

**THE KNOWLEDGE, PRACTICES AND ATTITUDE OF NURSES TOWARDS PAIN MANAGEMENT OF
NEONATES IN THE WESTERN CAPE**

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Abstract

Aim: To investigate the knowledge, practices, and attitudes, of nurses towards pain management of neonates in Western Cape.

Background: Pain is regarded as a sensory modality which is vital for surviving. Effective pain management presents positive patient's outcome, reduced hospitalisation, and improved developmental milestone. The advancement of modern technology has facilitated the survival of premature and new-born babies in the Neonatal Intensive Care. This advanced technology may however be inflicting excruciating pain on sick neonates during treatment. The sick neonates are exposed to many painful procedures which include venepuncture, lumbar puncture, mechanical ventilation, non-invasive ventilation, urine catheterisation, heel prick and many other procedures. If neonatal pain is not managed, it may cause long-term damage to the child's neural development. This study is aimed to describe the factors of poor nurse management of neonate pain. The findings will be used to recommend pain management guidelines for the neonates receiving treatments in intensive care.

Methods: This study is a quantitative survey using self-administered questionnaires to investigate pain management by nurses. The questionnaire measured the knowledge, practices, and attitudes of nurses towards pain management of neonates. The population (n=121) includes all enrolled nurses (EN) and registered nurses (RN) working in neonatal intensive care of three tertiary hospitals in Western Cape. The researcher obtained permission from the Biomedical Research Ethical Committee of (Appendix A) UWC and the Western Cape

Department of Health. (Appendix E) and Health Research Ethics committee (Appendix F) of University of Cape Town.

Results: Out of a total of 121 respondents who are nurses working from three tertiary hospitals 106 (87.6%) were female and 15 (12.4%) were male. The mean age of the respondents was 38.7 years (sd=9.96). Of the sample 76 (63.9%) were registered nurses (RNs), and 32(26.7%) had obtained a postgraduate diploma/degree. 45(36,1%) were enrolled nurses (ENs). More than half of the respondents were NICU experienced nurses (56, 55.4%), with 34.5 % reported a high level of working experience (>10 year) in NICU and over three quarters of the respondents (76.7%) had experienced pain related procedure in their lifetime.

A total of 61.9% of the respondents reported that they were knowledgeable about the availability of pain management guidelines in the ward; and 90.8% of the respondents understood neonatal pain to be both behavioural and physiological response to painful stimuli and both behavioural and physiological response to painful stimuli. The respondents were knowledgeable about the use of pharmacological pain management intervention of the following procedures: lumbar puncture (90.0%), insertion of intercostal drain (89.9%) and intestinal perforation (85.8%). Most of the respondents (88.2%) indicated that neonates do perceive pain, however, 47.1% indicated that neonates forget pain faster than adults. Most of the respondents (86%) agreed that there is a need for a pain management training course or workshops for the nurses working in NICU.

Conclusion: The study showed that though the respondents had some knowledge of painful procedures, they lacked awareness of the availability of pain management guidelines in the ward, and how to use neonatal pain assessment tools.

Keywords

Attitudes; Knowledge; Neonates; Pain management; Nurses.



Declaration

I declare that *The Knowledge Practices and Attitude of Nurses towards Pain Management of Neonates in the Western Cape* is my own work, that it has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete references.

Date: 09 Nov. 2023

Signed: 

RACHEL DIELE



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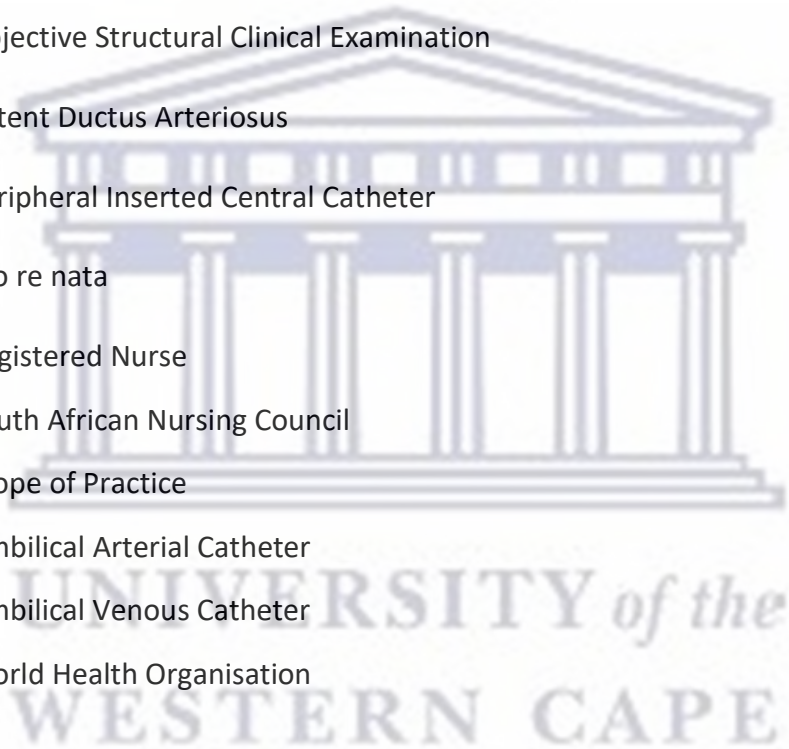
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Abbreviations

NICU	Neonatal Intensive Care Unit
CNS	Central Nervous System
EN	Enrolled Nurse
EMLA	Eutectic Mixture of Local Anaesthetics (Lidocaine and prilocaine)
ICU	Intensive Care Unit
NEC	Necrotizing Enterocolitis
OSCE	Objective Structural Clinical Examination
PDA	Patent Ductus Arteriosus
PICC	Peripheral Inserted Central Catheter
PRN	Pro re nata
RN	Registered Nurse
SANC	South African Nursing Council
SOP	Scope of Practice
UAC	Umbilical Arterial Catheter
UVC	Umbilical Venous Catheter
WHO	World Health Organisation



Dedication.

To my mother Mary, Mother of Jesus Christ.

To all the nurses working in NICUs and the preemies and their families.

To all those in my family whose love I have shared and who are now asleep with the Lord, especially my niece Abigail Angel Kwankam who demised of prematurity and my friend Philomena Lekeacha who did not survive maternal health complications and preterm labour.



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Chapter 1

Introduction and Background

1.1 Introduction

A key issue for neonatal nurses to deal with is dealing with neonatal pain management. Dealing with pain is a challenge in patients generally (Hennessee, 2012), which is exacerbated with neonates as these patients are not able to verbally communicate that they are in pain (Sherrill, 2013) due to the early, non-verbal stages of development (Samarkandi, 2018). An exhaustive pain assessment is important in prioritising the needs of neonatal patients (Al-Quliti & Alamri, 2015).

The literature shows that nurses primarily rely on their own personal knowledge for the assessment of pain in neonates (Nimbalkar, Dongara, Phatak & Nimbalkar, 2014). In addition, research indicates that while there is a practice of not using sedation in the neonatal intensive care procedures which are painful when administered, implying lack of knowledge and poor pain management practices (Kothari, Dongara, Nimbalkar, Phatak & Nimbalkar, 2016). Nurses seem to have casual attitudes towards the pain management of neonates (Asadi-Noghabi, Tavassoli-Farahi, Yousefi & Sadeghi, 2014). This may be due to the mistaken fallacy that neonates cannot feel pain (Asadi-Noghabi et al., 2014). For this reason, (Kothari et al., 2016) has urged that there is need and emphasis on education and having refresher workshops for NICU nurses, residents, and fellows.

Due to poor pain management in neonates, there are various health problems which can be experienced by neonates. According to Pancekauskaitė, & Jankauskaitė (2018) the continued use of procedures without anesthetics to numb the pain, can lead to an altered

development of the "pain system" and may be associated with decreased pain thresholds during development. This may then lead to possible changes in the brain development of a neonate that makes him or her vulnerable to other disorders such as stress and anxiety, further exacerbated by the prolonged periods of neonatal intensive care (Pancekauskaitė, et al., 2018). Other studies indicate that other complications of neonatal pain include a decrease in the immune response, delayed weight gain, prolonged hospitalisation, impaired neonate-parent bonding, and development of psychosomatic conditions such as hyperalgesia and allodynia. (American Academy of Pediatrics, 2016; & Hartley, Miller & Gephart, 2015)

Central to this phenomenon, is the perception that efficient pain management of neonates is a poorly managed issue, despite big advances in pharmacological, physiological, and behavioural pain interventions of neonates in the last decades (Mehrnoush, Ashktorab, Heidarzaden & Momenzadeh, 2017). The limited knowledge and the negative or casual attitudes of nurses may lead to poor practices by nurses in neonatal pain management. Studies have found that qualifications and experiences in nurses resulted in better practices about the management of pain (Asadi-Noghabi et al., 2014). This is corroborated by research demonstrating the significance of nurses' knowledge and attitudes in the execution of pain management programs, advice on potential improvements to pain management, and nurses' education programs (Lake, 2013). The literature has established that the lack of sufficient knowledge about pain management in nurses regarding neonates in NICU is common (Cong, McGrath, Delaney, Chen, Liang & Vazquez, 2014). Study showed that the physicians and the nurses did not have adequate knowledge to evaluate the neonates' pain levels and determine the best pain management plan for both pharmacological and non-pharmacological interventions. (Schultz, Loughran, Fowlds & Spence, 2010). Similarly, only a

small proportion of respondents were able to differentiate long-term effects between neonates and older children and only a few experienced doctors were aware of this (Schultz et al., 2010).

It is important to emphasize that the benefits of effective pain management link to positive patient outcomes, for example, a decrease in length of stay in hospital; reduced incidences of infections; and steady increase in the weight of a child (American Academy of Pediatrics, 2016).

To assess the situation in terms of pain management knowledge and practices in the Western Cape, a replication of a study which of two public hospitals in Gauteng (Khoza, et al. 2014) were conducted with the aim to investigate the knowledge, practices, and attitudes of nurses towards pain management of neonates in selected hospitals in the Western Cape.

1.2 Background

Neonates experience a range of health effects from poor pain management, ranging from altered development of the pain system, decreased pain thresholds during development to other long-term effects such as stress and anxiety-related disorders (Walker, 2013). Other negative effects include a decrease in the immune response, delayed weight gain, prolonged hospitalization, impaired neonate-parent bonding, and development of psychosomatic conditions (Hartley, Miller & Gephart, 2015); American Academy of Pediatrics, 2016).

Prolonged levels of stress in neonates can slow brain development and physical growth, because the heightened exposure to cortisol released during the stress response leads to long-term damage to the developing brain, with a possible negative effect on the immune

system (Duerden, Grunau, Guo, Foong, Pearson Au-Young, Lavoie, Chakravarty, Chau, Synnes & Miller, 2018; Vinall et al., 2014). In addition to these effects, there is a growing wealth of literature on the effects of various painful invasive and non-invasive procedures in Neonatal Intensive Care (NICU), which are ignored due to the non-verbal nature of the neonates (Khoza et al., 2014).

A focus on the knowledge, practices and attitudes of nurses working in NICU is important as failure to attend to pain management may have long-term side effects (American Academy of Pediatrics, 2016). Nurses may have the knowledge but may fail to engage it due to personal beliefs and perceptions on neonatal pain (Khoza et al., 2014). As such, the reasons that inform their actions may not be linked only to their knowledge or lack thereof, but also due to personal reasons that they bring to the workplace, devoid of any professional underpinnings (Lake, 2013).

Central to this, nurses who care for neonates have a responsibility to promote safety and make sure that their assessment and appropriate management of painful procedures (Abazari & Namnabati, 2017). Pain management is vital, as neonates cannot show pain (Mehnoush, Ashktorab, Heidarzaden & Momenzadeh, 2017) and can only show these in the form of physiological and behavioural signs (Mirzarahimi, Mehnoush, Shahizadeh, Samadi & Amani, 2013). This is a specific concern for the neonates who are born prematurely and who need intensive care as they go through several painful procedures during their first few weeks in hospital (Lake, 2013). However, many of these procedures are done without pharmacological pain control measures (Asadi-Noghabi et al., 2014). However, pain management of neonates and knowledge on side effects of pain may still result in pain (Akuma & Jordan, 2012; Cong, Delaney & Vazquez, 2013). This study will seek to understand

and investigate the knowledge, practices, and attitudes of nurses towards neonatal pain management in the Western Cape.

1.3 Problem statement

In the NICU neonates are exposed to many painful procedures which include venipuncture, lumbar puncture, mechanical ventilation, noninvasive ventilation, urine catheterisation, heel prick and many other procedures (Lake, 2013). Pain is an unpleasant subjective experience with actual or potential tissue damage that presents differently in different patients (Chetty, Frohlich, Penfold, Hodgson, Raff, Kluyts, Travers, Lee, Wallis, Lundgren & Milner, 2017). The appropriate management of pain lies in the knowledge of efficient pain assessment and the ability of the nurses to establish its location and intensity for effective management (Breivik, Allen, & Stubhaug 2013). The assessment of pain in non-communicating patients poses a significant challenge; particularly in settings such as the NICU, this area of nursing care require attention. However, while this is a significant challenge, it is essential to develop effective pain assessment methods that can address this gap in knowledge, practices, and attitude towards neonatal pain management. This will empower nurses to advocate for the neonates' best interests with confidence and accuracy. (Inci, Gundogdu, Gungor, Arslan, Turkyilmaz & Eroglu, 2013). Evidence suggests that lack of knowledge and inadequate practices in neonatal pain management can lead to long term poor health outcome such as cognitive and social dysfunctions, long-term emotional and behavioral problems related to prolonged exposure to pain. Therefore, effective pain management in NICU is crucial to mitigate these negative outcomes. (Hartley, Miller & Gephart, 2015).

There are several factors contributing to poor neonatal pain management. These include personal beliefs about neonatal pain, lack of knowledge, misconceptions, and poor historical practices (Gradin & Eriksson, 2010; Khoza et al., 2014). Therefore, this study will investigate the knowledge, attitudes, and practices of nurses to manage neonatal pain.

1.4 The study

1.4.1 Research aim

The aim of this study is to investigate the knowledge, practices, and attitudes of nurses towards pain management of neonates in the Western Cape.

1.4.2 Objectives

The objectives of the study are as follows:

To measure the knowledge of nurses on pain management of neonates.

To investigate the practice of nurses on pain management of neonates; and

To identify the attitudes of nurses on pain management of neonates.

1.4.3 Rationale of the study.

It is hoped that this study will contribute an understanding of the practices of nurses towards neonatal pain management. It is envisaged that the use of education as a tool in the pain management of neonates aids the advancement, improvement, and use of knowledge in a manner that enables the nurses to be rational, devoid of wrong attitudes and practices in the pain management of neonates. This will therefore guide nurses' practice in appropriately managing neonatal pain.

1.4.4 Operational definitions

In this study, the following operational definitions will be used (Table 1).

Table 1: Definition of terms

Term	Definition
Nurse	A nurse is a person registered in a category under section 31(1) to practice nursing or midwifery (SANC, act no. 33 of 2005). In this study, nurse refers to Registered and Enrolled nurses working in Neonatal Intensive Care of three tertiary hospitals in Western Cape. According to Tarjoman, Vasigh, Safari and Borji (2019), neonatal nurses are responsible for attending to births, measuring, and weighing infants, caring for and monitoring the health of infants directly after birth, and educating new parents about breastfeeding and the care of their child including the management of pain thereafter.
Attitude	Attitude, in this context, is the behaviour of nurses towards pain management of the neonates (Asadi-Noghabi et al., 2014). <i>Operational definition:</i> Attitudes as defined as per questionnaire are how often healthcare professional use pain assessment tools and assist neonates who are in pain.
Knowledge	<i>Operational definition:</i> Knowledge is the ability to determine the area where the nurses have or lack knowledge towards pain management of neonates (Khoza et al. 2014) (as per questionnaire).
Neonate	According to the WHO definition, a neonate is a newborn infant between the age 0-28 days old.
Pain management of neonates	This refers to the ability to appropriately assess pain in neonates by using standardised pain scores and to give immediate and appropriate pharmacological and non-pharmacological intervention to alleviate the pain (Allegaert & Van Den Anker, 2016)
Practice	Practice refers to the responsibilities and activities of nurses towards pain assessment and the management of pain of neonates which they are authorised to perform within their scope of practice (Buckle, 2014). <i>Operational definition:</i> Practice as per the questionnaire refers to what nurses do and what they don't do towards the management of pain of neonates, either pharmacological, non-pharmacological or both.

1.5 Structure of the thesis

This research thesis has six chapters.

Chapter One includes the introduction to the study and outlines the background and contextualisation of the study. It also describes the aims and objectives of the study, provides definitions of terms and explains the significance of the study.

Chapter Two includes a summary of the literature on pain management in neonates.

Chapter Three describes the research approach and design, population and sample, instrument selected, data collection and analysis, as well as ethical procedures of the study.

Chapter Four presents the data collected.

Chapter Five presents a discussion based on the findings.

Chapter Six summarises the entire research. This chapter concludes the study, presents its limitations, and outlines recommendation for future research.



Chapter 2

Literature Review

2.1 Introduction

This literature review provides a summary of the current literature on pain management of neonates. Effective pain management presents positive patient outcomes, such as a decrease in length of stay in hospital; reduced incidences of infections; and steady increase in the weight of a child (America Academy of Pediatrics, 2016). There is the belief that neonates do not feel pain (Marchant, 2014). However, the perception is that efficient pain management of neonates is a controversial issue, despite big advances in pharmacological, physiological, and behavioural pain interventions of neonates in the last decades (Mehnoush, Ashktorab, Heidarzaden & Momenzadeh, 2017). A study has shown that the nurses' knowledge and attitude are important in implementation of pain management program, guidance on the possible improvement of pain management is instructive in design and hold training courses to inform the Personnel (Lake, 2013). According to the review, the root causes of insufficient pain management in NICUs are NICU nurses' lack of expertise, lack of collaboration, and ineffective communication. Furthermore, Kassab et al. (2021) note that despite their years of NICU experience; over half of the nurses in their study lack the knowledge necessary to conduct procedural pain management interventions to neonates. Also, in a different study, it was also suggested that NICU nurses should have access to a training platform where they could attend conferences and workshops to learn more about the most recent developments in NICU pain management techniques (Khalil, El-husseiny, Abed-Ella & Mohamed, 2019)

A study by (Nimbalkar, et al., 2014) indicates that nurses rely primarily on their personal knowledge for the assessment of pain in neonates. Similar research indicates that while there is a practice of not using sedation in NICU procedures, they are painful when administered – an implication of lack of knowledge that exhibits poor pain management practices (Kothari et al., 2016). A research urge that there is need for education and the authors emphasises having refresher workshops for NICU nurses, residents, and fellows (Kotari et al., 2016). In addition to issues of knowledge about pain and pain management, nurses seem to have casual attitudes towards the pain management of neonates, due to the mistaken fallacy that neonates cannot feel pain (Asadi-Noghabi, Tavassoli-Farahi, Yousefi & Sadeghi, 2014). Research indicates that nurses’ casual attitudes fuel the misconception that leads to patients continuously suffering from postoperative pain. This is exacerbated by the belief that it is nurses, and not patients, who are in control of the existence of patients’ pain (Asadi-Noghabi et al. 2014).

2.2 Broad definition and description of pain in neonates

Pain is described as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage “(Al-Quliti & Alamri, 2015). Pain is often best described in terms of self-reports with verbal communication as the gold standard for interpreting pain (Twycross, Voepel-Lewis, Vincent, Franck & Von Baeyer, 2015). As this is not possible in the neonatal population, it implies that neonates who lack verbal expression consequently lack the ability to experience and interpret pain (Fitzgerald, 2015). Neonates do, in fact, experience and interpret pain (Al-Quliti & Alamri, 2015). Furthermore, neonates may experience pain even more than older infants because the adaptive mechanisms that can modulate painful stimuli, extrauterine painful stimuli is

actively present at birth at 32 weeks and above (Asadi-Noghabi, Tavassoli-Farahi, Yousefi & Sadeghi, 2014; Khoza et al., 2014). Although neonates cannot verbalise their discomfort or express their pain, they reveal their vulnerability to pain and stress through behavioural and physiological changes, changes in cerebral blood flow, cellular and molecular changes in the pain processing pathways, and adverse clinical sequelae (Butkevich & Mikhailenko, 2016).

According to Marchant (2014) most people associate the word 'pain' with early life injury, implying that memory has a role to play. The beginning of declarative memory use is due to prefrontal cortex and hippocampal development at the age of 2 – 4 months old when they can store learned information (Asadi-Noghabi et al., 2014). There is evidence supporting the fact that early pain sensation is mediated sub cortically and is stronger than evidence for declarative pain memory in the neonate (Sousa, 2016). However, it is important to note that the development role of the cortex and its relationship with the sub cortex in pain function (and consciousness) is controversial (Tortora, Severino, Biase, Malova, Parodi, Minghetti & Ramenghi, 2019). The appearance of the pain function in the healthy foetus is present at above 24 weeks of gestation (Marchant, 2014).

Research has indicated that nociception, the initial sensation of pain, the spinal pathways that carry the chemical impulse, and the supra spinal mechanisms responsible for interpreting and modulating pain and stress as well as the physiological basis, allows the neurological system to identify and protect noxious and potentially damaging stimuli short- and long-term effects on the neonatal pain (Nimbalkar et al., 2014).

To understand how and when to treat the different types of pain and stress in the neonate, the nurse must be able to identify the physiological and behavioural response to pain and understand the long-term effect of pain on the neonates (Butkevich et al., 2016).

2.3 The Physiology of Pain in Neonates

The physiology of pain and stress in the neonatal population describes how pain and stress can lead to adverse neonatal outcomes (Williams & Lascelles, 2020). During the vulnerable neonatal period from birth onwards in which forced immobilisation, feeding tube insertion, heel prick and other such invasive procedures often take place, one would assume that pain sensitivity is greatest (Lake, 2013).

Up until the late 1980s, however, it was widely considered among clinicians that neonatal pain experience is non-existent due to the belief that neonates were undeveloped and incapable (Chetty et al. 2017). The 20th century appeared to be when clinicians are more concerned about foetal distress as reflected by the significant lack of studies from 1920 until 1980 investigating pain in the neonate, curare often being used as a surgical muscular paralysis agent up until 1985, making pain-related protest or movement impossible regardless of its existence (Ingraham, 2019). This dry spell in neonatal pain research was alleviated in 1980, with a study by (Vinall et.al., 2014) leading to the observation of pain-induced responses and death due to endocrine shock during neonatal surgery, emphasising the importance of anaesthesia. Convergence of human and animal study data has led to recent advances in the field of neonatal pain (Hartley, Miller & Gephart, 2015).

Despite many findings pointing towards unpleasant sensations being felt in the neonate on administration of noxious stimuli, conflicting experimental results (potentially due to the subjective nature of whether we think neonates feel pain, for example) still prevail in the discussion of neonatal pain (Marchant, 2014). The significant limitations of pain research, such as the inability of neonates to verbally vocalise whether they are in pain can often lead to contrasting ideas of pain management practices (Balda & Guinsburg, 2019). Neonates do

not verbalise pain; it is the responsibility of the nurses in NICU to identify the pain and plan a pain management intervention (Cruz, Gomes, Kirchner & Stumm, 2016). In addition, only non-invasive, medically essential methods of pain induction are permitted in humans, as per the ethical restrictions laid down by the International Association for the Study of Pain (2013).

Nonetheless, direct quantitative measurement of pain is also not possible on the neonates due to the lack of verbal communication, for example, a behavioural pain score can be high on one neonate for just a diaper change and be low to another for a procedural pain (Duff, Moultrie, van der Vaart, Goksan, Abos, Fitzgibbon & Slater, 2020). Objective indicators such as self-report (in adults) and facial expressions (in neonates such as brow bulge, crease and furrow) are heavily relied upon (Lake, 2013). Some physiological correlates, however, can often be indicative of the pain experience, such as respiratory distress, tachypnoea, tachycardia, and serum cortisol levels (Field, 2017). Modern breakthroughs such as non-invasive neuroimaging (specifically functional magnetic resonance imaging or MRI) have brought invaluable neural pain activities that can be detected in the neonates. This technology is vital for our further understanding of the intensity of pain, especially on the peripheral nervous system. However, verbal communication remains the best method to classify and manage pain (Duff & Moultrie, et al. 2020).

2.4 Peripheral Nervous System and pain

The anatomic pathways of the peripheral nervous system appear to be functional by third trimester although tracts in the spinal cord and brainstem may be variably myelinated, and the areas of pain processing are different from that in the mature central nervous system (CNS) (Cerritelli, Frasch, Antonelli, Viglione, Vecchi, Chiera & Manzotti, 2021). These fibres

differ from each other in their response to different types of tissue injury and in their thresholds and other physiologic properties (Cerritelli & Frasch, et al. 2021). The number and types of peripheral nociceptors is like adult numbers by 20 to 24 weeks' gestation in the human foetus, implying a greater density per area of skin (Sherrill, 2013). These are connected via peripheral nerve fibres, which consist of the myelinated A-fibre and unmyelinated C-fibres, with the developing spinal cord dorsal horn at that time (Yam, Loh, Tan, Khadijah Adam, Abdul Manan & Basir, 2018).

During development, the thickly myelinated A-fibres, which transmit light touch and proprioception in the adult, also appear to transmit noxious information to pain processing areas of the spinal cord (Samarkandi, 2018). Lack of myelination in the A delta or C-fibres or spinal cord tracts was proposed as an argument against pain perception in neonates, but even in adults, most pain impulses are carried, albeit slowly, via unmyelinated C-fibres. Incomplete myelination merely implies a slower conduction rate (Henessee, 2012).

Thus, the CNS of the developing foetus receives a repertoire of different information, depending on the type and intensity of the noxious stimulation of the Peripheral Nervous System (Cerritelli & Frasch, et al. 2021). These fibres are inactive during homeostasis and are only triggered by pain. This activity will send sensory impulses to the brain to detect pain and produce a physiological and or behavioural response to pain (Cerritelli, & Frasch et al., 2021).

2.5 The causes and consequences of pain in neonates

Changing levels of neural activity can alter the normal development of the CNS (Walker, 2019). As a result, there is increasing awareness of the need to not only reduce acute behavioural responses to neonatal pain, but also to protect from persistent sensitisation of

pain pathways and potential damaging effects of excess activity on brain development (Mooney-Leber, & Brummelte, 2017). Sucrose effectively reduces the acute behavioural response to painful procedures but does not reduce spinal reflex response or cortical activity or prevent hyperalgesia and therefore may not prevent adverse effects of repeated procedures (McPherson, Miller, El-Dib, Massaro, & Inder, 2020).

According to Visoiu (2022), neonatal surgery has been associated with alterations in future pain response. The procedure of neonatal circumcision without analgesia, increases the behavioural response to immunisation, and triggers pain response (Morris, Moreton, Bailis, Cox & Krieger, 2022) The increased use of pharmacological intervention during peri-post-operative pain management intervention was noted in infants who had also required surgery as neonates (Visoiu, 2022). Older children between the age of 8 – 12 years old, who previously underwent surgery as a neonate and those who were nursed in NICU, had a firm overreaction to painful stimulus than those children who were never in NICU nor had surgery as a neonate. (Walker, 2014).

According to Walker (2017), postnatal rodents allow evaluation of the effects of pain and injury at different age development of the mammalian (rodents). The results from the study have shown that changes in the responses to neonatal injury were dependent on age (Walker,2017). According to Walker (2017), long-term alterations existed in sensory functions of the neonates that were not evident in older ages. The study also investigated underlying mechanisms and modification by analgesia. The results showed that altering sensory input into the spinal cord within the neonatal phase is detrimental to the development of the excitatory and inhibitory synaptic function (Walker, 2017).

Another study of neonatal pain by Anderson & Patel (2018) used the plantar incision which is commonly used to investigate variations in acute and long-term consequences of neonatal injury from surgery (Anderson et.al. 2018) The findings showed that neonatal incision affects both excitatory and inhibitory synaptic function (Anderson et.al.2018). The incision also raised the microglial reactivity in the spine which leads to an elevated degree and longevity of hyperalgesia after an injury (Anderson et. al. 2018). These effects are moderated by the peripheral nerve block but there still exists a gap in knowledge on the potential existence of other analgesic interventions (Visoiu, 2022). Negative neurodevelopmental results after neonatal intensive care have been demonstrated in the literature. Studies have determined that lengthy exposure to procedural pain causes poor cognitive development, reduced white matter, impairs motor scores of growths, slows maturity of subcortical grey matter, and impairs corticospinal tract structure (Breivick, 2012). Furthermore, research in preterm birth and with surgical versus medical management of patent ductus arteriosus (PDA) and necrotising enterocolitis (NEC) found undesirable neurodevelopment (Weisz et al., 2017). Patients with high neonatal brain injury are usually excluded and the analyses are statistically employed to increase the validity and reliability of the results (Kothari et al, 2016).

There are various health effects on the neonates who experience pain. According to Lake (2013), the continued use of anaesthesia to numb procedural pain, leads to the alteration of the development of the pain threshold. This may affect the neurodevelopment of the neonates making them vulnerable to other disorders such as stress and anxiety (Chetty et al. 2017). This is exacerbated by the assertion that this is true with neonates who are exposed to prolonged periods of neonatal intensive care (Burke & Trang, 2017).

Other studies indicate that other effects include a decrease in the immune response; delayed weight gain; prolonged hospitalisation; impaired neonate-parent bonding; and development of psychosomatic conditions, such as hyperalgesia and allodynia which will result in delaying developmental milestones (Hartley, Miller & Gephart, 2015; American Academy of Pediatrics., 2016).

2.6 Pain management of neonates

It has been demonstrated that effective pain management presents positive patient outcomes, such as a decrease in length of stay in hospital; reduced incidences of infections; steady increase in the weight of a child; and adequate developmental milestones (American Academy of Paediatrics, 2016).

Multiple studies have observed pain-induced activation of the hypothalamic-pituitary-adrenal axis, immune system, and autonomic nervous system in both the pre-term and the full-term neonate (Ingraham, 2019). This often leads to a general increase in stress response mediators; their effects often being maintained beyond that which is normal, switched off prematurely or due to multiple irritations (Yam et al., 2018). Determining the specific effects of neonatal pain is challenging due to the multiple NICU stressors contributing to high 'allostatic load' (the cumulative stress upon the neonate) (Kahsay, 2017).

The neonatal nociceptive stress induces a persistent hypertensive response, eventually causing the developing brain to reset and increase its basal level (Gursul et al., 2019). In addition, handling an early maternal separation can also result in visceral and somatic hyperalgesia as found by (Melchior, Kuhn, & Poisbeau, 2022). Long-term structural effects of the neonatal pain experience have also been established. Neurotrophins are vital for the

development of sensory skin innervation, also controlling the survival and function of neurons both centrally and peripherally (Asadi-Noghabi et al, 2014).

One can therefore conclude that prevention of central nervous system damage caused by neonatal pain, can be enabled by hyperinnervation to reduce the effects of neonatal neurodevelopmental damage in NICU or through surgery (Schwaller & Fitzgerald, 2014).

The literature argues that anti-nociceptive structures may be underdeveloped at birth Marchant, (2014). A study found that there was a correlation between procedural invasive intervention and early neurodevelopment in preterm neonates (Tortora & Severino, et al. 2019). A similar study by Vinall & Grunau (2014) suggests that successful postnatal growth is dependent on the quantity of painful procedures encountered during early NICU, showing that brain maturation is affected by neonatal affliction, rather than the degree of prematurity at birth.

This section aimed to discuss some of the causes of pain on neonates and the evidence shows that preterm noxious stimuli exposure triggers the activation of affective, cognitive pain and sensory regions (Chetty et al 2017). Evidence shows increased sensitisation in neonates combined with a lack of habituation which indicates that pain may persistently increase the gain within pain pathways (Perry et al., 2018). Children start developing sensitivity to painful stimulus as early as 20 weeks gestation, this falsifies the hypothesis that neonates do not feel pain neonate do not feel pain (Perry et al., 2018).

2.7 Pharmaceutical management of pain in neonates

Effective neonatal pain management remains a controversial topic, despite major advances in pharmacological, physiological, and behavioural neonatal pain interventions within the last few decades (Ayede, 2020). Opioids are routinely used in the NICU, and their pharmacokinetics and pharmacodynamics in infants have been studied intensely. Morphine is often used in NICU on mechanically ventilated neonates and other invasive procedural management; however, its analgesic efficacy is unclear (Hartley, Moultrie, Hoskin, Green, Monk, Bell & Slater, 2018)

In an assessment by Johnston (2020), the author's eligibility screening was 22 live premature neonates, born at 32 weeks gestation and below, who were between 12 to 48 hours old. These neonates were studied 30 and 60 min after a single administration of the opioid, fentanyl (3 mg/kg) or placebo, measuring the indication of ventilator associated physiological and behavioural pain and stress (Moultrie, Slater & Hartley, 2017). In the screening test the behavioural scales indicating pain indicated increased levels of hydrocortisone, lactate, and growth hormone before treatment (Marchant, 2014). Following fentanyl administration, the pulse decreases drastically (due to opioid enhancement of the vagal tone (Mallappallil, Sabu, Friedmann & Salifu. (2017) and growth hormone level increased, with behavioural postoperative comfort score increasing and neonatal facial coding system score decreasing. Even though the behavioural findings were purely qualitative, (assessed through bedside observation, video playback and still images) and that even premature neonatal handling has been shown to induce pain, these findings imply a decrease in non-acute pain-related responses after morphine administration (Chetty et al. 2017). Further studies have confirmed these results and contributed to falsifying the hypothesis that neonates do not feel pain (Marchant, 2014). Also observed a decrease in

pain-related response and insignificant differences in arterial blood gas levels after fentanyl administration. The above studies by Ayede (2020) indicate that neonatal opioid administration may not only decrease suffering that may potentially lead to long-term adverse effects, but also stabilises blood pressure, diverts energy sources to growth and has a beneficial effect on the clinical stability of critically ill preterm neonates.

To conclude, physiological, haemodynamic, and behavioural data both before analgesia and the alterations in pain-related response after analgesia indicate that neonates react to noxious stimuli, experiencing stress and displaying stereotypical pain-induced responses.

2.8 The knowledge, attitude, and practice of nurses in neonatal intensive care

Due to technological advances, the amount of painful and invasive procedures has increased, making the recognition, evaluation, and implementation of pain management in neonates indispensable in the maternity wards. Nurses have the duty of contributing to the improvement of the care to the neonate submitted to pain in NICU (Campos, 2018).

The knowledge of nursing staff regarding whether neonates experience pain has been changing with the recognition of pain by professionals in contrast with previous studies which showed that professionals believed that neonates did not have pain stimulus (Campos, 2018; Zewdie, Ciechanski, Kuo, Giuffre, Kahl, King, & Kirton., 2020). Despite these perception changes, nurses still experience barriers to use pain assessment tools to classify the intensity of the pain Khoza et al. (2014). Using pain scales are not being performed systematically, taking into consideration subjective criteria, without scientific basis (Shattnawi, 2017). Lastly, the lack of knowledge of pain assessment and pain management among nurses is a call for concern (Rababa, Al-Sabba, & Hayajneh, 2021).

Nurses do seek to relieve neonatal pain (Anand, 2017). In addition, nurses do attempt different approaches, such as a sugary pacifier, reducing the light and noise, and controlling the unit temperature, and asking the physician to prescribe sedatives or analgesics (Gallagher & Leppard, 2020).

2.9 Neonatal Pain Management by nurses

2.9.1 Factors influencing pain management – knowledge.

Research indicates that nurses primarily rely on their personal knowledge for the assessment of pain in neonates. (Nimbalkar, et al. 2014). The knowledge deficiency of nurses towards neonatal pain management in NICU is common (Cong et al., 2014).

The limited knowledge and the negative or casual attitudes often lead to poor practices by nurses, which exacerbates instead of manages the pain of neonates (Samarkandi, 2018) Research indicates that while there is a practice of not using sedation in NICU procedures, they are painful when administered; an implication of lack of knowledge that exhibits poor pain management practices (Kothari et al., 2016). Nurses with appropriate qualifications and a couple of years' experience may exhibit better practices with regard to the management of pain (Asadi-Noghabi, Tavassoli-Farahi, Yousefi & Sadeghi. 2014). This is further confirmed by another study, which showed that the physicians and the nurses did not have adequate knowledge to assess and survey pain level or how to use pharmacological and non-pharmacological interventions for neonates (Cong et al., 2014). However, a low proportion of respondents acknowledged the difference in long-term effects between neonates and older children. Less experienced doctors were especially unaware of these differences (Cong et al., 2014).

2.9.2 Factors contributing to poor knowledge of pain management.

To be able to identify the behavioural and physiological reaction to pain of the neonates, the nurse should first understand and believe that neonates do feel pain (Khoza et al 2014). Central to this study is the perception that efficient pain management of neonates is a controversial issue, despite of huge advances in pharmacological, physiological, and behavioural pain interventions of neonates in the last decades (Mehrnoush, Ashktorab, Heidarzaden & Momenzadeh, 2017). As such, where the results show that the nurses' knowledge and attitude are important in implementation of pain management programme, guidance for improvement of pain management, the document should be user-friendly and training courses to educate nurses should be mandatory (Cong et al., 2014).

Studies have shown that the lack of enough knowledge about pain management of nurses towards neonates in NICU is common (Cong et al., 2014). Moreover, other studies show that nurses did not have adequate knowledge to assess and survey pain levels or how to effectively manage neonatal pain (Muteteli, 2019). However, a study reported that, despite the clinical experience of nurses (>5 years) in NICU, they still lack the knowledge to effectively manage neonatal pain. This is a result because they (nurses) do not have any formal pain management education and training, and the unavailability of pain management protocol in the NICU (Muteteli et al. 2019; Khoza, et al.2014).

In addition, two studies in Egypt and Taiwan reported the feeble knowledge of nurses towards neonatal pain management in NICU that leads to a negative attitude which is a significant obstacle to effective pain management intervention of the neonates (Adam, Dabash, Hassan & Daihoum, 2019; Peng, Lee, Su, Lee, Chen, Chang & Huang,2021).

Adequate improvement of knowledge through education and training will improve practice and care (Peng et al., 2021).

Furthermore, (Peng et al., 2021) reported that there is a gap between the attitude and practice of nurses towards neonatal pain management. Nurses are knowledgeable and having the right attitude that neonates perceive pain, and neonates react physiological and behavioural to painful stimuli and nonpharmacological intervention, is necessary (Muteteli, 2019). Finally, neonates forget pain faster, pain management intervention is not necessary, pharmacological intervention is not required, are all indications of a negative attitude towards neonatal pain management enabling poor practices.

2.10 Consequences of poor pain management

There are various health effects on the neonates who experience pain. According to (Hartley, Miller & Gephart, 2015), neonates in intensive care with the continued use of procedures involving anaesthetics to numb the pain, leads to an altered development of the 'pain system associated with decreased pain thresholds during development. Other studies indicate additional effects, which include a decrease in the immune response; delayed weight gain; prolonged hospitalisation; impaired neonate-parent bonding; and development of psychosomatic conditions such as hyperalgesia and allodynia (Hartley, Miller & Gephart, 2015)

2.11 Conclusion

The earlier a neonate is subjected to pain, the greater the potential for harm as emphasised by structural study of clinical and experimental implications on procedural pain in the premature neonates (Williams & Lascelles, 2020).

These effects have proven the existence of neonatal pain and hence negates the hypothesis that neonates do not feel pain. However, while pain is stressful, it is questionable as to whether stress is related to pain and whether some results of pain assessment are pain specific. It is a reasonable assumption from previous studies that pain-related responses can partly be mediated through reflex pathways within the brainstem and spinal cord and that pain experience is possible on establishment of thalamocortical connections from gestational week 20.

However, a more likely explanation may be due to ambiguous results and techniques that make its existence slightly cloudier. Various noxious stimuli-induced inconsistencies emphasise the variability between individuals and the importance of repetitive single-subject analysis and sizeable study groups in pain research. Neonates with neurological lesions have typically been excluded from both pain-related studies of the premature and full term, possibly due to the vast inter-individual variation of lesions. Due to this, minimal knowledge of pain experience within these populations has been elucidated, this being a potential area for further neonatal pain research.

The logo of the University of the Western Cape, featuring a stylized building with columns and a pediment.

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Chapter 3

Methodology

3.1 Introduction

This chapter provides a description of the research methodology adopted for the study. This includes outlining the research design, study area, population, sampling procedure, research instruments, data collection, and data analysis. The chapter discusses the ethical issues and provides an overview of reliability, validity, and limitations of the study.

3.2 Research setting

Grove and Gray (2022) describe research setting as the environment in which a study will be conducted. The research setting for this study was the neonatal intensive care unit at the three tertiary hospitals in Western Cape. At Hospital 1, the upgraded neonatal unit can accommodate 80 babies, including provision for kangaroo mother care (KMC). Hospital 2 has 10 high care beds for neonatal babies and Hospital 3 has 74 neonatal beds. All three of the tertiary hospitals are in the Cape Town metropolitan region.

3.3 Research approach

This study uses a quantitative research approach to measure the demographic variables, knowledge, investigate practices and identify attitudes of pain management by the nurses towards neonatal critical care patients at three tertiary hospitals in the Western Cape. A quantitative descriptive approach is the process of collecting and analysing numerical data. It can be used to find patterns and averages, make predictions, test causal relationships, and generalise results to wider populations (Creswell & Creswell, 2017). Quantitative methodology makes use of techniques such as surveys and the administering of

questionnaires to collect data and procedures such as graphs, tables, or statistics to analyse the numerical data which has been generated (Quick & Hall, 2015). Quantitative research yields data, which is quantifiable, as opposed to the non-numerical data which is generated by qualitative research (Streefkerk, 2022).

3.4 Research design

A research design is a complete outline of the steps that must be followed to implement a research project. Creswell et al., (2017) posits that research design provides a detailed technique of how data will be collected, interpreted, and analysed. A research design must be appropriate and sufficiently answer the research questions (Creswell et al., 2017). In this study, a survey design was applied using a self-administered questionnaire.

3.5 Population and sample

A research population is a collection of all the individual people or other units such as families, health institutions, videos, textbooks from which data can be collected (Burns & Grove, 2012). A population refers to people with characteristics relevant to study (Creswell et al., 2017). In this study, the population was nurses from three tertiary hospitals in Western Cape who were working in neonatal Intensive Care Unit (NICU) (N=121) at the time of the study. Sampling therefore refers to a group that forms part of a larger population to offer clarity to the study in terms of data collection (Rubin & Babbie, 2011). The sample size refers to the number or quantity of persons who will be representative of the population, and take part in the study (Creswell et al., 2017). All-inclusive sampling was used of all the nurses (n=212) working in NICU who are eligible to administered medication according to their scope of practice by South African nursing council. A total of n=121 nurses were approached using a self-administered questionnaire. The respondents' rates were 100%.

3.6 Instrument

The questionnaire was formulated based on the objectives, aim and problem of the study and was a replica of the questionnaire of Sizakele Khoza. Khoza et al, 2014) (Appendix H) who gave permission for the researcher to adapt her questionnaire. Dr Khoza adapted her questionnaire from a study they conducted on Pain and Pain Management in Newborn babies (1997), last published in *America Academy of Paediatrics* in 2013 (Porter, Wolf, Gold, Lotsoff & Miller, 1997).

3.6.1. Validity of research instrument

According to (Maree K.,2016), Validity is the extent to which the research instrument is measures to cover all areas of the research findings. (p.239). Face validity was conducted to ensure that the technicalities of the items in the questionnaire were appropriate to the study, and the content validity of the instrument was checked to confirm their specification for comprehensives (Maree, 2016). Face validity was established in the Khoza study. Khoza et al, (2014). In addition, the questionnaire was reviewed by my co-supervisor (supervisor and midwifery expert). Content validity is set out in the Table 2 below.

Table 2: Content validity and internal consistency

Objective section B-D	Questionnaire
To measure the knowledge, of nurses on pain management of neonates	Section B: Question 1-4
To identify the attitudes of nurses on pain management of neonates	Section C: Question 5-10
To investigate the practice of nurses on pain management of neonates	Section D: Question 11-13
General overview and self-evaluation	Section E: Question 14-18

3.6.2 Reliability of research instrument

Reliability is concerned with the consistency, accuracy, and predictability of the results. (Maree, K. 2016). A pre-test method was used to test reliability of the data collectively by giving the questionnaire to five (5) Advanced Midwifery students to check the questionnaire, describing the different section in the questionnaire. Pre-test data were excluded. Cronbach's alphas were calculated for the different sections in the questionnaire, the internal consistency of the measurement instruments used in a study was measured with $\alpha=.929$ for knowledge, $\alpha=.786$ for practices and $\alpha=.857$ for attitudes.

3.7 Data analysis

Statistical Package for the Social Sciences (SPSS 27.0) was used to analyse the gathered data which reflect the data as graphical representations (Pallant, 2013). Frequency tables and measures of central tendency were used as descriptive to complement the accuracy and efficiency of data processing.

3.8 Ethical considerations

The researcher obtained permission from the Biomedical Research Ethics Committee of the University of the Western Cape (Appendix A), the Western Cape Department of Health (Appendix E) and the Human Research Ethics Committee (Appendix F). Subsequently, the researcher also gained permission from the various hospitals and operational managers before conducting the study. A self-administered questionnaire (Appendix G) was distributed to respondents to answer the questions during their breaks (tea or lunch) so that it would not interfere with their work considering their busy schedule during working hours.

3.8.1 Informed consent and permission

The researcher offered as much information as possible about the study to avert instances of viewing the research process with suspicion, and practices against the research ethics standard operating procedure (Williams, Willging, Quintero, Kalishman, Sussman & Freeman, 2010). Considering the highlighted ethical dimensions that require the researcher to maintain both moral and professional obligations, the researcher was guided by ethics even when the respondents were unaware of the same (Neuman, 2011). The first step was to get official permission hence the letters of request (Appendix D), a copy of the questionnaire (Appendix G) and the approved research proposal were sent to the hospitals by email, to try to obtain the hospitals' consent before the questionnaire was to be distributed.

The aims of the study, the benefits from their participation, the responsibilities and obligations of the researcher were explained to the respondents (using the information sheet Appendix B). A consent form (Appendix C) was provided which the respondents read and signed to signify their willingness to participate in the study. The participants were informed that their participation is voluntary and that they have the liberty to withdraw at any moment during the investigation. The respondents were provided with the contact details of the researcher, the supervisor, and the course coordinator, whom they were free to contact in case of any concerns, complaints, or feedback.

3.8.2 Respect, confidentiality, and protection of personal information

To ensure respect, respondents' identities were kept anonymous. The use of confidentiality and anonymity was to ensure respect for the potential participants. During the actual data collection, the researcher was extra mindful and sensitive to every word spoken. The

researcher also ensured truth, honesty, and respect for the respondents' morals throughout the research process for the purpose of integrity in the research.

The respondents were informed that the data obtained (questionnaires) would be kept in a safe and secure place to maintain confidentiality. Where the respondents needed assistance, possible referrals would be made, with the help of the Faculty of Community and Health Sciences at the University of the Western Cape.

3.8.3 Beneficence and protection from harm

To ensure the safety and well-being of the respondents during the data collection process, the researcher took all necessary measures which include close monitoring of respondents, providing a comfortable and well-ventilated environment with proper seating arrangements, and strict adherence to safety protocols such as wet floor signs. The researcher prioritized the respondents' safety and comfort throughout. (Creswell et al., 2017). This was greatly emphasised in the use of ethical clearance, confidentiality, anonymity, among other measures. The potential benefit of the study was also explained to the respondents.

3.9 Conclusion

In this chapter, the researcher outlined the research methodology that was utilised. The research design was discussed which was purely quantitative. In addition, the study area, sampling procedure, research instruments, data collection techniques and how data would be analysed were also discussed. This included highlighting the ethical issues that were taken into consideration. The challenges that were encountered in the study were discussed. In the following chapter, the researcher will provide a discussion on the findings of the study.

Chapter 4

Presentation of Results

4.1 Introduction

The previous chapter discussed the research methodology for this study, the process of data gathering, issues of reliability and validity and how these issues have been addressed in this data analysis. This chapter discusses the findings of the study based on the study objectives.

The objectives were:

1. To measure the knowledge of nurses on pain management of neonates.
2. To investigate the practice of nurses on pain management of neonates; and
3. To identify the attitudes of nurses on pain management of neonates.

4.2 Demographic information

This study included 121 respondents from three tertiary hospitals (Hospital 1 n=59, Hospital 2: n=30 and Hospital 3; n=32). Of these 121, 106 respondents were female (87.6%) and 15 male (12.4%) (Table 3). The mean age of respondents was 38.7 years (sd=9.96). Nearly two thirds of the respondents were registered nurses 76 (63.9%), with 48 respondents working in the ICU ward/unit (39.7%), and 32 reported that they had obtained a postgraduate diploma/degree (26.7%) (Table 3). Ten 10(29.4%) respondents reported a low-level experience (0-2 years), however, 41 (34.5 %) reported a high level of experience having worked for ten (10) years and above. More than half were neonatal experienced nurses 56 (55.4%) (Table 4.1). Only sixteen 16 (15.8%) were specialised (Neonatal).

Table 3: Demographics (n=121)

	Variable	F	(%)
Gender:	Male	15	12.4
	Female	106	87.6
Age	m=38.7, sd=9.96		
Ward/unit:	High care	44	36.4
	ICU	48	39.7
	Both	29	24.0
Category:	Enrolled nurse	43	36.1
	Registered nurse	76	63.9
Highest level of education	Grade 12	20	16.7
	Certificate	20	16.7
	Diploma	24	20.0
	Degree	24	20.0
	Postgraduate Diploma	32	26.7
Years of experience:	0 – 2 years (low level experience)	35	29.4
	3 – 9 years (medium level experience)	43	36.1
	< 10 years (high level experience)	41	34.5
Type of experience:	Neonatal experienced nurse	56	55.4
	Neonatal trained (ICU)	16	15.8
	All of the above	12	11.9
	None of the above	17	16.8

4.3 Knowledge of pain management of neonates

Knowledge was assessed through asking about exposure to pain management, and definitions of neonatal pain and awareness of the need for pain management for different procedures.

4.3.1 Exposure to pain management

When asked if they were aware that the ward had pain management guidelines, nearly a third of the respondents reported that they had knowledge of the availability of pain management guidelines in the ward (73, 61.9%) (Table 4). However, a few of the respondents were unsure whether pain management guidelines were accessible in the ward (18, 15.3%). More than three quarters (92,76.7%) of the respondents had experienced pain-related procedure in their lifetime.

Table 4: Exposure to pain management (n=119)

Exposure	Yes (%)	No (%)	Unsure (%)
Is there a pain management guideline in the ward? (n=118)	73 (61.9)	27 (22.9)	18 (15.3)
Have you experienced a pain-related procedure in your lifetime? (n=120)	92 (76.7)	28 (23.3)	-

Regarding how the respondents acquired knowledge on pain management, and their understanding of neonatal pain, 31(25.6%) of the respondents indicated that they acquired knowledge of pain management from training, 15 (12.4%), 11(9.1%), and 17 (14.0%) acquired their knowledge from health workers, books, and patient reaction to pain, respectively. Nearly a quarter of the respondents 26 (21.5%) indicated having acquired the knowledge of all the above methods. (Table 5).

Table 5: Access to knowledge on pain management (n=110)

Sources of knowledge	Frequency	(%)
Training (s)	31	25.6
All of the above	26	21.5
Patient reaction to pain	17	14.0
Health workers	15	12.4
Books	11	9.1
None of the above	10	8.3

4.3.2 Definitions of pain management

In assessing the respondents' knowledge of definitions of neonatal pain were checked. Less than half (58, 48.3%) of the respondents specifically understood neonatal pain to be both a behavioural and physiological response to painful stimuli (Table 4.4), with 51(42.5%) indicating it to be a physiological reaction to pain, or behavioural response to painful stimulus, and or both behavioural and physiological response to painful stimuli. Taking both

these options as correct, 109 (90.8%) of the respondents understood the concept of neonatal pain (Table 6).

Table 6: Understanding of neonatal pain (n=120)

Definitions	Frequency	(%)
As both behavioural and physiological response to painful stimuli.	58	48.3
As a behavioural reaction to painful stimulus	7	5.8
As a physiological reaction to pain	4	3.3
All of the above	51	42.5

4.3.3 Knowledge of pain relief for different procedures

In assessing the knowledge of pharmacological pain relief for different procedures, all relevant procedures were listed, and respondents were asked to rate whether pain relief should be provided during these procedures. Indicating “yes” was coded as knowledgeable, “no” as misinformation and unsure or missing as lack of information. The procedures the respondents were most knowledgeable about were lumbar puncture 108, (90.0%), insertion of intercostal drain 107 (89.9%) and intestinal perforation 103 (85.8%) (Table 4.5).

The highest levels of misinformation were for insertion of a feeding tube 84 (69.4%) chest physiotherapy (75, 62%) and endotracheal suction 57(47.1%) (Table 4.5).

The areas in which most of the respondents lacked knowledge: Endotracheal Intubation 49 (40.5%) Insertion of Umbilical Venous Catheter (UVC) 37(30.6%); and Insertion of Umbilical Arterial Catheter (UAC) 39 (32.3%) (Table 7).

Table 7: Knowledge of pharmacological pain management (n=121)

Procedures	Knowledge	Misinformation	Lack of Knowledge
Lumbar Puncture	108 (90.0)	8 (6.6)	5 (4.1)
Insertion of intercostal (chest) drain	107(88.4)	8(6.6)	6(5.0)
Intestinal perforation	103 (85.1)	12 (9.9)	6(5.0)
Insertion of arterial line	86 (71.1)	29 (24.0)	6 (5.0)
Insertion of IV lines	80 (66.1)	38 (31,4)	3 (2.5)
Endotracheal Intubation	68 (56.2)	4 (5.3)	49 (40.5)
Insertion of Umbilical Venous Catheter (UVC)	66 (54.4)	18 (14.9)	37 (30.6)
Insertion of Umbilical Arterial Catheter (UAC)	65 (53.7)	17 (14.0)	39 (32.3)
Insertion of urinary catheter	51(42.1)	62(51.2)	8(6.6)
Blood sampling	50(41.3)	62(51.2)	9(7.5)
Endotracheal suction	48 (39.7)	57 (47.1)	16 (13.3)
Chest physiotherapy	34 (28.1)	75 (62.0)	11(9.9)
Insertion of a feeding tube	23(19)	84(69.4)	14(11.6)

4.4 Attitudes of respondents on pain management of neonate

Attitudes of respondents were measured using a question on whether they perceived that neonates perceive pain. Most of the 105 of the respondents (88.2%) indicated that neonates do perceive pain, with 13(10.9%) being unsure and only one (1) respondent indicating “no”. Out of the 105 respondents who indicated “yes”, 34(28.1%) indicated that neonates always perceive pain, 65(53.7%) indicated that neonates perceive pain sometimes, and two (2, 1.7%) indicated that neonates perceive pain rarely, and 20 (16.5%) did not answer the question. In addition, several attitudinal statements on pain perception were asked and rated out of a scale of 4 (Table 8).

Table 8: Attitudes on pain management of neonates (n=119)

Item	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	Mean (sd)
There is a need for staff training courses on neonatal pain management implementation (n=120)	12 (9.9)	1 (0.8)	3 (2.5)	40 (33.1)	64 (52.9)	3.19 (1.21)
Neonates experience more pain than adults. (n=121)	14 (11.6)	26 (21.5)	29 (24.0)	39 (32.2)	13 (10.7)	2.09 (1.20)
Neonates forget pain faster than adults (n=115)	14 (11.6)	20 (16.5)	10 (8.3)	57 (47.1)	14 (11.6)	2.32 (1.25)
Neonates' perception of pain is less than that of adults (n=121)	32 (26.4)	40 (33.1)	13 (10.7)	23 (19.0)	13 (10.7)	1.55 (1.34)

Looking at the positive statements, the statement with the highest rating was *The need for staff training courses on neonatal pain management implementation* (3.19, sd 1.21) with the majority of the respondents (64(52.9%) strongly agree and 40(33.1%) agree) agreeing with the statement. This was followed by the statement *Neonates experience pain more than adults* (2.09, sd 1.2), with a third of the respondents agreeing with this statement (39 , 32.2%) and 13 (10.7%) strongly agreeing (Table 8).

In terms of the negative statements on attitude of neonatal pain, the statement that *Neonates forget pain faster than adults*, was rated the highest with 57(47.1%) of respondents agreeing and 14(11.6%) strongly agreeing. The lowest rated statement overall was for neonates' *Perception of pain is less than that of adults* with less than a third of the respondents agreeing with this statement 23 (19.0%) agree and 13 (10.7%) strongly agreeing (Table 8).

4.4 Practice of nurses on pain management of neonates

Practice of pain management was measured using the following items, namely, identification of most painful procedures; identifying pharmacological and non-pharmacological pain relief practices for procedures in neonates; and a self-evaluation of their pain management practices.

4.4.1 Identification of most painful procedures

Lumbar puncture 31(25.6%), followed by insertion of intercostal drain/chest-drain 22 (18.1%) were identified as the most painful management procedures on neonates in NICU. However, a few respondents only thought blood sampling 6 (4.9%) and insertion of arterial line 4(3,3%), would be the most painful management procedures on babies in NICU. Only one (1) (0.8%) respondent was of the view that the insertion of an umbilical venous catheter would be the most painful management procedure on babies in NICU (Table 9).

Table 9: Identification of painful procedures in NICU (n=100)

Procedures	Frequency (%)	
Lumbar puncture	31	25.6
Insertion of intercostal drain/chest-drain	22	18.1
Insertion of IV lines	19	15.7
Endotracheal intubation	17	14.0
Blood sampling	6	4.9
Insertion of arterial line	4	3.3
Insertion of umbilical venous catheter	1	0.8

4.4.2 Pharmacological pain relief practices

The highest rated practice was sedation 34(28.1%), followed by the administration of Paracetamol 32(26.4%) in managing pain during painful procedures. Only a few respondents used quick in and out i.e., to touch the patient very briefly and quickly during a procedure to minimise pain without sedation or any form of analgesics 5(4.1%) as a pharmacological pain relief measure during painful procedures (Table 9).

4.4.3 Non-pharmacological pain relief practices

The highest rated non-pharmacological procedure was using comfort (dry & warm) 23(1%), positioning 20(7%), and soothing (pacifier/dummy) 24(19.8) as the nonpharmacological methods. in managing pain in neonates. Only a few of them use quick in and out 5(4.1%) as a non-pharmacological pain relief measure during painful procedures as displayed on Table 10.

Table 10: Respondents' pharmacological and non-pharmacological methods adopted in pain management in neonates (n=121)

Item		Frequency	(%)
What is the pharmacological pain relief practice do you use during painful procedures?	Sedation	34	28.1
	Paracetamol	32	26.4
	Administration of local anaesthesia	18	14.9
	Opioid Analgesic	18	14.9
	EMLA cream	14	11.6
What are the non-pharmacological methods do you use to manage pain in neonates?	Comfort (dry and warm)	28	23.1
	Positioning	25	20.7
	Soothing (pacifier/dummy)	24	19.8
	Touch	19	15.7
	Relaxation (reduce noise and dim light)	19	15.7
	Restrain	6	5.0
	Quick in and out	5	4.1

4.4.4 Respondents' self-evaluation of practices

Respondents were asked to rate the reason(s) out of a score of 4 for not practicing neonatal pain management adequately (Table 11).

Table 11: Nurses' self-evaluation of their pain management practices (n=120)

Item	Strongly agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly disagree (%)	Mean (sd)
Lack of knowledge cause me not to practice Neonatal Pain Management (n=121)	22(18.2)	30(24.8)	15(12.4)	34(28.1)	20(16.5)	2.0(1.39)
Workload causes me not to practice Neonatal Pain Management (n=118)	16(18.2)	28(23.1)	20(16.5)	34 (28.1)	20(16.5)	1.83(1.34)
Personal experiences cause me not to practice Neonatal Pain Management (n=121)	10(8.3)	13(10.7)	13(10.7)	53(43.8)	32(26.4)	1.30(1.21)
Attitude towards infants cause me not to practice Neonatal Pain Management (n=119)	5(4.1)	13(10.7)	8(6.6)	55(45.5)	38(31.4)	1.09(1.10)
Professional experience causes me not to practice Neonatal Pain Management (n=121)	5(4.1)	9(7.4)	14(11.6)	54(44.6)	39(32.2)	1.07(1.05)

The highest rated reason was *Lack of knowledge* (2.0, sd 1.39), with 30 (24.8%) agreeing and 22(18.2%) strongly agreeing with this statement. This was followed by *Workload* (1.83 sd 1.34) with 28 (23.1%) agreeing and 16 (18.2%) strongly agreeing with this statement

(Table 4.9). The lowest rated reason was *Professional experience* 1.07 (1.05) with only 9 (7.4%) agreeing and 5 (4.1%) strongly agreeing with this statement (Table 11).

4.5 Conclusion

This chapter discussed the findings of the study addressing the objectives outlined in Chapter One. The respondents do not have a structured formal learning platform to acquire knowledge and skills of pain management intervention in NICU. Despite the fact that the respondents were aware of neonates' physiological and behavioural response to pain, and also the availability of pain management guidelines in the ward, they did not use it to manage the pain. It appears that the nurses tend to rely on their personal knowledge of pain management rather than following the available pain management guidelines. Also, the attitude of nurses towards pain management of the neonates has significant influence on pain management practices in the three NICUs in setting. The respondents are aware neonates perceive pain. Even though most of the respondents agreed that neonates perceive pain, they further agreed that neonates forget pain faster than adults. As a result, pain management is often neglected. Finally, pain management practices in NICU are influenced by the lack of knowledge as more than (80%) indicated the need for staff training on neonatal pain management and the attitude (mindset) of the respondents.

CHAPTER 5

Discussion of Research Findings.

5.1 Introduction

This chapter provides the discussion and interpretation of the findings related to the literature response to the objectives of the study. The study was conducted by administering a questionnaire to nurses working in NICU in three tertiary hospitals in the Western Cape.

This chapter addresses the objectives of the study:

1. To measure the knowledge of nurses on pain management of neonates.
2. To investigate the practice of nurses on pain management of neonates
3. To identify the attitudes of nurses on pain management of neonates.

The first part of the chapter discusses the knowledge of nurses towards pain management on the neonates. The second part of the chapter discusses the findings on the practices of nurses towards pain management of neonates, and the third part discusses the attitudes of nurses towards pain management of neonates. Lastly, the factors affecting the adequate management of neonatal pain management are discussed.

5.2 Knowledge of nurses on pain management of neonates

Nurses working with neonates require knowledge to improve their practices and hence change their attitude towards neonatal pain management (Khoza et al., 2014). Knowledge was assessed, through exposure to pain management procedures and training; secondly, through understanding the complexity of the nature of neonatal pain; and thirdly, by

assessing whether nurses were knowledgeable about pain associated with procedures in NICU.

5.2.1. Exposure to pain management

The first criterion to examine in measuring knowledge is prior exposure to pain management through understanding of current pain management guidelines in their work settings, as well as knowledge development through exposure to pain in their work environment and pain management training.

5.2.1.1 Pain management guidelines

Guidelines play an important part in the appropriate management of pain in neonates with reports that, for example, the availability and the practical use of written pain management guidelines had improved the management of procedural pain and decreased use of fentanyl (Rana, Bellflower, Sahni, Kaplan, A, Owens, Arrindell & Dhanireddy, 2017). Nurses in South Africa are authorised and guided by SANC to follow their Scope of Practice as per the Nursing Act No 33 of 2005, R2598 amended on the 30th of November 1984. As such, it's vital for nurses who are responsible for neonates to manage painful procedures related with neonatal pain management guidelines (61.9% agreed to its availability in the ward) to monitor and evaluate the comforts of the neonates during and after painful clinical procedures, to improve patients' wellbeing.

This study demonstrated that nearly two thirds (61.9%) of the respondents were aware of the availability of pain management guidelines in the ward. This is contrary to the research findings of a similar study conducted by (Muteteli et al., 2019) in Kigali Rwanda, and ((Khoza, et al. 2014) in Gauteng, South Africa in which both researchers reported that majority of

their respondents (93.94%) and (64%), respectively were not aware of the availability of pain management guidelines in the neonatal wards.

5.2.1.2 Neonatal pain management acquisition of knowledge

As per (Khoza et al., 2014), knowledge is obtained in two ways - formally through academic preparation and informally through clinical experience. In this study, more than three quarters (76.7%) of respondents reported that they had experienced pain-related procedures in their lifetime. People who had previously experienced clinical procedural pain are more likely to fear any pain-induced procedures (Sahiner & Bal, 2016). Surprisingly, when asked how they learnt about neonatal pain management, only a quarter of the respondents reported that they had formal training. Most respondents reported that they acquired knowledge of neonatal pain management from neonates' reaction to pain (14.0%); through healthcare workers (12.4%), and self-directed learning (9.1%). This correlates with the findings of (Muteteli, et al., 2019) who reported the lack of formal training in nursing college and the in-service training at workplaces of neonatal nurses, and their belief that neonates forget pain faster, has impacted the lack of knowledge on neonatal pain management. When asked about training in neonatal pain management, most of the respondents 64(,86.6%) felt that there was a need for staff training courses on neonatal pain management implementation.

5.2.2 Complexity of pain management

In this study, in assessing their understanding of the complexity of pain, nearly all respondents (90%) in this study understood neonatal pain to be both behavioural and

physiological responses to painful stimuli, and more than three quarters (88.2%) of respondents were knowledgeable about neonatal pain. The findings were in line with the study conducted in four NICUs in Cairo, Egypt, in which more than half of the respondents strongly agreed that neonatal pain affected the behavioural and psychological status of the neonates, such as tachycardia, hypertension, respiratory distress, desaturation, tachypnoea, crying, restlessness, facial expression, and central and peripheral cyanosis (Adam et al., 2019; Hockenberry & Wilson, 2019).

5.2.3 Knowledge of pain-related to procedures in NICU

Nurses play a vital role in the neonates' pain assessment to maintain a balance between pain relief and adverse effects of analgesics, and they require continuous knowledge and training (Khoza, et al., 2014). This study assessed the specific knowledge of respondents related to their understanding of the pain associated with procedures conducted in NICUs. This study found high level of knowledge of the following most painful procedures: lumbar puncture; 90% agreed to pharmaceutical pain management procedure. Intercostal drain incision; 89,9% indicated to be painful and require analgesia. And necrotising Enterocolitis (intestinal perforation) 85.8% indicated this to be most painful and required pharmacological pain management intervention. The procedures with the highest levels of missing information were for the insertion of a feeding tube (69.4%), chest physiotherapy (62%), and endotracheal suctioning (47.1%). The procedures in which most of the respondents were unsure were: Endotracheal Intubation (40.5%), Insertion of Umbilical Arterial Catheter (UAC) (32.3%) and Insertion of Umbilical Venous Catheter (UVC) (30.6%). Based on the study findings and the researcher's observation, the respondents would be categorised as having moderate knowledge towards neonatal pain management procedure.

These findings contradicted study findings conducted in Taiwan indicating that the nurses had low level knowledge of neonatal pain management (Peng et al., 2021). A lack of knowledge is a barrier to holistic pain management of the neonate. A study conducted in four NICUs in Cairo Egypt, (Adam et al.,2019) found that more than 50% of the respondents agreed that lack of knowledge is a barrier to neonatal pain management. This is important as increased knowledge will lead to more effective pain management and may reduce the risk of neonates not being assessed and treated properly for their procedural pain (Costa, Silva, Peres, Duarte & Bueno, 2022).

5.3 Practice of nurses on pain management of neonates

One of the principal components required in NICU, is a very competent nurse who can identify pain and properly alleviate the pain (Stenkjaer, Pedersen, Hundrup & Weis, 2019). Nurses working in NICUs have a vital role to assess the pain score of the patient, managing the pain effectively and minimising discomfort (Tarjoman, Vasigh, Safari & Borji, 2019). In a study conducted by (Afifi, Abed, Elessi, Utt, Elblbessy, Obaid, & Abeid, 2019), the non-pharmacological pain management intervention has been found to be more effective when combined with pharmaceutical intervention.

The practices of nurses in the management of pain in neonates were assessed in three ways: their identification of painful procedures; the use of pharmaceutical for pain management; and the use of non-pharmaceutical management of pain.

5.3.1 Identification of painful procedures

In identifying the practices of respondents on pain associated with different procedures, most respondents indicated that the following procedures were painful and require pain relief: Lumbar puncture (90.0%); insertion of intercostal drain/chest-drain (88.4%); Intestinal perforation (85.1%); insertion of peripheral arterial line (71.1%); insertion of IV lines; UAC (53.7%) and UCV (54.4%). These findings are corroborated by the findings of Khoza et al.(2014) who reported that 93.9% of the respondents in their study, agreed chest drain to be the most painful procedural intervention followed by lumbar puncture (89%); and that insertion of arterial line (83%) are the most painful and invasive procedures. In addition, (Muteteli et al.,2019) reported that 92% of the respondents indicated that intercostal drain insertion (71%), lumbar puncture and the insertion of an arterial line (45.5%) were the most painful procedures on neonates receiving treatment in NICUs. Majority of the respondents indicated that insertion of IV lines (66.1%) and Endotracheal Intubation (56.1%) were less painful procedures in this study. This finding is also consistent with the findings of (Khoza et al., 2014) who reported that 76% of the respondents indicated that endotracheal intubation, followed by 72% who reported that insertion of IV lines were perceived to be moderately painful. Khoza further determined that 54% of the respondents reported that umbilical venous catheterisation (UVC) and umbilical arterial catheterisation (UAC) were classified as moderate pain; this report is in slight contradictions of this study finding whereby UAC insertion (76.8%) and UVC insertion (77.6%) were found to be the most painful management procedures in NICU (Khoza, et al., 2014).

Finally, majority of the respondents indicated that pharmacological pain relief should not be administered for the following procedures: insertion of feeding tube (73.0%), chest physiotherapy (63.6%), insertion of urinary catheter (52.5%), blood sampling (52.5%) and endotracheal suction (49.6%). This concurred with Muteteli et al. (2019) who reported

(48.5%) non-pharmacological pain relief for the insertion of nasogastric (feeding) tube, (43.9%) indicated non-pharmacological intervention required during urinary catheter insertion (Muteteli, Tengera & Gowan, 2019). Adding to the above findings, Khoza et al., (2014) reported (76.8%) agreed that feeding tube insertion and (62%) endotracheal suctioning does not require pharmacological intervention Khoza, et al. (2014).

5.3.2 Pharmaceutical management

The findings of this study demonstrate that the respondents generally practiced pharmacological pain management intervention in NICU, in accordance with the WHO Analgesic Guidelines of 2018 to ensure satisfactory management of mild and acute pain (World Health Organization, 2018). One of the key findings showed varied practices by the respondents with nearly a third (28.1%) reporting that they have administered sedation and a quarter (26.4%) that they had administered Paracetamol to manage pain during painful procedures. This corroborates with the international perspective whereby it was reported that majority of the respondents uses analgesia selectively for the following painful procedures: lumbar puncture (62%), intubation (82%), chest drain (80%), and catheterisation of PICC line (50%) (Muteteli et al., 2019).

Even though the Scope of Practice (SOP) of registered nurses prevents a nurse from authorising prescription (SANC Regulation 2418 of 1984), it is advised that a paediatrician should prescribe analgesia when necessary (PRN) so that it could be considered after the outcome of the pain score assessment (Muteteli, et al., 2019). The registered nurse, who administers the prescription, should assess efficacy, and monitor for adverse effects to promote neonatal welfare and response to treatment, to alleviate or minimise clinical

instability such as pyrexia, desaturation, and tachycardia (Muteteli, Tengera & Gowan, 2019).

5.3.3 Non-pharmaceutical management.

In the absence of a prescription for pain, the nurse can only control the pain with non-pharmacological pain therapies to decrease pain. A study conducted in South Africa reported that often, some of the nurses who are not quite sure of pain medication will opt for the non-pharmacological pain management intervention, as the use of analgesia requires a prescription from a paediatrician or neonatologist and the nurses may not be competent to safely administered analgesia to avoid overdose and minimise side effects (Muteteli, et al., 2019).

This study supported this with most of the respondents agreeing to the use of various non-pharmacological methods to minimise pain in the neonates. However, considering non-pharmaceutical pain management, varied practices were reported with about a quarter (23.1%) indicating that they use comfort (dry and warm), (20.7%) positioning, and (19.8%) soothing (pacifier/dummy). These findings are in line with the international perspective of Peng, et al. (2021), a similar study conducted in Taiwan NICUs reported that 66% agreed to soothing and 47% indicated comfort to be the most commonly use pain management intervention. The authors also added that non-pharmaceutical pain management practices have effectively reduced neonatal pain (Peng, et al., 2021). These practices were in accordance with (Adam et al., 2019) who in their study revealed that majority of the nurses (53.3%) indicated positioning and soothing to be the most suitable pain relief methods and also 48.3% reported massage to be the best nonpharmacological pain management intervention in NICUs (Adam et al, 2019.).

These practices of non-pharmaceutical pain management have proven to effectively decrease mild to moderate pain in neonates in NICUs (Adam et al., 2019; Mohamed, El-Bana, Mohamed & Abolwafa, 2019). Similarly, a Canadian study reported that 88% of the respondents suggested that kangaroo mother care (KMC) together with oral sucrose effectively relieved pain for neonates (Campbell-Yeo, Johnston, Benoit, Disher, Caddell, Vincer & Inglis, 2019).

Some factors can affect non-pharmaceutical management as a study by (Elessi et al., 2019) reported that, in research conducted in Palestine, the healthcare professionals preferred the pharmacological method of pain relief due to cultural intervention which explains the low knowledge of nursing comfort care in NICU (Elessi et al., 2019; Gai, Naser, Hanley, Peliowski, Hayes & Aoyama, 2020).

5.4 Attitudes of respondents on pain management of neonates.

Attitude in this context refers to the behaviour of nurses towards pain management of the neonates (Asadi-Noghabi et al., 2014). This study established that there is need for staff training courses on neonatal pain management implementation which majority of the respondents (64, 52.9%) strongly agreed and 40(33.1%) agreed with the statement. This is in line with the recommendations by (Adam et al., 2019; Peng, et al. 2021) who also found that 50% of the nurses had knowledge deficiency of pain management and recommended training. Also, nearly half (47.1%) of the respondents agreed that neonates forget pain faster than adults. This corroborates with the findings of (Muteteli et al, 2019) who reported that 80.3% of the respondents indicated that neonates, especially premature babies do not feel pain, and 92.4% indicated that since neonates do not remember painful experience, pain management intervention is not necessary (Muteteli, Tengera & Gowan, 2019). In

addition, they reported that although the respondents mentioned above indicated pharmacological management of invasive procedural pains, there were some respondents (87.9%) indicating that neonates are less responsive to pain than adults, so they should be given less analgesia than adults (Muteteli, Tengera & Gowan, 2019).

5.5 Factors influencing pain management practices.

The study concluded with an assessment on the factors that the respondents perceive to affect less than adequate pain management in NICUs. A knowledge deficiency can impact on the pain management practices in NICUs. The study found that a quarter (24.8%) of the respondents agree that the lack of knowledge causes them not to practice neonatal pain management. This is in line with (Adam et al., 2019) who reported that 46.7% of the respondents strongly agree that they lack the knowledge to identify the behavioural and physiological responses of pains, and their lack of knowledge of the use of pain assessment tools has influences the practices of pain management of the neonates. The study from Muteteli et al. (2019) also reported the majority (74.24%) lacked knowledge of neonatal pain management.

The second factor rated was workload with nearly a quarter of the respondents (23.1%) indicating that workload impacted on their ability to practice neonatal pain management. Again, this finding was in accordance with (Adam et al., 2019) in which it was reported that the majority (76.6%) of the respondents strongly agreed that lack of time and increase workload are major barriers to pain assessment and pain management practices in NICUs. In this study, professional experience and personal experience were not rated as hindrances to practice neonatal pain management in NICU, with nearly half of the respondents (43.8%) and (44.6%), respectively disagreed to it. This is in line with (Adam et al., 2019; Khoza et al.,

2014) with both studies highlighting that the more qualified and experienced the nurse is, the more the chances of him or her to provide comprehensive care, and adequate pain management controls.

5.6 Conclusion

This study determined that nurses had feeble knowledge of the availability and the use of neonatal pain assessment tools and displayed a negative attitude towards neonatal pain management. Respondents indicated that neonates feel less pain than adults, hence pain management intervention is not necessary. The limited use of pain management guidelines in the NICU has been a significant finding in this study. The lack of knowledge of formal training on neonatal pain management is affecting the practices in these NICUs. A total of 90% of the respondents were aware that neonatal pain is both physiological and behavioural, but they have never received any formal pain management training. Although respondents could identify pain by observing the patient, there will be limitation of practices by the unavailability of analgesia; either the prescription will be ready, but the medication is not available, or the doctor is not available to issue a prescription. This will eventually impact on the accuracy of pain management intervention of the neonates. The nurses caring for a sick baby already have a negative attitude that, neonates do not remember painful experiences, hence limiting implementation of pain management intervention. Also, there are several painful procedures which the respondents indicated that pain management intervention is necessary.

CHAPTER 6

Conclusion and Recommendations

6.1. Introduction

Chapter six presents the conclusion, recommendations, and limitations of the study. There has been significant progress in understanding neonatal pain over the past few decades and studies have indicated that neonates not only experience pain, but if the pain is not properly managed, it can impact the growth and developmental milestones of the neonates (McPherson, et al 2020).

This chapter summarises the study that was conducted to investigate the knowledge, attitudes and practices of nurses working in NICUs. The chapter discusses the limitations of the study and present recommendations for nursing practice, education, and future research.

6.2 Summary of key findings

The key findings of the study are provided in terms of the objectives of the study.

6.2.1 Exposure to pain management knowledge

Based on the research findings, knowledge has not been fully implemented in NICUs. Some NICUs do not have pain management guidelines, while others do but the neonatal nurses are not aware of the presence of pain management guidelines in the wards and have never used it. However, neonates and infants continue to undergo multiple painful procedural interventions in NICUs without adequate pain management (Walker, 2019).

6.2.2 To measure the knowledge of nurses on pain management of neonates.

The study findings revealed that 109 (90.8%) of respondents are knowledgeable that neonatal pain is both a behavioural and physiological response to painful stimuli. The respondents were also very knowledgeable of the use of pharmacological pain relief during the following procedures: lumbar puncture (90.0%), insertion of intercostal drain (89.9%) and intestinal perforation (85.8%). Most of the respondents (88.2%) indicated that neonates do perceive pain. Nearly a third (73, 61.9%) of the respondents were aware of the availability of pain management guidelines in the ward but they don't use it. More than three quarters (92, 76.7%) of the respondents had experienced pain-related procedure in their lifetime and finally, 74 (82.6%) have not had any formal pain management training course.

6.2.3 To investigate the practice of nurses on pain management of neonates.

The following practice procedures were identified as the most painful management procedures on neonates in NICU; lumbar puncture (31, 25.6%), and intercostal drain/chest-drain (22, 18.1%). The highest rated practice was sedation (34, 28.1%), followed by the administration of Paracetamol (32, 26.4%) in managing pain during painful procedures. The highest rated non-pharmacological procedure was using comfort (dry & warm) (28, 23.1%), positioning (25, 20.7%), and soothing (pacifier/dummy) (24, 19.8%). Several the respondents indicated that *Lack of knowledge* prohibited them not to practice neonatal pain management with (30, 24.8%) agreeing and (22, 18.2%) strongly agreeing with this.

6.2.4. To identify the attitudes of nurses on pain management of neonates.

The study found that most respondents 105(88.2%) believed that neonates do perceive pain. Among those respondents, 34(28.1%) believed that neonates always perceive pain, while 65(53.7%) believed that neonates sometimes perceive pain. Attitudinal statements on pain perception were also rated on a scale of 4.

6.3 Recommendations

6.3.1 Education

Recommendation 1: The development and offering of competency-based educational training on pain management guidelines and pain management procedures must be implemented in all neonatal and paediatric units to provide nurses with competent knowledge and skills regarding effective pain management of neonates. These guidelines should cover a broad range of topics, including pain assessment, pharmacological and non-pharmacological interventions, and the ethical considerations associated with neonatal pain management. By following these guidelines, nurses can provide the best pain management practices for neonates and ensure that they are treated with compassion and dignity.

Motivation: It is concerning that this study found low levels of training on pain management among respondents. The findings revealed that only 31 out of 121 respondents (25.6%) had received training on neonatal pain management. Additionally, 26 respondents (21.5%) reported informal training through colleagues, self-study, and patient reactions to pain. These results highlight the need for increased emphasis on pain management training for nurses. It is essential to ensure that the nurses should receive adequate training to provide appropriate pain relief to these vulnerable patients. This training should include education on the pharmacological and non-pharmacological methods of pain management, pain

assessment, pain monitoring and intervention. (Kothari et al., 2016). The development of evidence-based training and guidelines is crucial to ensure competent pain management of neonates. (Griffiths, Spence, Loughran-Fowlds, & Westrup.,2019).

Recommendation 2: Pain assessment tools should be included in midwifery training and should be a clinical competency criterion in the Objective structural clinical examination (OSCE).

Motivation: Peng et al., (2021) added that nurses' knowledge and attitude towards neonatal pain management can affect the quality of care and practices. Hence the study suggests that there is a need for continuing education to improve knowledge and empower neonatal nurses.

6.3.2. Practice

Recommendation 1: The development and implementation of standardised pain management guidelines for all three tertiary NICUs in the research setting in particular and Western Cape in general, for the consistency of routine assessment and intervention by all the neonatal nurses working in NICUs. To increase awareness of neonatal pain management, the ward should offer informal training opportunities for the nurses and emphasise on compulsory attendance.

Motivation: The study established a low level of awareness of pain management guidelines and use of guidelines in the wards. In addition, the lack of knowledge is a major barrier to pain management practices towards the neonates. By receiving proper training, nurses can become even more effective to put their patients first and ensure that their needs are being met (Kothari et al.,2016).

Recommendation 2: It is crucial for the nurses to advocate and ensuring the best possible outcomes for their patients. The study found that a few of the nurses combine both pharmacological and non-pharmacological pain management practices. Training to advocate for the patients' best interests during painful procedures and discomfort are vital to ensure a uniformly practice of the combine use of both pharmacological and non-pharmacological pain management. If this practice can be taught to all nurses, it has the potential to significantly improve nursing care and patient comforts.

Motivation: However, practice is sometimes limited with prescription. According to the SOP of a PN, a nurse cannot administer analgesia without prescription, so a non-pharmacological pain management practice will serve as immediate intervention improve minimise discomforts caused by pain while waiting for pharmacological prescription. Studies have proven that neonatal pain management interventions are more effective when pharmacological and non-pharmacological methods are combined (Afifi et al., 2019).

6.3.3. Research

Recommendation 1: Further research is needed to improve knowledge, and practices of nurses and the perception of nurses towards neonatal pain management.

6.4. Limitations of this research study

6.4.1. Data collection limitations

There were several issues which impacted on the data collection phase of the study. Firstly, data collection was done in the peak of the Covid-19 pandemic during level 3 lockdown restrictions. Movement in and out of the hospitals and NICUs were severely restricted. At the outset, the researcher experienced low response rates and a significant number of

incomplete questionnaires resulting in a delay of the data collection phase beyond our anticipated timeline. However, in due course, there were several calls from respondents who requested me to provide them with the questionnaires, which they were eager to complete. Ultimately, the outcome was a success. In addition, during the COVID period there were delayed ethics approvals from the Western Cape Government, Department of Health.

Secondly, there was a high level of staff shortages and full bedded wards to an extent that some of the special care neonates were moved to Pre-Kangaroo mother care and the special care beds were used for high care patients. Despite facing a challenge during data collection, the researcher is confident that the returned questionnaires accurately represent the thoughts and opinions of the respondents. Though there was a delay in the process, the researcher made every effort to ensure the data collected was of the highest quality.

6.4.2. Research limitations

The research setting was limited to only three tertiary NICUs in the Western Cape, and this may not represent all the hospitals in the Western Cape.

6.5. Summary

The study was a quantitative survey, with data collection from nurses working in three NICUs in Western Cape. The pain management intervention of neonates receiving treatment and care in NICU, and that neonate do not remember pain and/or forget pain faster than adults have been a cause of concern in the NICUs. On reflection, the researcher noticed that all the in-patients of paediatric and adult wards have analgesia PRN on their prescription chart meanwhile that is not the case with the neonates in NICU. This concern triggered the inspiration for this research study. Though majority of the respondents agrees

to pharmaceutical pain management intervention for acute and severe painful clinical procedure, they (respondents) also agreed to non-pharmaceutical pain management for moderate to mild clinical procedures. Nurses working in NICU should be aware and considerate that neonates go through extra-uterine adaptation and development while in NICU and they need effective pain management intervention to facilitate their growth and development.

The results of the findings reveal that the respondents are knowledgeable of neonatal pain but they lack the skills to practice pain management. Though the respondent's attitude towards neonatal pain management were negative, *such as neonates do not remember pain, neonates forget pain faster than adults*, they still indicated the need for a pain management training workshop to eradicate the barriers to effective pain management practices in NICUs. A pain management learning platform and the implementation of the use of the pain assessment tools will improve knowledge and change the attitude towards neonatal pain management.

6.6. Conclusion

The knowledge, practices, and attitudes of nurses towards neonatal pain management must be addressed through education to ensure holistic care for an effective pain management and the provision of pain management guidelines that are evidence based.

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APPENDICE

APPENDIX A: BIOMEDICAL RESEARCH ETHICS COMMITTEE



UNIVERSITY of the
WESTERN CAPE



03 June 2020

Ms RE Dielle
School of Nursing
Faculty of Community and Health Sciences

Ethics Reference Number: BM20/4/18

Project Title: The Knowledge Practices and Attitude of Nurses towards Pain Management of Neonates in the Western Cape.

Approval Period: 03 June 2020 – 03 June 2023

I hereby certify that the Biomedical Science Research Ethics Committee of the University of the Western Cape approved the scientific methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report annually by 30 November for the duration of the project.

Permission to conduct the study must be submitted to BMREC for record-keeping.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

Director: Research Development
University of the Western Cape
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FROM HOPE TO ACTION THROUGH KNOWLEDGE.

APPENDIX B: INFORMATION SHEET



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INFORMATION SHEET

Project Title: The Knowledge Practices and Attitude of Nurses towards Pain Management of Neonate in the Western Cape

What is this study about?

This is a research project being conducted by Rachel Epie Dielle at the University of the Western Cape. We are inviting you to participate in this research project because you are the advocates of the neonates receiving treatment under your care. The purpose of this research project is to collect data that described the pain management towards neonates in the intensive care. The information will be used to develop a written neonatal pain management guidelines and pain assessment tool

What will I be asked to do if I agree to participate?

You will be asked to fill in the Infant Pain Questionnaire during your tea or lunch break. The process will take ten minutes of your time to complete the questionnaire. Questionnaires will be handed out at the beginning of the shift to all staff on duty.

Would my participation in this study be kept confidential?

The researchers undertake to protect your identity and the nature of your contribution. To ensure your anonymity, please do not write your name on the questionnaire in other to protect your identity. To ensure your confidentiality, a sealed collection box left in the ward for the return of all questionnaires during the shift. The researcher will collect the box at the end of the shift.

If we write a report or article about this research project, your identity will be protected.

In accordance with legal requirements and/or professional standards, we will disclose to the appropriate individuals and/or authorities information that comes to our attention concerning child abuse or neglect or potential harm to you or others. In this event, we will inform you that we have to break confidentiality to fulfil our legal responsibility to report to the designated authorities.

What are the risks of this research?

All human interactions and talking about self or others carry some amount of risks. We will nevertheless minimise such risks and act promptly to assist you if you experience any discomfort, psychological or otherwise during the process of your participation in this study. Where necessary, an appropriate referral will be made to a suitable professional for further assistance or intervention.

What are the benefits of this research?

This research is not designed to help you personally but it will improve nursing care towards pain management. The results may help to develop pain management guidelines and pain assessment tool of neonates. We hope that, in the future, other people might benefit from this study through improved understanding of nurses towards pain management of neonates. When the pain of a neonate is properly managed, it will reduced hospitalization and facilitates psychosocial bonding.

Do I have to be in this research and may I stop participating at any time?

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify and the researcher will gladly accept your questionnaire even it is incomplete but you are not allowed to destroy or discard any questionnaire even if it is blank.

What if I have questions?

This research is being conducted by Rachel Epie Dielle of School of Nursing at the University of the Western Cape. If you have any questions about the research study itself, please contact Rachel Epie Dielle on whatsapp: 0817707215 or via e-mail: 2651314@uwc.ac.za

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

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This research has been approved by the University of the Western Cape's



APPENDIX C: CONSENT FORM



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CONSENT FORM

Title of Research Project: **The Knowledge Practices and Attitude of Nurses towards Pain Management of Neonates in the Western Cape**

The study has been described to me in language that I understand. My questions about the study have been answered. I understand what my participation will involve and I agree to participate of my own choice and free will. I understand that my identity will not be disclosed to anyone. I understand that I may withdraw from the study at any time without giving a reason and without fear of negative consequences or loss of benefits.

Participant's name.....
Participant's signature.....
Date.....



APPENDIX D: LETTER REQUESTING FACILITY PERMISSION TO CONDUCT A RESEARCH



UNIVERSITY OF THE WESTERN CAPE

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION
Research Office, New Arts Building, C-Block, Top Floor, Room 28
Tel:021959 4111, Email research/ethics@uwc.ac.za
Tel :021 959 9483 Email: 2651314@myuwc.ac.za
PERMISSION LETTER TO CONDUCT RESEARCH

To whom it may concern,

My name is Rachel Epie Dielle. I am a postgraduate student pursuing a Masters in Midwifery and Neonatology under the supervision of Professor J.Chipps at the University of Western Cape. My research focuses on *The Knowledge Practices and Attitude of Nurses towards Pain Management of Neonate in Western Cape*. I would like to seek permission from the western Cape Department of Health to conduct my study at the following health facilities: Grootte Schuur Hospital, Red Cross war memorial Children Hospital and Mowbray Maternity Hospital. In this research project, questionnaires will be used to collect data from the nurses, lasting about 10 minutes. The researcher will ensure that appropriate methods are used to secure informed consent by obtaining permission from the participants before participating in the research through written consent form that will be signed by the participants.

In addition, the following ethics consideration will be maintained: fair treatment of respondents, privacy, confidentiality and beneficence.

Your earliest response and approval to conduct this study will be highly appreciated.



UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee



Room G50- Old Main Building
Grootte Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-enquiries@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

06 October 2020

HREC REF: 530/2020

Ms Rachael Dielle
Department of Nursing
University of Western Cape
Email: - 2651314@myuct.ac.za

Dear Ms Dielle

PROJECT TITLE: THE KNOWLEDGE PRACTICES AND ATTITUDE OF NURSES TOWARDS PAIN MANAGEMENT OF NEONATES IN WESTERN CAPE - (MASTER'S IN NURSING - MS RACHEL DIELE)

Thank you for your response letter, addressing the issues raised by to the Faculty of Health Sciences Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19, dated 17 March 2020 & 06 July 2020.

Approval is granted for one year until the 30 October 2021.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

HREC/REF:530/2020sa

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938
NHREC-registration number: REC-210208-007

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2006), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.



HREC/REF:530/2020sa

APPENDIX G: QUESTIONNAIRE

QUESTIONNAIRE

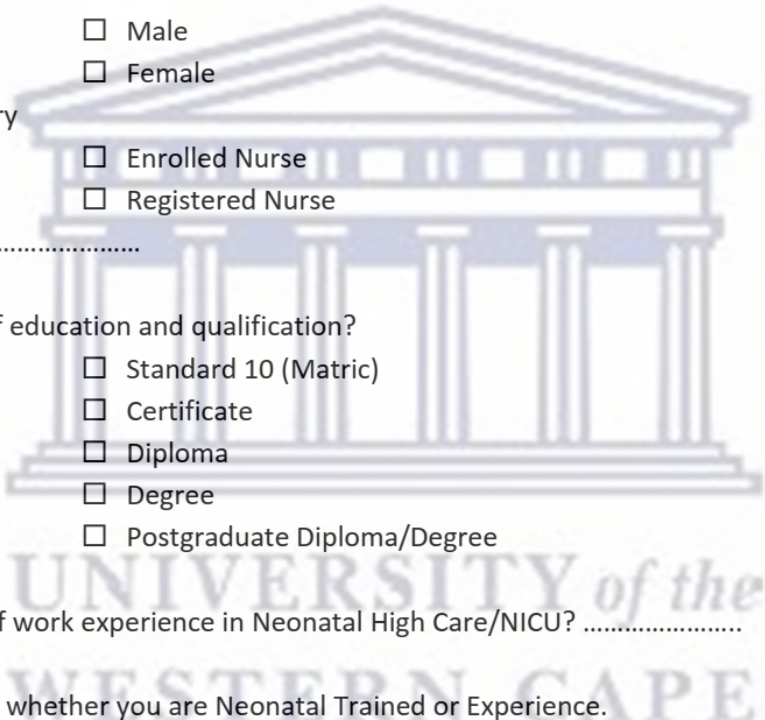
Thank you for accepting to participate in the research study titled:

THE KNOWLEDGE, PRACTICE AND ATTITUDE OF NURSES TOWARD PAIN MANAGEMENT OF NEONATES – By Rachel Epie Dielle.

Place a tick on the correct block

Section A:

Demographic Data

1. ward/Unit (Neonatal)
 - High Care
 - ICU
 - Both
 2. Gender
 - Male
 - Female
 3. Category
 - Enrolled Nurse
 - Registered Nurse
 4. Age.....
 5. Level of education and qualification?
 - Standard 10 (Matric)
 - Certificate
 - Diploma
 - Degree
 - Postgraduate Diploma/Degree
 6. Years of work experience in Neonatal High Care/NICU?
 7. Indicate whether you are Neonatal Trained or Experience.
 - Neonatal experienced Nurse
 - Neonatal trained (ICU)
 - None of the above
 - All of the above
- 

Section B:

Knowledge about Neonatal Pain Management (NPM)

1. Is there a pain management guideline in the ward?
 - Yes
 - No
 - Unsure

2. Where did you learn about neonatal pain management?
 - Colleagues/peers
 - Training (s)
 - Health workers.
 - Books
 - Patient reaction to pain
 - All of the above
 - None of the above

3. Have you experience a pain related procedure in your lifetime?
 - Yes
 - No

4. What is your understanding of neonatal pain?
 - As a physiological reaction to pain
 - As a non-specific behavioural response to a painful stimulus
 - As a behavioural response to painful stimulus
 - As both behavioural and physiological response to painful stimuli.
 - All of the above

Section C: Attitudes of Nurses on Pain Management of Neonates

5. Do you think infants perceive pain?
 - Yes
 - No
 - Unsure

6. If yes above, how often do they perceive pain?
 - Rarely
 - Sometimes

Always

Please rate the following questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
7. Infant perception of pain is less than that of adults					
8. Infants forget pain faster than adults					
9. Neonates experience more pain than adult.					
10. There is a need for staff training courses on neonatal pain management implementation					

Question 11.

Should pharmacological pain relieve be administered during the following Neonatal procedure? Please cross an X on the appropriate column

i. Endotracheal Intubation	YES	No	Unsure
ii. Endotracheal suction	Y	N	Unsure
iii. Insertion of Arterial line	Y	N	Unsure
iv. Insertion of IV lines	Y	N	Unsure
v. Lumber puncture	Y	N	Unsure
vi. Insertion of feeding tube	Y	N	Unsure
vii. Insertion of urinary catheter	Y	N	Unsure
viii. Insertion of intercostal drain	Y	N	Unsure
ix. Blood sampling	Y	N	Unsure
x. Chest Physiotherapy	Y	N	Unsure
xi. Intestinal perforation	Y	N	Unsure
xii. Insertion of Umbilical Arterial Catheter (UAC)	Y	N	Unsure
xiii. Insertion of Umbilical Venous Catheter	Y	N	Unsure

(UVC)			
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Section D: Practices of Nurses towards Pain management of Neonates

12. What are the pharmacological pain relieve practice do you use during painful procedures? *You can tick more than ones*

- Paracetamol
- Opioid Analgesic
- Quick in and out
- EMLA
- Administration of local Anaesthesia
- Sedation

13. What are the nonpharmacological methods do you use to manage pain in Neonates?

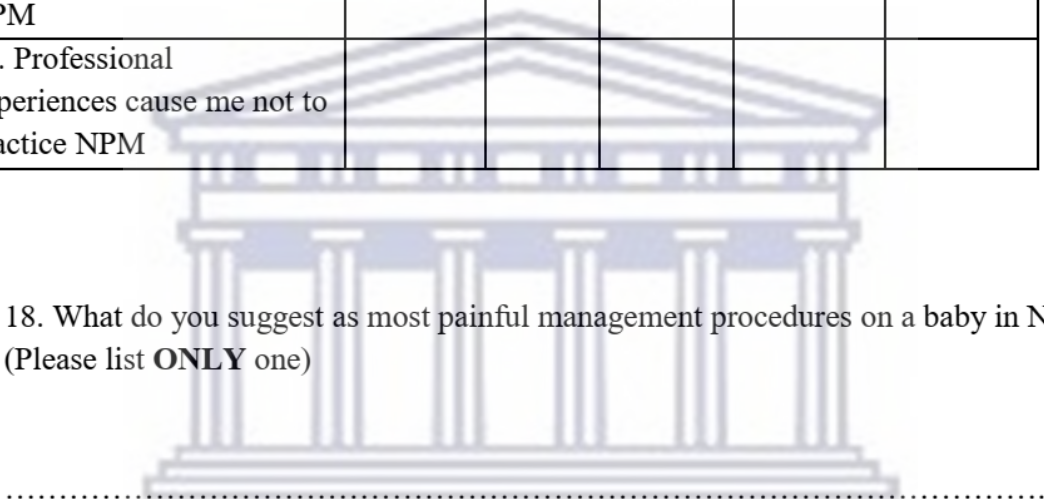
You can tick more than ones

- Touch
- Positioning
- Restrain
- Soothing (pacifier/dummy)
- Comfort (dry & warm)
- Relaxation (reduce noise & deem light)

Section E: Self evaluation

Please rate the following statements	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
13. Lack of knowledge cause me not to practice Neonatal Pain Management (NPM)					
14. Workload cause me not to practice NPM					
15. Attitude towards infants cause me not to practice NPM					
16. Personal experiences cause me not to practice NPM					
17. Professional experiences cause me not to practice NPM					

18. What do you suggest as most painful management procedures on a baby in NICU?
(Please list **ONLY** one)



UNIVERSITY of the
WESTERN CAPE

THANK YOU

JUN 24, 2019



Sizakele Khoza • 5:54 pm

Dear Rachel

Please accept my apology for not responding yesterday as indicated I had a very hectic beginning of week. I did not develop the instrument I adapted it from 2 studies mentioned in the article (Potter et al.). In terms of using the adapted instrument, I grant you permission.

Kind regards

Siza



APPENDIX I: TURNITIN



Rachel Dielle

Dielle Turnitin

23%

