done with is like you have neglected the other high care babies. And you are still expected to see other babies that you might even be behind with their medications and still have to do paper work thereafter... And we have to take bloods, give some sedations like (dopamines) and the attention has to be on this little ones as some times their sugars are high now, and we have to mix the (actrapid)... And everything falls behind. And it’s just by luck or God’s grace that when still busy with those ones we have never had an incident of losing the other ones. We do have the guideless hence we even make others aware that this is how we supposed to be doing things. We are trying.” (FG3)*
- *“Even that is chaotic in the morning when multi-disciplinary teams come to do their routines... Sometimes wants to do other procedure all again, like putting on the CVP lines. But once is done is done.” (FG4)*

### Category 3: Recommendations for implementing BPG1

Despite all the experiences and the challenges the participants faced during their daily schedules in caring for the premature infants in the NICU and NHCU, the participants shared recommendations for implementing BPGs in NICUs.

#### Theme 3.1: Resources

Participants agreed that they failed to implement the suggested BPG due to staff shortages. They believed that nursing workloads were affected by staff levels which might affect premature infants' care. The participants were concerned about the shrinking pool of new nurses to replace those who retired, resigned or died.

Participants thought hospital management should enhance the recruitment and retention of NICU trained and experienced nurses.

- *"Taking care of shortage of staff. If we are enough staff I don't think there can be a lot of problems." (FG1)*
- *"More staff, more advanced equipment, ..." (FG1)*
- *"To hire more NICU nurses. There will be a quality care for the baby as a result a combat on the infection control. Because sometimes between the babies there are no time to wash your hands, sometimes when you are still on the other baby the doctor can just call you to say come clean this one." (FG2)*
- *"And for every baby to have its monitor as sometimes they are sharing. Even when we transfer the baby we have to take the monitor from the other baby clean it as to use it on this one that is being transferred. And is also a waste of time. As we still need to monitor the saturations at the time of transferring the baby." (FG2)*
- *"... if there was enough budget that was going to assist with hiring of more staff to high care, purchasing of monitors for each and every child to have his her own monitor..." (FG3)*
- *"Enough staffing can solve a lot of problems, and increase on the budget." (FG3)*
- *"It would be nice if they can replace all the staff that we have lost, as is four that I know of resigned, two transferred to Johannesburg, two passed on, lost one in a car accident just last week." (FG4)*

### **Theme 3.2: In-service training/advanced education**

NICU nurses indicated that training in BPGs and NDSC was of paramount importance for performing their nursing duties effectively. Some respondents were unfamiliar with the BPGs related to their tasks.

- *We need more training on the importance of implementation of BGPS and NDSC.” (FG1)*
- *“It’s better for routine work is done at the same time even though is a lot of noise at the same time, but is once and for all.” (FG2)*
- *“We do have the guidelines, our matron, does the orientation.” (FG3)*

### **Theme 3.3: Ward routine**

Some participants agreed that due to the NICU’s nature of being a specialty unit, multi-disciplinary routines should preferably be done in the morning, to allow the infants the chance to rest and sleep throughout the course of the day.

- *“its also difficult, but to do the routine yes at the same time once and for all.” (FG2)*
- *“... however in the morning due to multidisciplinary teams when they come to do the routine they all come at once, they are x-rays, speech therapist, and whoever coming.” (FG3)*

## **Ethical considerations**

### Potential benefits and hazards

As only focus group interviews were conducted, participants were not exposed to any harm. Although there might have been no direct benefits for the participants, the recommendations emanating from the focus group interviews’ contributions might enable the NICU to implement these BPGs in future.

### Permission to conduct the study, informed consent and recruitment procedures

The Health Research Ethics Committee, Faculty of Health Sciences at the North-West University granted permission with ethical number (NWU- 00010-14-S1) for the study to be conducted and also the Free State Department of Health. Each participant was

provided with information to make an informed decision as to whether to participate voluntarily in the study. Participants signed consent forms before the data were collected. Participants agreed that the focus group interviews could be audiotaped and were informed about voluntary participation and withdrawal without incurring any penalty. The first author arranged focus group interviews telephonically and through follow-up emails regarding the place, duration, date and time of each focus group interview.

Due to the nature of the focus group interview only partial anonymity could be ensured, but rules were set before each focus group interview to ensure that participants would not discuss the issues outside the groups.

The researchers followed the ethical principles as described in the Declaration of Helsinki, Nuremberg code (Delon, 2000) and the Medical Research Council (Delon, 2000) that stipulate the handling of human subjects in the medical research.

### Data protection

Confidentiality was ensured by omitting any identifying data when reporting the findings. The audio tapes and field notes would be kept locked up in a locked office in the Department of Nursing, North-West University for six years. The transcribed data would remain locked on a password protected computer to which only the first author had access for six years. Only the authors and the co-coder had access to the raw data.

### **Trustworthiness**

Rigour in research refers to the establishment of confidence in the truth (credibility) of the findings of the study and the criteria through which this credibility was established (Lincoln & Guba, 1985:290). Trustworthiness of qualitative research was established by using four strategies, namely credibility, transferability, dependability and confirmability (Krefting, 1991:1).

Transcriptions of the focus group interviews were provided to participants to ensure the correctness of the recorded data. Triangulation of data sources was obtained by using of an in-depth literature review, focus group interviews and field notes to produce a thick description of the data (Burns & Grove, 2001:240).

A detailed and thorough description of methods, processes and results throughout the study were provided (Burns & Grove, 2001:64) which should enable the reader to decide to what extent his or her context is similar to or different from the study's site and whether the findings of this study might be generalized to another setting.

The researchers enhanced dependability by employing an independent reviewer and by comparing the independent analyses of the findings.

The researchers clearly defined the research problem and purpose and the problem statement was guided by a conceptual and theoretical framework, enhancing the confirmability of the study's findings.

## **Discussion**

White (2007) believed that it would be easy to achieve adequate control of a NICU's environmental design when building a new unit. However, this is impossible in most situations requiring strategies to be put in place to ensure implementation of the BPGs within a given environment. The core concept that emerged from the analysis of the current study's findings was that the proper implementation of BPG (number one) to enhance the NDSC of preterm infants was challenging. The following themes emerged from the data analysis with regard to strategies to improve the implementation.

Sounds were hard to control in the NICU, because numerous activities and procedures were performed by multidisciplinary team members. Monitors' alarms could not be titrated because nurses needed to hear these alarms throughout the NICU.

Olfactory stimulation could be achieved by putting gauze dipped in the mother's breast milk inside the incubator to support maternal-infant bonding by means of smell, and it

also has calming effects on the infant (Browne & Graven, 2008:181) while antagonising noxious odours (Als, Beuhler, Kerr, Feinberg & Gilkerson, 2006:9). The gustatory (taste) and olfactory (smell) systems develop at 26-28 weeks' and 28 weeks' gestation respectively. These systems are important for survival, since the infant depends on taste and smell to find the mother's breast for feeding and comfort. Most participants indicated that they attempted to prevent exposing the infants to harsh smells of solutions used to prevent nosocomial infections in the NICU. However, provision of the mother's scent to infants nursed in NICU was omitted, except in cases of kangaroo managed care as these infants were with their mothers most of the time.

Browne and Graven (2008:194-195) stipulated that the visual system only matures during the 31<sup>st</sup> week of gestation. Als *et al.* (2006), in the Synactive Theory of Infant Development stated that an early exposure of premature infants to light might have a negative impact on the development of sight. This is supported by Perlman (2007:1344) who reported that bright light prevents the infant's eyes from opening and decreases its attention.

Other factors that influenced the non-implementation of the BPGs in the NICU were the reported shortages of staff and resources, as well as the lack of maintenance of the available equipment.

### **Limitations of the study**

Some information might have been withheld by participants about factors influencing the implementation of guidelines for a NICU's environmental design to facilitate NDSC of preterm infants, in the presence of their colleagues. The fact that the interviewer is also a midwife and neonatal nurse could have contributed to participants' discomfort in sharing information.

More in-depth information might have been obtained if individual interviews had been conducted, but this was impossible as the study had to be completed within a limited time period and within a limited budget.

The information provided during the focus group interviews was also not checked through subsequent systematic observations of the NICU environment.

## **Recommendations**

The hospital's policy committee and quality coordinator should be made aware of the existing BPGs and the implementation challenges identified during the current study so that the implementation could be facilitated.

Curriculum content from basic to advanced training programmes of nurses, midwives, neonatal and ICU nurses should include evidence-based information on the BPGs (1) for NDSC of preterm infants. This information should be repeated during in-service education sessions.

Future researchers should revise the implementation of BPGs (1), identify and address implementation challenges and evaluate the preterm neonates' outcomes before and after such implementation.

## **Acknowledgements**

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## **CHAPTER 4:**

# **CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS**

### **4.1 INTRODUCTION**

The previous chapter presented the data analysis process, the research findings and discussions with reference to the literature. This chapter presents the conclusions, limitations and the recommendations for nursing practice, nursing education and recommendations for further research.

### **4.2 RECOMMENDATIONS**

Recommendations are provided for the implementation of BPGs for NDSC for preterm infants in the public hospitals in South Africa, specifically for nursing practice, nursing education and further research.

#### **4.2.1 Recommendations for nursing practice**

The hospital's policy committee and quality coordinator should be familiar with the existing BPGs and facilitate the implementation thereof.

Nurses working in NICUs and NHCUs should be trained to implement BPGs for providing effective NDSC of preterm infants.

Nurses should remain updated about the best evidence for BPGs for providing NDSC to preterm infants in NICUs and NHCUs.

#### **4.2.2 Recommendations for nursing education**

Curriculum content from basic to advanced training programmes of nurses, midwives, neonatal and ICU nurses should include evidence-based information on BPGs for NDSC of preterm infants and the implementation thereof.

Hospitals' skills development officers should provide continuous education about NDSC as to disseminate the information to all nurses.

#### **4.2.3 Recommendations for nursing research**

Researchers should continue to monitor the implementation of BPGs and the effect thereof for patients, family members, staff members and resource utilization. BPGs should be implemented and revised as evidence-based information become available.

The impact of the implementation of the BPGs should be evaluated continuously and these research findings should be shared with health care providers and used to enhance the hospital's policies.

Long term evaluation of the neonates' outcomes should be monitored at least until they reach five years of age. This would necessitate collaboration with the well-baby clinics caring for these babies after discharge from hospital. Such long term evaluations would enable the detection of sight, hearing and coordination problems as well as developmental delays. Early detection and appropriate referrals of these problems could help these children and their families to obtain help timeously, and to improve their quality of life.

### **4.3 LIMITATIONS OF THE STUDY**

The sample was selected from only one public tertiary hospital in the Free State Province of South Africa, since some of this hospital's nurses had been trained about the BPGs for enhancing NDSC and were thus expected to use the BPGs.

Only nurses working in the NICU and NHCU were interviewed during their free time as they could not be taken away from patient care during their 'on-duty' time. This impacted negatively on the nurses' participation in the focus groups as some nurses were not willing to sacrifice their free time to participate in focus group interviews. Some nurses did not want to be interviewed in English which was not their mother tongue. Focus groups interviews could not be conducted in different languages. This possibility was unforeseen as the nurses completed their training in English and communicated in English in the NICU and NHCU every single day of their working lives. Nevertheless these nurses' opinions were respected and they were allowed to withdraw from participating in the focus group interviews without incurring any negative consequences whatsoever.

Some information might have been withheld by participants who were reluctant to share their perceptions about factors influencing the implementation of environmental design guidelines to facilitate NDSC of preterm infants, in the presence of colleagues. The fact that the researcher is also a midwife and neonatal nurse could have contributed to participants' discomfort in sharing information.

### **4.4 CONCLUSION**

The aim of the study was to explore factors influencing the implementation of BPGs regarding environmental design to create an environment conducive for preterm infant development, similar to the intra-uterine environment' (Lubbe, 2009; Lubbe *et al.*, 2012: 251-9). This research was conducted in one selected public hospital in South Africa, to suggest recommendations,

based on the study's findings, for enhancing developmental outcomes for preterm infants in this public sector hospital. The research question that was posed to accomplish this aim was: What are the factors influencing the implementation of environmental design guidelines to promote NDSC for preterm infants in the NICU of a selected hospital in the Free State Province of South Africa?

The literature reviewed indicated that if all the measures were implemented, like developed BPGs for NDSC of preterm infants, this could contribute to optimal development of preterm infants and reach the fourth millennium developmental goal to combat child morbidity and mortality rates. However, the findings of the current study revealed some challenges impacting on the effective implementation of environmental design guidelines in the NICU to facilitate NDSC one NICU. The major barriers were shortages of staff, poor unit maintenance and financial constraints.

#### **4.5 SUMMARY**

This chapter was the final chapter in this dissertation. The aim and the objectives were achieved. The researcher found that some nurses working in the NICU were trained and aware of the developed BPGs for NDSC for preterm infants. However, some factors influenced the implementation of the environmental design guidelines to facilitate NDSC in the NICU. As a result some preterm infants might continue to be exposed to a less than ideal NICU environment where lights, noises and smells might impact negatively on their neurodevelopment with potentially lifelong adverse effects. Implementing the guidelines to create and maintain a NICU environment promoting preterm neonates' NDSC, need not involve huge costs and could be done in a sustainable way with the support of multidisciplinary team members and policy makers.

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## **ANNEXURE 1: PARTICIPANTS' CONSENT FORM**

### **Factors influencing the implementation of environmental design guidelines to facilitate neurodevelopmental supportive care in neonatal intensive care units**

#### CONSENT TO BE A RESEARCH PARTICIPANT

*I am Miss Mabatho Rakhethla from the North-West University working on factors influencing the implementation of best practice guidelines for neurodevelopmental supportive care of the preterm infant and would like to invite you to give consent and participate in this study. To follow is information about the study so that you can make an informed decision.*

#### **1. PURPOSE OF THE STUDY**

The purpose of this study is to identify the factors that influence the implementation of Best Practice Guideline: 'BPG 1 – Environmental design: Create an environment conducive for preterm infant development, similar to the intra-uterine environment' (Lubbe, 2009: 276) within selected government hospitals in South Africa to ensure better developmental outcomes for preterm infants in public sector hospitals.

Participants will be all neonatal nurses employed in the NICU and in neonatal high care unit of the chosen hospital, which is situated in the Free State Province in South Africa. These nurses comprise the population of the study, as they are perceived as being knowledgeable about factors influencing the implementation strategies regarding environmental design in neonatal intensive care units (Burns & Grove, 2005:159). This hospital, in particular, has been selected by the researcher, since it participated in the preceding study, done by Lubbe, (2009). The researcher is conducting a follow-up study on the proposed BPGs by Lubbe, (2009), focusing on BPG number one that relates to the NICU environment.

You are kindly requested to participate in this study because the researcher trusts that you would have something to say about factors influencing the implementation of environmental design guidelines to facilitate neurodevelopmental supportive care in neonatal intensive care units. As is assumed that you have been exposed to NICUs

and/or neonatal high care units, and your experience, perceptions and feelings are very valuable for this study.

## **2. PROCEDURE**

If you agree to participate in this study you will be expected to:

- Participate in a focus group interview, where, as a member of the group, you will be sharing/discussing different experiences, feelings, perceptions and opinions about factors influencing the implementation of the environmental design in the NICU. The focus group interview is estimated to take about 30 to 60 minutes. The researcher will be guiding the group discussion, whilst audio taping the discussion and also taking some field notes during and after each focus group interview.

## **3. RISKS/DISCOMFORTS**

(Foreseeable risk) – (Precautions taken/debriefing opportunities)

Some of your anonymity might be lost during this study since participants might know each other. However, precautions will be taken to ensure that your name will never be made known as no names will be used but only code numbers. Your information will be handled as confidentially as possible. No individual's identifying information will be used in any publication resulting from this study and only the team of researchers will work with the information that you shared. However, not even the research team members will be able to identify any individual participant. All information will be protected by locking it up and storing it on a password protected computer, in a locked office.

## **4. BENEFITS**

As an individual you will benefit from this study by sharing different NICU experiences with your colleagues in a semi-formal manner, hopefully to identify ways in which guidelines could be implemented in the NICU environment in future. When suggestions are implemented this could improve the quality of care in the NICU. This study's findings could increase the body of knowledge regarding an ideal NICU environment's design to enhance the quality of preterm neonatal care.

## **5. COSTS**

There will be no cost to you as a result of your participation in this study. The researcher just requests 30 to 60 minutes of your time.

## **6. PAYMENT**

You will receive no payment for participation in this study. However some refreshments will be available during the focus group interviews.

## **7. QUESTIONS**

You are welcome to ask any questions from a member of the research team before you decide to give consent. You are also welcome to contact me, Mabatho Rakheta who will be conducting the focus group interviews, if you have any further questions concerning you consent (at cellular phone number 0785213446).

## **8. FEEDBACK OF FINDINGS**

The findings of the research will be shared with you if you are interested. You are welcome to contact us regarding the findings of the research. We will be sharing the findings with you as soon as they become available after acceptance of the research report by North-West University.

## CONSENT FORM

### PARTICIPATION IN THIS RESEARCH IS VOLUNTARY

You are free to decline to participate in this study, or to withdraw at any point even after you have signed the form to give consent without incurring any consequences.

Should you be willing to participate you are requested to sign below:

I \_\_\_\_\_ hereby voluntarily consent to participate in the above mentioned study. I am not coerced in any way to participate and I understand that I can withdraw at any time should I feel uncomfortable during the study. I also understand that my name will not be disclosed to anybody who is not part of the study and that the information will be kept confidential and not linked to my name at any stage. I also understand what I might benefit from participation as well as what might be the possible risks and should I need further discussions someone will be available.

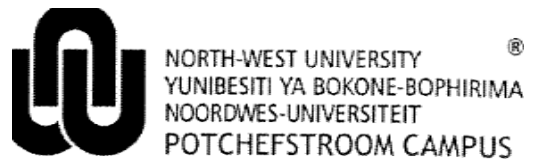
\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of the participant

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of the person obtaining consent

## ANNEXURE 2: INSTITUTIONAL INFORMATION AND CONSENT FORM



Private bag x 6001, Potchefstroom  
South Africa 2520  
Tel: + 27 18 299-1111/2222  
Web: <http://www.nwu.ac.za>

03 JUNE 2014

### INSTITUTIONAL INFORMATION AND CONSENT FORM

The Manager/CEO: Universitas Hospital Bloemfontein

Dear Sir or Madam

I am a master's student of the Potchefstroom Campus of the North-West University. This research forms part of a bigger study, which attempts to implement Best Practice Guidelines that were developed by Dr Welma Lubbe (2009). As a follow-up on Lubbe's (2009) study, you are therefore invited to participate in a research project regarding the implementation of best practice guidelines (BPGs) for neurodevelopmental supportive care (NDSC) of the prematurely born infant in South African public hospitals.

#### **The nature and purpose of the study**

This study aims to identify factors that influence the implementation of the BPG on environmental design: to create an environment conducive for preterm infant development, similar to the intra-uterine environment, to ensure better developmental outcomes for preterm infants in the public sector hospitals.

You are requested to grant permission for this research, which includes focus group interviews conducted with professional nurses working in the NICU. Interviews will be audio-taped and transcribed.

#### **Approval to do research**

The protocol of this study was submitted to the Ethics Committee of the Faculty of Health Science of the Potchefstroom Campus of the North-West University and approval has been granted. Ethical number (NWU-00010-14-S1).

### **Risk or discomfort involved**

There will be no direct risk involved in this research, except for possible discomfort of having to participate in a discussion with persons you know and time involved.

### **Confidentiality**

Any personal information that may become known to the researcher will be kept strictly confidential. The results will be published or presented in such a way that all participants will remain unidentifiable. Only the researcher will have access to the raw data. No information, by which a patient or any of the staff could be recognised, will be used in the published report.

### **Right to withdraw**

Participation of your institution in this research is entirely voluntary and you can refuse to participate or stop at any time without stating any reason. There will not be discriminated against you if you prefer not to participate.

### **Possible benefits of this research**

Your contribution to this research project, regarding neurodevelopmental supportive care for the prematurely born infant in the public sector in South Africa, will contribute to the implementation of best practice guidelines to improve the care and outcomes of prematurely born infants. These guidelines may be to the benefit of patients as well as nurses working in the NICU.

### **Information**

If you have any questions about the research, you are welcome to contact the researcher, Miss Mabatho Rakhetla, at telephone 0785213446 or email [mrakhetla@yahoo.com](mailto:mrakhetla@yahoo.com).

I have read the above information before signing this consent form. The content and meaning of the information are clear to me. I have been given an opportunity to ask questions. I understand that if I do not participate it will not be to my disadvantage. I hereby volunteer to take part in this study.

Signed: \_\_\_\_\_ Date: \_\_\_\_\_

*CEO signature on behalf of Department of Health / Hospital*

Witness: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher: \_\_\_\_\_ Date: \_\_\_\_\_

(Or person obtaining informed consent)

# ANNEXURE 3: APPROVAL LETTER FOR DATA COLLECTION FROM HOSPITAL



health

Department of  
Health  
FREE STATE PROVINCE

Universitas Academic Hospital  
Private Bag X20660  
Bloemfontein  
9300

04 November 2014

RE: Research Proposal (Ms Mabatho Rakhethla)

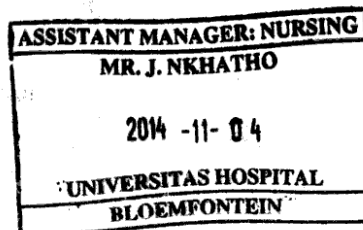
To whom it may concern

Kindly be informed that Universitas Academic Hospital has granted permission to your student, Ms Mabatho Rakhethla to collect data in the Neonatal ICU and High Care Unit as part of her research project.

This permission was granted with the view that information so gathered and findings thereof would be shared with Universitas with the aim of improving the care rendered to the neonates for their optimal development.

I hope you find the above information in order.

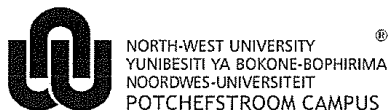
Yours faithfully



**UNIVERSITAS ACADEMIC HOSPITAL**  
**Mr J. Nkhatho – Assistant Manager - Nursing**  
Private Bag X20660, Bloemfontein, 9300  
Room 1083, First Floor, Logeman Street, Universitas, Bloemfontein, 9301  
Tel: (051) 405 3408/3415 Fax: (051) 4440792

www.fs.gov.za

# ANNEXURE 4: ETHICAL APPROVAL FROM NORTH-WEST UNIVERSITY



Private Bag X6001, Potchefstroom  
South Africa 2520

Tel: 018 299-1111/2222  
Web: <http://www.nwu.ac.za>

Dr W Lubbe

Faculty of Health Sciences  
Tel: 018 299-2092  
Fax: 018 299-2088  
Email: [Minrie.Greeff@nwu.ac.za](mailto:Minrie.Greeff@nwu.ac.za)

12 August 2014

Dear Dr W Lubbe

## Ethics Application: NWU-00010-14-S1

### Factors influencing implementation of environmental design guidelines to facilitate neurodevelopmental supportive care in neonatal intensive care units

Thank you for amending your application. All ethical concerns have now been addressed and ethical approval is granted until 01/08/2019.

Yours sincerely

Prof Minrie Greeff  
Chairperson of Health Research Ethics Committee

Original details: Prof Minrie Greeff(10167308) C:\Users\13210572\Documents\ETIEK\2014 ETHICS\NWU-00010-14-S1 Lubbe & Rakhella Goedkeuring.docm  
12 August 2014

File reference: NWU-00010-14-S1

## ANNEXURE 5: THEMES WITH DIRECT QUOTATIONS (FG = FOCUS GROUP)

<b>CATEGORY 1: CURRENT PRACTICES OF BPGs</b>	<b>CATEGORY 2: REASONS NOT IMPLEMENTING BPGs</b>	<b>CATEGORY 3: RECOMMENDATIONS TO IMPLEMENT BPGs</b>
<p><b>theme 1: Noises/sounds</b></p> <ul style="list-style-type: none"> <li>Wear soft soled shoes</li> <li>Do safety checks daily</li> <li>Sounds from ward routine – x-rays, sonars, suctioning, ringing telephone, visitors (such as mothers), nurses’ voice level, habits of nurses not to cover new equipment/</li> <li>Equipment and monitors – utilization of sound controlling devices, volume of monitors not titrated – due to staff shortages and high nurse:patient ratios need to put alarm levels higher to hear from across room, talking louder to call for help; mobile monitors when transferring babies make more noise; noisy towel dispensers; medical representatives show new monitors; banging closing IVACs and incubators</li> <li>Multi-disciplinary team – ward rounds, handing over, doctor’s orders to implement; clinical instructors with students</li> <li>Emergencies – resuscitations, transfers and admissions</li> </ul> <p><b>Quotes:</b></p> <ul style="list-style-type: none"> <li>“Most of the time we wear this kind of shoes (participant pointed to the rubber soled shoes she was wearing) high heels are not allowed as you can hear the footsteps even from the kitchen. Even when you wear high heels, when you get to work you change to a soft soled shoes.” (FG1)</li> </ul>	<p><b>theme 2.1: Shortages</b></p> <ul style="list-style-type: none"> <li>Staff – no ward clerk to answer phones, patient :nurse ratio not according to policy</li> <li>Equipment – not enough, not specialized (. sharing of monitors)</li> <li>Facilities – not enough beds, sometimes admit more than bed occupancy, extra rooms for clerk to answer phones and have ward rounds, handing over report.</li> <li>Financial constraints</li> </ul> <p><b>Quotes:</b></p> <ul style="list-style-type: none"> <li>“Are the machines and shortage of staff.” (FG1)</li> <li>“Yes financial constraints from the department.” (FG1)</li> <li>“NB shortage of staff is a big problem.” (FG2)</li> <li>“... however another big challenge is financial constraints from the department. Sanitizers we never run short of, the only challenge is by the time one has to weigh the benefit against the risk when you don’t allow it to dry off thus exposing the child to the harsh smell but the child will still be alive. Maintenance always comes on time, but there was a time that they took long to come and fixes a fused light. They do not maintain it</li> </ul>	<p><b>theme 3.1: Resources</b></p> <ul style="list-style-type: none"> <li>Staff – more trained NICU nurses employed; replace staff who left</li> <li>Equipment – working and specialized equipment ( sensing kind of power towel dispensers, enough monitors)</li> <li>Facilities – extra rooms with visibility of babies to have meetings</li> </ul> <p><b>Quotes:</b></p> <ul style="list-style-type: none"> <li>“Taking care of shortage of staff. If we are enough staff I don’t think there can be a lot of problems. If shortage of staff can be addressed something can happen.” (FG1)</li> <li>“More staff, more advanced equipment, ...”(FG1)</li> <li>“To hire more NICU nurses. There will be a quality care for the baby as a result a combat on the infection control. Because sometimes between the babies there are no time to wash your hands, sometimes when your still on the other baby the doctor can just call you to say come clean this one.” (FG2)</li> <li>“And for every baby to have its monitor as sometimes they are sharing. Even when we transferee the baby we have to take the monitor from the other baby</li> </ul>

<p align="center"><b>CATEGORY 1: CURRENT PRACTICES OF BPGs</b></p>	<p align="center"><b>CATEGORY 2: REASONS NOT IMPLEMENTING BPGs</b></p>	<p align="center"><b>CATEGORY 3: RECOMMENDATIONS TO IMPLEMENT BPGs</b></p>
<ul style="list-style-type: none"> <li>• <i>“Monitors sound? The reason not to titrate their volume? Let me say if you’re listening to babies and you are busy with the other one you would not be aware that the other one needs your attention. So it boils back to shortage of staff.” (FG1)</i></li> <li>• <i>“The main problem is the noise from the equipment. You find that many people are coming in the morning to do their routines. And then it’s a lot of different sounds from equipment. Again from the sound of the monitors, even when the medical representatives come to showcase their equipment they test them with the babies.” (FG2)</i></li> <li>• <i>“They use mobile X-ray but they come once in the morning. I think that is also a lot, as the x-ray will be taken from bed one to bed 14. In the morning. All the multidisciplinary team come at the same time every day.” (FG2)</i></li> <li>• <i>“There is a lot of noise when babies are supposed to be transferred to high care as are supposed to be place in to the incubators from the meco’s and transferring of other monitors like saturation monitors. Or when there is admission, us also walking, even when we wear soft soled shoes, as high heels are not allowed.” (FG2)</i></li> <li>• <i>“The noise is a problem from the machines that are used by the cleaners, sometimes can be noisy. And monitors themselves for they got their ranges, the moment they reach the set alarm or goes above those ranges they alarms most of the time.” (FG3)</i></li> </ul>	<p><i>regularly. However the unit manager ensures that in the morning the safety managers like checking of working lights, suction are maintained. We have the privilege where we can titrate the lights to be lighter or dim them.” (FG1)</i></p> <ul style="list-style-type: none"> <li>• <i>“Yes, shortage of staff is a big big challenge.” (FG3)</i></li> <li>• <i>“Main problem is shortage of staff that is leading to many challenges, and financial constraints, ...” (FG3)</i></li> <li>• <i>“The environment also is a challenge for if there is not enough space we are forced to take a high care baby to low care, sometimes we are even forced to admit 18 babies instead of 16 babies. Mind you are only two sisters at night, we once having six mecos in our high care babies that are ICU cases?” (FG3)</i></li> <li>• <i>“Shortage of staff is really the main issue. It really puts much burden on everything.” (FG4)</i></li> <li>• <i>“Monitors are not really the best; we have send in the requisition for the new monitors but are still waiting for the approvals. Hopefully in about two weeks’ time will be having new neonatal monitors. Previously we got a donation from Carte Blanche on the monitors however those monitors could not pick on neonatal values, could not pick on the babies Saturation, it was a hassle, so we had to</i></li> </ul>	<p><i>clean it as to use it on this one that is being transferred. And is also a waste of time. Even though most of the time is the saturation monitor one. As we still need to monitor the saturations at the time/ during the time of transferring the baby.” (FG2)</i></p> <ul style="list-style-type: none"> <li>• <i>“... if there was enough budget that was going to assist with hiring of more staff to high care, purchasing of monitors for each and every child to have his her own monitor...” (FG3)</i></li> <li>• <i>Enough staffing can solve a lot of problems, and increase on the budget.” (FG3)</i></li> <li>• <i>“It would be nice if they can replace all the staff that we have lost, as is four that I know of resigned , two transferred to Johannesburg, two passed on, lost one in a car accident just last week.” (FG4)</i></li> </ul>

<b>CATEGORY 1: CURRENT PRACTICES OF BPGs</b>	<b>CATEGORY 2: REASONS NOT IMPLEMENTING BPGs</b>	<b>CATEGORY 3: RECOMMENDATIONS TO IMPLEMENT BPGs</b>
<ul style="list-style-type: none"> <li>• <i>“The report we take it next to the babies, but we try to talk softly. However in cases of emergencies as we work to the ratio of 1:5 we have to shout like call the doctor or whatever, in times of emergencies we have to shout, sometimes we look like we are crazy for we have to shout for help.” (FG3)</i></li> <li>• <i>“Noise is a very massive challenge, it can be noisy here. As there are a lot of people coming in the ward, so is very very difficult to keep the voice level down. I see the TV, is actually off but sometimes the night staff actually put it on may be to prevent them from sleeping. And is quite loud that might be disturbing to the little one. Hence is a massive challenge. Even though most of the time is during the morning hours during routines but after that it calms a lot.” (FG4)</i></li> <li>• <i>“On the monitors we do not set the alarms on the soft note we set them to the high levels due to the shortage of staff so that even if is a few of you on duty you can hear it when it alarms. However, for a person that comes here for the first time it irritates them. However we try to respond to the alarms as quick as possible. But if it’s only the two or three of you on duty and busy with the babies you cannot just leave the baby you’re working on to run to the monitor so you finish what you’re doing. So sometimes it keeps on alarming before you can switch it off. So you finish what you’re doing so that can attend to the monitor.” (FG4)</i></li> </ul>	<p><i>use complementary saturations monitors to back up the main ones.” (FG4)</i></p>	

<p align="center"><b>CATEGORY 1: CURRENT PRACTICES OF BPGs</b></p>	<p align="center"><b>CATEGORY 2: REASONS NOT IMPLEMENTING BPGs</b></p>	<p align="center"><b>CATEGORY 3: RECOMMENDATIONS TO IMPLEMENT BPGs</b></p>
<p><b>theme1. 2: Smell</b></p> <ul style="list-style-type: none"> <li>• Use hand sanitizers</li> <li>• Use sterile gauze and water, not wipes</li> <li>• Cleaning material used for cleaning floors</li> <li>• In emergencies, not enough time to dry hands</li> </ul> <p><b>Quotes:</b></p> <ul style="list-style-type: none"> <li>• <i>“The smell, also we bide, however the cleaning material, however we use biocide to clean the area, but we never realized that they are affecting the babies when we are cleaning that.” (FG1)</i></li> <li>• <i>“I can say sometimes when you are in a hurry to handle the baby you don’t have time to allow it dry.” (FG1)</i></li> <li>• <i>“We do not use the wipes for the babies we only use the gauze and water, to avoid the harsh smell, is not like in a private where you have to bring your own things/your babies toiletry, we just have to wet the gauze and that’s it. It’s just a sterile gauze and water.” (FG2)</i></li> <li>• <i>“Yes, we still wash our hands and use the hand sanitizers between patients and allow it to dry, like (chlohexidide) even when you allow drying it still smells. However still in cases of emergencies one really does not have time to allow it to dry off, in a situation where you have to rush to the baby.” (FG2)</i></li> <li>• <i>“There was one disinfected that we used to use, I could</i></li> </ul>	<p><b>theme 2.2: Maintenance</b></p> <ul style="list-style-type: none"> <li>• Not kept up to date/ broken monitors</li> <li>• Time wait to repair faulty equipment</li> </ul> <p><b>Quotes:</b></p> <ul style="list-style-type: none"> <li>• <i>“There was a time when we had a problem by fused light, but they came, even though they do not maintain it regularly, but sometimes when you call them they come.” (FG1)</i></li> <li>• <i>“We have a challenge for most of the bed lights don’t work, sometimes even the head lights the little lights on top/spot lights, are faulty, they take ages to replace them.” (FG4)</i></li> </ul>	<p><b>theme 3.2: In-service training/ advance education</b></p> <ul style="list-style-type: none"> <li>• On new policies and BPG’s</li> <li>• More trained NICU nurses</li> </ul> <p><b>Quotes:</b></p> <ul style="list-style-type: none"> <li>• <i>“We need more training on the importance of implementation of BGPS and NDSC.” (FG1)</i></li> <li>• <i>“It’s better for routine work is done at the same time even though is a lot of noise at the same time, but is once and for all.” (FG2)</i></li> <li>• <i>“We do have the guidelines, our matron, does the orientation.” (FG3)</i></li> </ul>

<b>CATEGORY 1: CURRENT PRACTICES OF BPGs</b>	<b>CATEGORY 2: REASONS NOT IMPLEMENTING BPGs</b>	<b>CATEGORY 3: RECOMMENDATIONS TO IMPLEMENT BPGs</b>
<p><i>not even use it on myself, was this (G something) however others are a little bit soft. We are also using the hand sanitizer that is automated one and this one doesn't smell." (FG3)</i></p> <ul style="list-style-type: none"> <li><i>"Smells that's your alcohols, and the wipes like (proicetine) it's not ideal but if you dry it nice before handling the baby and not too close to the baby whilst still drying off. But then your alcohol swabs, hibiscrub and skin preps are the ones that we are using and they smell, yes is not ideal but I prefer using them, that rather than damaging the baby's skin, when you weigh the benefit against the risks. Since then no one has ever been replaced." (FG4)</i></li> </ul>		
<p><b>theme 3.1: Lights</b></p> <ul style="list-style-type: none"> <li>Most of time abide – lights on during routine care and emergencies</li> <li>X-rays lights do cover eyes of babies</li> <li>Ward routine</li> </ul> <p><b>Quotes:</b></p> <ul style="list-style-type: none"> <li><i>"With the light we abide, we only switching on the light when we clean, most of the day/time its dim light." (FG1)</i></li> <li><i>"Our lights are always dim; we only switch them on when there is procedure that needs to be done. Even when there are cleaners, when they need to clean, and the routine check-ups, we only put on lights during routine care of the babies and during emergencies only. We</i></li> </ul>	<p><b>theme 2.3: Ward routine</b></p> <ul style="list-style-type: none"> <li>Expectations from management – duties perform even with not enough staff, bed occupancy, patient:staff ratio</li> <li>Policies and guidelines not always feasible due to shortages/time management/emergencies</li> <li>Visitors and inter-professional team – doing x-rays, sonars, visiting mothers</li> <li>Emergencies - due to conditions of babies, resuscitations, transfer and admissions</li> </ul> <p><b>Quotes:</b></p> <ul style="list-style-type: none"> <li><i>"It depends on the viscosity of the secretions, or let's say we do our routine three hourly but now we have changed to 6 hourly, we will know that</i></li> </ul>	<p><b>theme 3.3: Ward routine</b></p> <ul style="list-style-type: none"> <li>Do same activities at same time, such as suctioning of babies, ward rounds, doing sonars and x-rays.</li> <li>Keep to ward routine</li> </ul> <p><b>Quotes:</b></p> <ul style="list-style-type: none"> <li><i>"Mmhh it's also difficult, but to do the routine yes at the same time once and for all. So for me is better for they are doing everything at the same time and is done." (FG2)</i></li> <li><i>"... however in the morning due to multidisciplinary teams when they come to do the routine they all come at once, they are X-rays, speech therapist, and whoever coming." (FG3)</i></li> </ul>

<p align="center"><b>CATEGORY 1: CURRENT PRACTICES OF BPGs</b></p>	<p align="center"><b>CATEGORY 2: REASONS NOT IMPLEMENTING BPGs</b></p>	<p align="center"><b>CATEGORY 3: RECOMMENDATIONS TO IMPLEMENT BPGs</b></p>
<p><i>have the sport lights but they are being used at night. Incubators are only in high care.” (FG2)</i></p> <ul style="list-style-type: none"> <li>• <i>“our lights are forever dim, we are trying, however in the morning due to multidisciplinary teams when they come to do the routine they all come at once, they are X-rays, speech therapist, and whoever coming. So in the morning is actually always traffic so in the morning we are struggling, it’s very busy, every one working on his/her routine. So in the morning we are struggling to dim. With the light, with the sound. But from 12 noon then we can dim the lights when everyone is done. We make a point that we dim the lights from 12noon.” (FG3)</i></li> <li>• <i>“We have a challenge for most of the bed lights don’t work, sometimes even the head lights the little lights on top/spot lights, are faulty, they take ages to replace them. So sometimes the babies are really sick and you don’t really see their veins, so one just has to put on the main lights, like when you have to put on a drip even though you don’t want to traumatize them by harsh lights. But most of the time the lights are off.” (FG4)</i></li> </ul>	<p><i>nine o’clock is the routine time, so you can imagine that noise coming from suctioning of the babies. And then with us we have to transfer them to the high care, you will find that, time and again we have to connect them to monitors, so surely that has impact on them. Say eleven o’clock we are transferring, to high care I have to do the transferring, or there is an admission now definitely, it’s a lot of noise around that.” (FG2)</i></p> <ul style="list-style-type: none"> <li>• <i>“Babies they need a close monitoring by the time you done with is like you have neglected the other high care babies. AND YOU are still expected to see other babies that you might even be behind with their medications and still have to do paper work thereafter. Sometimes we even admit even the babies that one could think is supposed to be in NICU because of their prematurity status, but will be send to high care for [they] are said not [to be] viable as they were born before 26 weeks of gestation. And are handled like NICU babies. And we have to take bloods, give some sedations like (dopamines) and the attention has to be on this little ones as some times their sugars are high now, and we have to mix the (actrapid0 at the end of the day you’re very exhausted. And it’s like you have ignored our poor high care ones for one consider them a bit stable physically. And</i></li> </ul>	

<b>CATEGORY 1: CURRENT PRACTICES OF BPGs</b>	<b>CATEGORY 2: REASONS NOT IMPLEMENTING BPGs</b>	<b>CATEGORY 3: RECOMMENDATIONS TO IMPLEMENT BPGs</b>
	<p><i>everything falls behind. And it's just by luck/God's grace that when still busy with those ones we have never had an incident of losing the other ones. We do have the guidelines hence we even make others aware that this is how we [are] supposed to be doing things. We are trying."</i> (FG3)</p> <ul style="list-style-type: none"> <li>• <i>"Even that is chaotic in the morning when multi disciplinary teams come to do their routines. Or unless there are admissions and all of that. But mainly is in the morning when it gets very crazy. Especially when there are caesarean sections to be done, the doctor will go to maternity then come back to the ward to be busy with the admission. Sometimes wants to do other procedure all again, and also like putting on the CVPs line. But once is done is done."</i> (FG4)</li> </ul>	

## ANNEXURE 6: AUTHOR GUIDELINES: CURATIONIS

<http://www.curationis.org.za/index.php/curationis/pages/view/author-guide>

### Structure and style of your empirical research article

The page provides an overview of the structure and style of your empirical research article to be submitted to the *Curationis*. The empirical research article provides an overview of innovative research in a particular field within or related to the focus and scope of the journal presented according to a clear and well-structured format (between 3500 and 7000 words with a maximum of 60 references).

- **Language:** Manuscripts must be written in British English.
- **Line numbers:** Insert continuous line numbers.
- **Font:**
  - **Font type:** Palatino
  - **Symbols font type:** Times New Roman
  - **General font size:** 12pt
- **Line spacing:** 1.5
- **Headings:** Ensure that formatting for headings is consistent in the manuscript.
  - First headings: normal case, bold and 14pt
  - Second headings: normal case, underlined and 14pt
  - Third headings: normal case, bold and 12pt
  - Fourth headings: normal case, bold, running-in text and separated by a colon.

Our publication system supports a limited range of formats for text and graphics. Text files can be submitted in the following formats only:

- Microsoft Word (.doc): We cannot accept Word 2007 DOCX files. If you have created your manuscript using Word 2007, you must save the document as a Word 2003 file before submission.
- Rich Text Format (RTF) documents uploaded during Step 2 of the submission process. Users of other word processing packages should save or convert their files to RTF before uploading. Many free tools are available that will make this process easier.



For full details on how to ensure your manuscript adheres to the house style, [click here](#).

[The structure and style of your original article](#)

### Page 1

The format of the **compulsory cover letter** forms part of your submission and is on the first page of your manuscript and should always be presented in English. You should provide all of the following elements:

- **Article title:** Provide a short title of 50 characters or less.
- **Significance of work:** Briefly state the significance of the work being reported on.
- **Full author details:** Provide title(s), full name(s), position(s), affiliation(s) and contact details (postal address, email, telephone and cellular number) of each author.
- **Corresponding author:** Identify to whom all correspondence should be addressed to.

- **Authors' contributions:** Briefly summarise the nature of the contribution made by each of the authors listed.
- **Summary:** Lastly, a list containing the number of words, pages, tables, figures and/or other supplementary material should accompany the submission.

Page 2 and onwards

**Title:** The article's full title should contain a maximum of 95 characters (including spaces).

### **Abstract (first-level heading)**

- Do not cite references in the abstract.
- Do not use abbreviations excessively in the abstract.
- The abstract should be written in English.
- The abstract should be no longer than 250 words and must be written in the past tense. The abstract should give a succinct account of the objectives, methods, results and significance of the matter. The structured abstract for an Original Research article should consist of five paragraphs labelled Background, Objectives, Method, Results and Conclusion.
- **Background: *Why do we care about the problem?*** The context and purpose of the study (what practical, scientific or theoretical gap is your research filling?).
- **Objectives: *What problem are you trying to solve?*** What is the scope of your work (a generalised approach, or for specific situation). Be careful not to use too much jargon.
- **Method: *How did you go about solving or making progress on the problem?*** How the study was performed and statistical tests used (what did you actually do to get the results). Clearly express the basic design of the study, name or briefly describe the basic methodology used without going into excessive detail. Be sure to indicate the key techniques used.
- **Results: *What is the answer?*** The main findings (as a result of completing the above procedure/study what did you learn/invent/create?). Identify trends, relative change or differences on answers to questions.
- **Conclusion: *What are the implications of your answer?*** Brief summary and potential implications (what are the larger implications of your findings, especially for the problem/gap identified in your motivation?).

### **Introduction (first-level heading)**

The introduction contains two subsections, namely the background section and the literature review.

- **Problem statement (second-level heading):** The setting section should be written from the standpoint of readers that is, without specialist knowledge in that area and must clearly state and illustrate the introduction to the research and its aims in the context of previous work bearing directly on the subject. The setting section to the article normally contains the following five elements.
- **Aims of the study/Key focus (third-level heading):** A thought-provoking introductory statement on the broad theme or topic of the research.
- **Background (third-level heading):** Providing the background or the context to the study (explaining the role of other relevant key variables in this study);
- **Trends (third-level heading):** Cite the most important published studies previously conducted on this topic or that has any relevance to this study (provide a high-level synopsis of the research literature on this topic).

- **Research objectives (third-level heading):** Indicate the most important controversies, gaps and inconsistencies in the literature that will be addressed by this study. In view of the above trends, state the core research problem and specific research objectives that will be addressed in this study and provide the reader with an outline of what to expect in the rest of the article.
- **Definition of key concepts (third-level heading)**
- **Contribution to field (third-level heading):** Explanation of the study's academic (theoretical and methodological) or practical merit and/or importance (provide the value-add and/or rationale for the study).
- **Literature review (second-level heading):** The literature review is the second subsection under the Introduction and provides a brief and concise overview of the literature under a separate second-level heading, e.g. literature review. A synthesis and critical evaluation of the literature (not a compilation of citations and references) should at least include or address the following elements, ensure these are in the literature review. Define conceptual (theoretical) definitions of all key concepts; A critical review and summary of previous research findings (theories, models, frameworks, etc.) on the topic; A clear indication of the gap in the literature and for the necessity to address this void; and A clearly established link exists between formulated research objectives and theoretical support from the relevant literature.

### **Research method and design (first-level heading)**

This section should include:

- **Design (second-level heading):** Describe your experimental design clearly, including a power calculation if appropriate. Note: Additional details can be placed in the online supplementary location.
- **Materials (second-level heading):** Describe the type of organism(s) or material(s) involved in the study.
- **Data collection method/Procedure (second-level heading):** Describe the protocol for your study in sufficient detail (clear description of all interventions and comparisons) that other scientists could repeat your work to verify your findings.
- **Data analysis (second-level heading):** Describe how the data were summarised and analysed, additional details can be placed in the online supplementary information.
- **Context of the study (second-level heading):** Describe the site and setting where your field study was conducted.

### **Results (first-level heading)**

This section provides a synthesis of the obtained literature grouped or categorised according to some organising or analysis principle.

Tables may be used and/or models may be drafted to indicate key components of the results of the study.

- Organise the results based on the sequence of Tables and Figures you will include in the manuscript.
- The body of the Results section is a text presentation of the key findings which includes references to each of the Tables and Figures.
- Statistical test summaries (test name, p-value) are usually reported parenthetically in conjunction with the biological results they support, use SI unit.
- Present the results of your experiment(s)/research data in a sequence that will logically support (or provide evidence against) the hypothesis, or answer the question, stated in the Introduction.

All units should conform to the **SI convention** and be abbreviated accordingly. Metric units and their international symbols are used throughout, as is the decimal point (not the decimal comma).

### **Ethical considerations (first-level heading)**

Articles based on the involvement of animals or humans must have been conducted in accordance with relevant national and international guidelines. Approval must have been obtained for all protocols from the author's institutional or other relevant ethics committee and the institution name and permit numbers provided at submission.

- **Potential benefits and hazards (second-level heading):** What risks to the subject are entailed in involvement in the research? Are there any potential physical, psychological or disclosure dangers that can be anticipated? What is the possible benefit or harm to the subject or society from their participation or from the project as a whole? What procedures have been established for the care and protection of subjects (e.g. insurance, medical cover) and the control of any information gained from them or about them?
- **Recruitment procedures (second-level heading):** Was there any sense in which subjects might be 'obliged' to participate – as in the case of students, prisoners, learners or patients – or were volunteers being recruited? If participation was compulsory, the potential consequences of non-compliance must be indicated to subjects; if voluntary, entitlement to withdraw consent must be indicated and when that entitlement lapses.
- **Informed consent (second-level heading):** Authors must include how informed consent was handled in the study.
- **Data protection (second-level heading):** Authors must include in detail the way in which data protection was handled.

### **Trustworthiness (first-level heading)**

This refers to the findings of the study being based on the discovery of human experience as it was experienced and observed by the participants.

- **Reliability (second-level heading):** Reliability is the extent to which an experiment, test, or any measuring procedure yields the same result on repeated trials. Without the agreement of independent observers able to replicate research procedures, or the ability to use research tools and procedures that yield consistent measurements, researchers would be unable to satisfactorily draw conclusions, formulate theories, or make claims about the generalisability of their research.
- **Validity (second-level heading):** Validity refers to the degree to which a study accurately reflects or assesses the specific concept that the researcher is attempting to measure. While reliability is concerned with the accuracy of the actual measuring instrument or procedure, validity is concerned with the study's success at measuring what the researchers set out to measure. Researchers should be concerned with both external and internal validity. External validity refers to the extent to which the results of a study are generalisable or transferable. Internal validity refers to (1) the rigor with which the study was conducted (e.g. the study's design, the care taken to conduct measurements, and decisions concerning what was and wasn't measured) and (2) the extent to which the designers of a study have taken into account alternative explanations for any causal relationships they explore. In studies that do not explore causal relationships, only the first of these definitions should be considered when assessing internal validity.

**Discussion (first-level heading)** this section normally contains the following four elements. It is suggested that sub-headings are used in this section:

- **Outline of the results (second-level heading):** Restate the main objective of the study and reaffirm the importance of the study by restating its main contributions; summarise the results in relation to each stated research objective or research hypothesis; link the findings back to the literature and to the results reported by other researchers; provide explanations for unexpected results.
- **Practical implications (second-level heading):** Reaffirm the importance of the study by restating its main contributions and provide the implications for the practical implementation your research.

**Limitations of the study (first-level heading):** Point out the possible limitations of the study and provide suggestions for future research.

**Recommendations (first-level heading):** Provide the recommendations emerging out of the current research.

**Conclusion (first-level heading)** This should state clearly the main conclusions of the research and give a clear explanation of their importance and relevance, with a recommendation for future research (implications for practice). Provide a brief conclusion that restates the objectives; the research design; the results and their meaning.

**Acknowledgements (first-level heading)** If, through your study, you received any significant help in conceiving, designing, or carrying out the work, or received materials from someone who did you a favour by supplying them, you must acknowledge their assistance and the service or material provided. **Authors should always acknowledge outside reviewers of their drafts and any sources of funding that supported the research.**

- **Competing interests (second-level heading):** A competing interest exists when your interpretation of data or presentation of information may be influenced by your personal or financial relationship with other people or organisations that can potentially prevent you from executing and publishing unbiased research. Authors should disclose any financial competing interests but also any non-financial competing interests that may cause them embarrassment were they to become public after the publication of the manuscript. **Where an author gives no competing interests, the listing will read 'The authors declare that they have no financial or personal relationship(s) which may have inappropriately influenced them in writing this article.'**
- **Authors' contributions (second-level heading):** This section is necessary to give appropriate credit to each author, and to the authors' applicable institution. The individual contributions of authors should be specified with their affiliation at the time of the study and completion of the work. An 'author' is generally considered to be someone who has made substantive intellectual contributions to a published study. Contributions made by each of the authors listed, along the lines of the following (please note the use of author initials):

J.K. (University of Pretoria) was the project leader, L.M.N. (University of KwaZulu-Natal) and A.B. (University of Stellenbosch) were responsible for experimental and project design. L.M.N. performed most of the experiments. P.R. made conceptual contributions and S.T. (University of Cape Town), U.V. (University of Cape Town) and C.D. (University of Cape Town) performed some of the experiments. S.M. (Cape Peninsula University of Technology) and V.C. (Cape Peninsula University of Technology) prepared the samples and calculations were performed by C.S., J.K. (Cape Peninsula University of Technology) and U.V. wrote the manuscript.

**References (first-level heading)** Begin the reference list on a separate page with no more than 60 references. **Curationis** uses the **Harvard referencing style**, details of which can be downloaded from the journal website. **Note: No other style will be permitted.**

# ANNEXURE 7: APPROVAL LETTER DATA COLLECTION FROM FREESTATE HOD 2015



health  
Department of  
Health  
FREE STATE PROVINCE

16 February 2015

Ms E Rakhethla  
Northwest University, Potchroom  
Dear Ms Rakhethla

**Subject: Factors influencing implementation of environmental design guidelines to facilitate neurodevelopment supportive care in neonatal intensive care units**

The above mentioned correspondence bears reference.

- Permission is hereby granted for the above – mentioned research on the following conditions:
- Participation in the study must be voluntary.
- A written consent by each participant must be obtained.
- Ascertain that your data collection exercise neither interferes with the day to day running of the health facilities nor the performance of duties by the respondents.
- Serious Adverse events to be reported to the Free State department of health and/ or termination of the study.
- Confidentiality of information will be ensured and no names will be used.
- Research results and a complete report should be made available to the Free State Department of Health on completion of the study (a hard copy plus a soft copy).
- Progress report must be presented not later than one year after approval of the project to the Ethics Committee of the University of Potchroom and to Free State Department of Health.
- Any amendments, extension or other modifications to the protocol or investigators must be submitted to the Ethics Committee of the University of Potchroom and to Free State Department of Health.
- Conditions stated in your Ethical Approval letter should be adhered to and a final copy of the Ethics Approval should be submitted to [khusemj@fshealth.gov.za](mailto:khusemj@fshealth.gov.za) or [sebeelats@fshealth.gov.za](mailto:sebeelats@fshealth.gov.za) before you commence with the study
- No financial liability will be placed on the Free State Department of Health
- Please discuss your study with the institution manager on commencement for logistical arrangements
- Department of Health to be fully indemnified from any harm that participants and staff experiences in the study
- Researchers will be required to enter in to a formal agreement with the Free State department of health regulating and formalizing the research relationship (document will follow)
- You are encouraged to present your study findings/results at the Free State Provincial health research day
- Future research will only be granted permission if correct procedures are followed see <http://nhrd.hst.org.za>

Trust you find the above in order.

Kind Regards

  
Dr D Motau

HEAD: HEALTH

Date: 23/02/2015

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# ANNEXURE 8: PROOF OF LANGUAGE EDITTING

**Valerie Janet Ehlers**

**Nurse Consultant and Researcher**

**Emeritus Professor and Research Fellow: University of South Africa**

**Associate Editor: International Nursing Review**

**(B Soc Sc, Honours B Soc Sc, BA Cur, Honours BA Cur, MA Cur, D Lit et Phil)**

## CONFIRMATION OF EDITING OF A DOCUMENT

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08 Novemberr 2015	I hereby certify that I have edited master's dissertation of Ms M Rakhetla:  FACTORS INFLUENCING THE IMPLEMENTATION OF ENVIRONMENTAL DESIGN GUIDELINES TO FACILITATE NEURODEVELOPMENTAL SUPPORTIVE CARE (NDSC) IN A NEONATAL INTENSIVE CARE UNIT IN SOUTH AFRICA
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Thank you



Prof VJ Ehlers