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Nursing Assessment and Management of Pain in Infants

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Bachelor's Thesis
October, 2016

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Abstract

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Year 2016 Pages 38

Pain is an unpleasant sensory and emotional experience, even for infants who are incapable of reporting it verbally. Nurses are the medical professionals in the front line to witness the patient's suffering and pain, giving them greater responsibility to act upon their observations.

The purpose of this thesis is to obtain and describe information from current literature to determine how a nurse can assess and manage pain in infants. The aim is to increase the authors' knowledge on the subject and of those reading this review.

The research methodology followed is a literature review, with inductive qualitative data analysis. Four databases were searched for data retrieval. These included CINAHL, Laurea FINNA, SAGE journals and PUBMED, resulting in a total of 22 articles selected.

Our findings indicated that infant pain assessment tools can be broken down into either unidimensional or multidimensional. Unidimensional tools use a single indicator of pain assessment such as physiological or behavioral aspects. Multidimensional tools include both physiological and behavioral aspects. Research suggests that the most effective and accurate assessment tools are those which are unidimensional or behavioral in nature. More specifically, pain assessment tools using facial expressions as a determining factor of pain are most indicated for use on infants. Our findings also show that pain management in infants relies on a combination of pharmacological and non-pharmacological methods.

In conclusion, neonatal nurses must first prevent pain whenever possible, secondly, they must assess pain in their neonatal patients who cannot verbalize their experienced pain, and thirdly, they must provide relief or reduction of pain through the implementation of nonpharmacological and/or pharmacological measures. Lastly, they must assist the infant in coping when pain cannot be prevented.

Keywords: Infant, Pain Assessment Scale, Nurse Pain Assessment and Pain Management

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1 Introduction

Pain is something all human beings share. It is a part of the definition of the human condition (Vetlesen 2009, 7). Some would define pain within a strictly neuroanatomic and neurophysiologic framework, while others would tend to define pain as a complex set of emotional, environmental, social and psycho-physiological variables (Tollison 1989, 2). This definition however poses a problem when considering infants who are incapable of self-report and who may not have had previous experience with injury (Kenner & Lott 2013, 571).

Pain has enormous physiological implications to the human body, even in infants. For a very long time it was believed that children, especially babies, were incapeable of feeling pain. Misconceptions were many and popular (Twycross et al. 2009, 18). Regrettably, lack of treatment has allowed the persistence of unnecessary suffering in children, particularly in the most vulnerable population of infants (Schechter 2002, 16).

Moreover, pain assessment provides the foundation for all pain treatment (Kenner & Lott 2013, 571). This involves clinical judgment that provides information to help nurses make decisions and to choose the most appropriate intervention (Twycross 2009, 85). A number of observational or behavioral pain measures have been formulized and confirmed for use in infants and children (Twycross 2009, 94).

It is important to note that healthcare professionals, including nurses, are the ones responsible for the assessment, prevention and management of pain in infants (Twycross 2009, 9). To effectively reduce or eliminate infant pain, environmental, behavioral and pharmacological interventions can be utilized (Twycross 2009, 9).

2 Background

2.1 Pain Definition

According to Tollison (1989, 2), for surgeons, pain is a sensation that can be best described as a strictly neuroanatomic and neurophysiologic phenomenon. They might argue that anything that does not fall within these categories is not pain but a "psychiatric disorder". Tollison (1989, 2) goes on to say that psychologists and psychiatrists tend to define pain as something that is controlled by a complex set of emotional, environmental, social and psycho-physiological variables. There seems to be an imaginable neuro-physiologic continuum where the truth would lie somewhere in the middle (Tollison 1989, 2).

According to the International Association for the Study of Pain (IASP), pain is defined as "An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Twycross et al. 2009, 2). Unfortunately, this definition of pain simply leaves out too many cases where we are truly confident that the person is experiencing pain, despite our inability to locate the pain or identify the cause of the pain (Ebert et al. 2010, 459).

In addition, IASP also suggests that pain is a highly subjective and individual experience due to its emotional and unpleasant nature (Tyler, 1990). Tyler goes on to say that many people report pain in the absence of tissue damage, therefore it is important to accept their experience as pain, if they report it as such. However, this is problematic regarding infants who are incapable of reporting their own pain (Kenner & Lott 2013, 571).

2.2 Pain Classification

Pain can be classified within two main categories, nociceptive or neuropathic. Nociceptive pain derives from actual or threatened damage to body tissue. The pain is often described as sharp, aching or throbbing. If nociceptors are stimulated, pain arises from bones, joints, and muscles (Tyler, 1990). Neuropathic pain is pain caused by damage of neural tissue. The abnormal processing of nerve impulses is caused by a lesion or dysfunction within the nervous system. Neuropathic pain is often described as a burning sensation or numbness around the affected nerve (Tyler, 1990).

2.3 Pain in Infants

For many years, it was believed that children, particularly babies, did not feel pain (Tyler, 1990). There were many misconceptions that infants cannot feel pain because of an immature nervous system. It was believed that neural pathways in young infants were not developed sufficiently for them to experience pain. There was also an assumption that infants and young children had not yet developed coping strategies. We now know this conception to be false. Even though children's emotional processing and cognitive abilities are still developing, they still express pain, just differently than adults (Twycross 2009, 18).

The basic mechanisms of pain perception, including the transmission, perception and modulation in infants and children are similar to those of adults (Kenner & Lott 2013, 571). Infants, including neonates, display behavioral, physiological and hormonal responses to pain (Twycross 2009, 5). In fact, the structures necessary for nociception are already present and functioning from an early stage of gestation (Kenner & Lott 2013, 571). This can be proven by studying the electroencephalogram (EEG) patterns in infants experiencing pain (Kenner & Lott

2013, 571). In addition, painful stimuli have been shown to produce a hormonal pain response even in preterm babies (Twycross 2009, 5).

Underdeveloped mechanisms in neonates mean that they are unable to distinguish between different types of stimuli, resulting in an exaggerated response to pain (Twycross 2009, 18). Therefore, young infants may experience pain more severely than older children or adults (Kenner & Lott 2013, 571). In addition, the infant's immature spinal cord may generate pain responses below the normal threshold for adults (Twycross 2009, 18).

Even in the absence of behavioral or physiological signs, pain should be assumed in all typical painful situations (Kenner & Lott 2013, 571). Despite the inability to communicate verbally, infants may still be experiencing pain without displaying outwardly signs, resulting in a persistence of unnecessary suffering (Schechter et al. 2013, 16).

2.4 Effects and Consequences of Untreated Pain

In the presence of potentially threatening thermal or chemical stimuli, information is transmitted from the pain receptors to the spinal cord by the afferent nerve fibers. A-delta (large, myelinated, and fast-conducting) and C (small, unmyelinated, and slow-conducting) fibers are primarily responsible for pain impulse transmission (nociception) (Kenner & Lott 2013, 571). Central mechanisms and modulation neurotransmitters in the spinal cord either amplify or attenuate pain information from the periphery. Pain transmission neurons in the spinal cord relay the message to higher centers including the brain (Kenner & Lott 2013, 571).

One of the physiological symptoms of pain is rapid, shallow breathing, which can lead to hypoxemia and alkalosis. In addition, shallow breathing is associated with inadequate expansion of lungs and poor cough, which can lead to retention of secretions and atelectasis. Pain can also affect the cardiovascular system increasing heart rate, blood pressure and myocardial oxygen requirements, which in turn can lead to cardiac morbidity and ischemia. Additionally, stress hormone levels are increased, for example cortisol and adrenaline. This in turn increases the metabolic rate, impedes healing and decreases immune function. Also, pain has an effect on the gastrointestinal and urinary systems, which may lead to nausea, vomiting, ileus and urinary retention. Pain is also associated with behavioral disturbances such as fear, anxiety, distress, sleep disturbance, reduced coping and developmental regression (Twycross 2009, 2).

3 Purpose Statement and Research Question

3.1 Purpose Statement

The purpose of this thesis is to obtain and describe information from current literature to determine how a nurse can assess and manage pain in infants. The aim is to increase the authors' knowledge on the subject and of those reading this review.

3.2 Research Question

How does a nurse assess and manage pain in infants?

4 Methodology

4.1 Literature Review

The research methodology used for this thesis is a literature review. Key features of the literature review method include literature as the population that provides the data for the study, the sample comes from the literature, data collection in the research setting is conducted by searching through various databases, the analysis is based on clear evaluative criteria, and the findings are synthesized using a systematic approach (Siu & Comerasamy 2013, 46). The literature review method attempts to collect and combine the evidence and use pre-specified eligibility criteria in order to answer a specific research question. The objective is to get a holistic understanding of the phenomenon subject to research (Kananen, 2015). Additionally, the review should be duplicable by other researchers adhering to the same methodology and rules (Polit & Beck, 2014).

The implemented methodology included the following steps: the formulation of the research question, selection of key terms or search terms, systematic database search with proper inclusion and exclusion criteria, and inductive qualitative data analysis.

4.2 Database Search

The authors used four different electronic bibliographical databases to retrieve the data. They were Laurea FINNA, SAGE, CINAHL (EBSCO), and PUBMED. Laurea FINNA is an electronic article search portal of Laurea UAS. SAGE is an academic and professional publisher of high quality content, which includes more than 900 journals published per year in various topics. CINAHL, which stands for the Cumulative Index to Nursing and Allied Health Literature (via EBSCO), is a leading content provider with high-quality medical content and evidence-based information. PUBMED is The United States National Library of Medicine's search engine, which provides access to more than 11 million citations.

Search terms	Database	Exclusions	No. of Hits	1st Selection Stage	2nd Selection Stage
Pain+Infant+Nursing	Laurea FINNA	Full text only, English language, published 2006 – 2016, e-article	45	6	1
Pain+Scale+Infant	Laurea FINNA	Full text only, English language, published 2006 – 2016, e-article	25	5	1
Pain+Infant+Management	Laurea FINNA	Full text only, English language, published 2006 – 2016, e-article	24	6	2
Pain+Infant+Assessment	SAGE	Full text only, English language, published 2006 – 2016, title	96	13	1
Infant+Pain+Nursing	SAGE	Full text only, English language, published 2006 – 2016, title	68	6	0
Nurse+Pain+Infant	SAGE	Full text only, English language, published 2006 – 2016, abstract	235	11	1
Pain+Infant+Nursing	CINAHL (EBSCO)	Full text only, English language, published 2006 – 2016	157	21	1
Nurses+Infant+Assessment	CINAHL (EBSCO)	Full text only, English language, published 2006 – 2016	206	17	1
Pediatric+Pain+Nursing	CINAHL (EBSCO)	Full text only, English language, published 2006 – 2016	185	22	1

Pain+Assessment+Infant	PUBMED	Full text only, English language, published 2006 – 2016	224	52	7
Pain+Infant+Nurse	PUBMED	Full text only, English language, published 2006 – 2016	56	26	4
Nursing care+Infant+Nurse	PUBMED	Full text only, English language, published 2006 – 2016	265	42	2
TOTAL			1586	227	22

Table 1: The electronic research process, containing total number of retrieved articles

4.3 Inclusion and Exclusion Criteria

The following restrictions were applied when conducting the database search: full text only, English-language articles, published between the years of 2006-2016. The age restriction was to ensure that only the latest and most up-to-date articles were included. With these applied restrictions, the primary search generated 1,586 articles in total. From these search results, the articles selection was based on the articles' title and abstract. Only apparent relevant articles to this study according to their title and abstract were selected for further review; this was 227 articles in total. The second selection phase consisted of an assessment of the full-text article for relevance and quality of the article. Articles that answered the research question and that were deemed to be of good enough quality were exclusively selected for inclusion in this review. After this selection process, 22 articles in total remained.

The authors used the PRISMA flow diagram tool to spell out the flow of the different steps of the literature review process. (Moher, Liberati, Tetzlaff, & Altman 2009). Table 2 details the steps taken.

Identification	**Records identified through database:** FINNA, SAGE, CINAHL, PUBMED. Full text only English language, 2006-2016 (n=1586)	**Exclusion criteria:** Duplicates, and based on title and abstract. Total exclusions (n=1359)

Screening and eligibility	**Inclusion criteria:** Pain, Nursing, Infant, Assessment, Management. Full text articles assessed for relevance (n=227)	**Exclusion criteria:** Did not answer the research question or low quality (n=225)
Included	**Studies included** (n=22)	

Table 2: PRISMA Tool (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)

4.4 Data Appraisal

"Critical appraisal is one of the most important steps in the systematic review process as it addresses the question of "should the study be included in the review?"" (Teing 2007, 105). Quality of the research must be established and included in the systematic review in order to ensure that the outcome of the review will not be affected (Teing, 2007).

The appraisal of the evidence and quality of the data retrieved was conducted by using The Johns Hopkins Nursing Evidence-Based Practice Model, more specifically; the Evidence Level and Quality Guide (Johns Hopkins University Hospital, 2016).

This tool consists of three evidence levels, with level I being of the highest evidence and level III of the lowest evidence level. Level I includes "experimental studies, randomized controlled trials (RCT), systematic review of RCTs, with or without meta-analysis" (Johns Hopkins University Hospital, 2016). Level II includes "quasi-experimental studies, systematic reviews of a combination of RCTs and quasi-experimental, or quasi-experimental studies only, with or without meta-analysis" (Johns Hopkins University Hospital, 2016). Level III includes "non-experimental studies, systematic reviews of a combination of RCTs, quasi-experimental and non-experimental studies, or non-experimental studies only, with or without meta-analysis, quality study or systematic review with or without meta-synthesis" (Johns Hopkins University Hospital, 2016).

The quality guides in this tool are as follows: A – high quality, B – good quality, and C – low quality or major flaws. High quality articles include "consistent, generalizable results with sufficient sample size for the study design; adequate control; definitive conclusions, consistent recommendations based on comprehensive literature review that includes thorough reference to scientific evidence" (Johns Hopkins University Hospital, 2016). Good quality articles include "reasonably consistent results; sufficient sample size for the study design; some control; fairly comprehensive literature review that includes some reference to scientific evidence" (Johns Hopkins University Hospital, 2016). Low quality or major flaws articles consist of "little evidence with inconsistent results; insufficient sample size for the study design; and conclusions cannot be drawn" (Johns Hopkins University Hospital, 2016).

As indicated on Table 3 below, of the 22 data sources selected for this literature review, 7 are experimental studies, indicated as levels I, according to the parameters of the scale. The remaining 15 are qualitative research studies, indicated as levels III on the scale. Five of the articles are deemed to be Quality A, of high quality, 2 articles are Quality B, of good quality. Two of the level III studies were of Quality A and 13 from the level III were of Quality B. Zero articles of low quality were included in this review.

Level of evidence	Number of Articles	Quality A (high quality)	Quality B (good quality)	Quality C (low quality)
Level I	7	5	2	0
Level II	0	0	0	0
Level III	15	2	13	0
Total:	22	7	15	0

Table 3: Johns Hopkins Nursing Evidence-Based Practice, Evidence Level and Quality Guide

4.5 Data Extraction

Qualitative data extraction consists of identifying and transferring study findings (Munn et al. 2014, 53) A data extraction form was used by both authors during the review of each individual article, keeping the research question in mind at all times. The authors conferred with each other their individual findings and then put them together into a single form consisting of only applicable data. (Refer to Appendix 1)

"The aim of meta-synthesis by meta-aggregation is to assemble findings from qualitative research; categorize those findings into groups on the basis of similarity in meaning; and aggregate these to generate a set of statements that adequately represent that aggregation. These statements are referred to as synthesized findings, and they can be used as a basis for evidence-based practice." (Munn et al, 2014, 53)

4.6 Data Analysis

Qualitative content analysis methodology was used to analyze and interpret the data. Content analysis was described by Polit and Beck (2014) as the process of organizing and integrating qualitative information according to emerging themes and concepts. An inductive approach to content analysis was used in this literature review. According to Speziale & Carpenter (2007, 10) inductive analysis begins with the details of the phenomenon of interest, to a more general picture. Therefore, by grouping and classifying data, an inductive method attempts to

interpret the data at hand. (Elo & Kyngäs 2008). This was the approach of choice used to grant the authors the ability to associate the findings and determine persistent themes.

This approach comprises of thorough examination of all the acquired material, and developing a series of subheadings to describe all facets of the content (Elo & Kyngäs 2008). Once the subheadings were developed, they were arranged according to their general theme, avoiding data repetition. The following are the recurring themes in the review: infant pain assessment tools and their components, and management of infant pain with non-pharmacological and pharmacological methods. (See Figure 1 below)

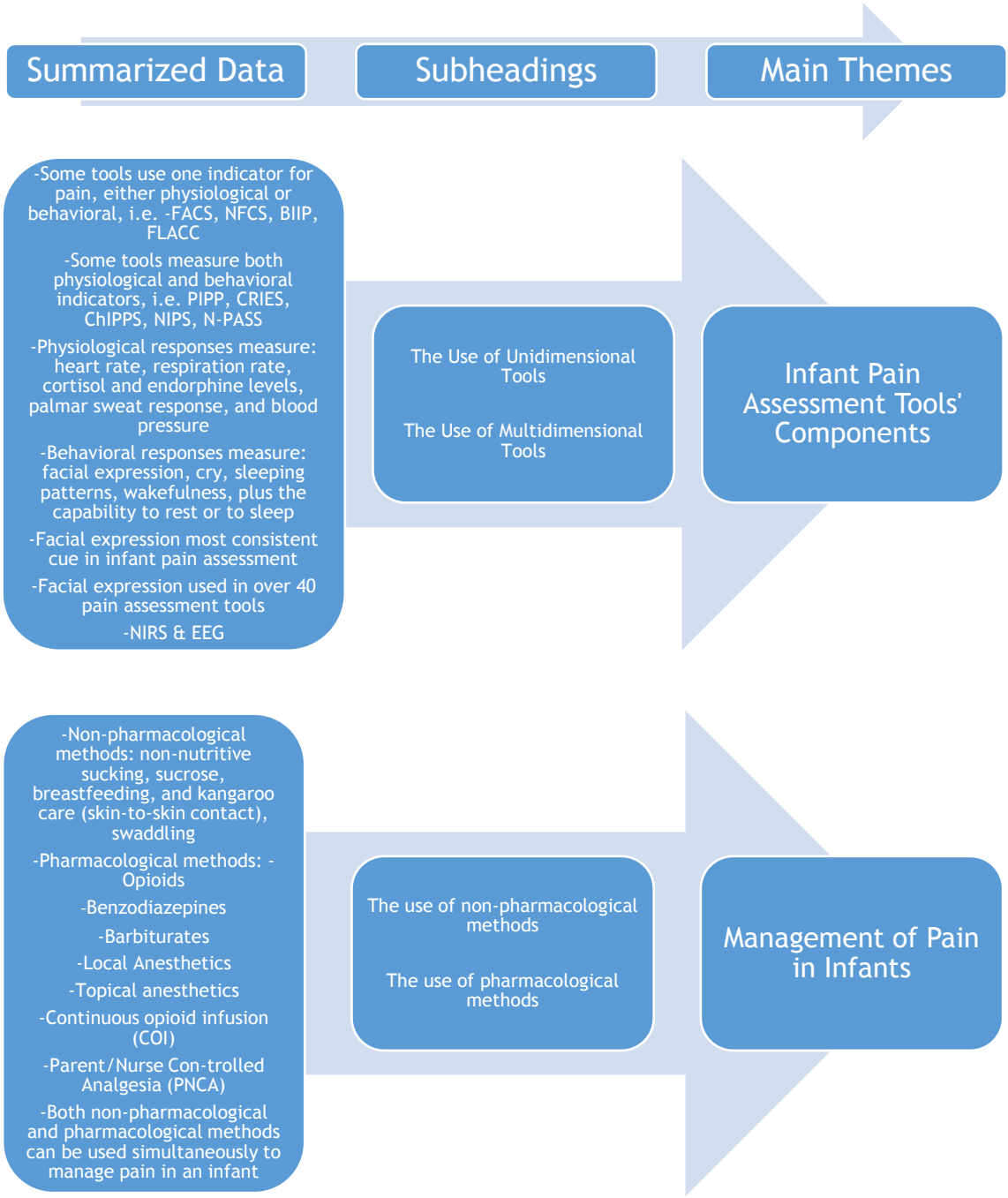

Figure 1: Inductive Data Analysis Process

5 Findings

5.1 Infant Pain Assessment Tools and Their Components

It is widely acknowledged that pain assessment is arguably the "fifth vital sign" according to the Joint Commission for the Accreditation of Hospitals (Hall, 2012). Holsti et al. (2011) stated that pain measures that have reliability and validity are in use for research and clinical assessment. Infant pain assessment tools can be broken down into either unidimensional or multidimensional. Unidimensional tools use a single indicator of pain assessment such as physiological or behavioral aspects. Multidimensional tools include both physiological and behavioral aspects.

Physiological responses to painful procedures tend to be less sensitive and specific to procedural pain compared to behavioral indicators (Bellieni, 2012). However, one must note that physiological responses are also often included in many composite and multidimensional pain assessment tools. The most commonly included physiological parameters to monitor pain are heart rate, respiration rate, cortisol and endorphin levels, palmar sweat response, and blood pressure (Tyler 1990, 13).

Behavioral measurements of pain grade the sleeping patterns, the wakefulness, plus the capability to rest or to sleep. Therefore, an unusual awakening, or crying, are indicators of acute pain (Bellieni, 2012). Taking into consideration that the existence of crying is a sign of pain, but by no means the only one, it cannot be used apart from other factors since crying can also be caused by other stimuli, such as hunger or anger (Bellieni, 2012). Also, large movements like withdrawal and tensing of the affected limb when touching the affected area, are indicators of pain.

Facial expression is likely to be the biggest crucial determinant and most consistent cue available. Measures of facial expression appear most useful and specific in infants. Given that fact, facial expressions form the foundation of most of the more than 40 pain assessment tools used to measure the existence and intensity of pain in infants. The following are typical facial signs of pain and physical distress in infants: eyebrows lowered and drawn together, a bulge between the eyebrows and vertical furrows on the forehead, eyes slightly closed, cheeks raised, nose broadened and bulging, deepened nasolabial fold, and squarish mouth (Mazur et al. 2013). Facial expressions of emotion are constant across cultures, they serve basic universal communicative functions in the language of emotions and they are biologically based. Although pain is not purely an emotion, it does have an emotional component which has been associated with facial expression across the lifespan. Having the ability to display certain emotions has been hardwired through bio-evolutionary processes (Schiavenato, 2008).

Twycross (2009, 89) states that behavioral pain assessment tools should be used with infants, toddlers, preverbal, cognitively impaired and sedated children. Behavioral methods for assessing pain in children generally include observation scales or checklists, and recording of the occurrence in children's physical behaviors when they are in pain. Behavioral responses and particularly facial expressions are the most useful in detecting pain (Tyler 1990, 11). However, Tyler (1990, 14) explains that the primary disadvantage for all behavioral scales is that the infants distress behaviors are not necessarily direct expressions of the intensity or quality of their pain experience. Environmental cues, such as the sights and sounds associated with the procedure, parental responses and expectations, children's expectations and their control, and anxiety about a disease or medical treatment are influencing the methods discussed.

Infants can be hypotonic or hyperactive and yet be able to feel pain, hence, sudden body movements can be misleading and be at odds as an indicator of pain. This means that pain assessment established only on body movements can raise concerns (Bellieni, 2012).

New technologies developed to measure cortical responses to pain, offer improved accuracy and allow for a more direct assessment of cortical processing, these include electroencephalography (EEG) and cerebral near-infrared spectroscopy (NIRS) (Harrison et al. 2015). NIRS evaluates acute changes in cerebral blood flow, volume and oxygenation. EEG has been utilized to evaluate neurological cerebral function in infants, as EEG records electrical activity reflecting cortical neuronal activity. These two methods can provide assessment of cortical responses to painful stimuli which can protect neurodevelopment (Holsti et al. 2011). It’s also important to note that there seems to be a possibility to have cortical activity with no relation to behavioral response. Which leads to the conclusion that using only behavioral assessment tools to assess infant pain may not be accurate (Slater et al. 2008).

An infant’s development, brain and health are at risk when systematic and scientific pain assessment tools are not used (Holsti et al. 2011). Given that early stress exposure on pain responses is associated with developmental impairments and imbalance between the external environments, this is something to be avoided at all costs (Holsti et al. 2011). In order to protect the brain, and to promote optimal long-term development, using accurate pain assessment tools is essential for mitigating pain (Holsti et al. 2011).

Pain assessment in infants is a holistic combination of clinical judgment based on the observation of many factors, including the nature, significance and context of the child’s pain experience. Although the majority of pain assessment tools focus on measuring pain intensity, a wider assessment is preferred, as it provides information such as where the pain is and what it is like. This assists nurses to determine the most likely cause of the pain and to decide the

best treatment option (Twycross 2009, 85). However, this does not come without challenges, as evident through any children's hospital in wards, outpatient clinics, emergency department, and critical care units (Tyler 1990, 5). Compared to assessing pain in adults, special considerations are taken into account when assessing the pain in infants. Infants are unable to communicate pain verbally and differences in their physiology mean they experience pain in a different and even more sensitive way than adults do.

5.1.1 Unidimensional Infant Pain Assessment Tools

Four different unidimensional tools available for nurses to use to assess pain in infants emerged in the review findings. They were the Facial Action Coding System (FACS), Neonatal Facial Coding System (NFCS), Behavioral Indicators of Infant Pain (BIIP) and the Face Leg Activity Cry Consolation (FLACC) tools.

FACS is the most widely used and oldest pain assessment tool available (Schiavenato, 2008). An adaptation for infants of the FACS, called the Baby FACS, recognizes anatomical variation in the facial structures of infants and older children. However, due to the complexity of the use of the FACS, it has led to the development of other coding systems (Schiavenat, 2008).

NFCS was developed by using a subset of facial actions from the FACS that are associated with pain, and it requires coding for the presence or absence of 10 facial actions, 5 of which have consistently been associated with pain in preterm newborns (Schiavenat, 2008).
According to Arias (2012), when comparing the unidimensional scales NFCS and BIIP to the multidimensional scale PIPP regarding their ability to assess pain, the unidimensional scales were more sensitive for the detection of pain than multidimensional scale.

BIIP combines sleep/wake states, 5 facial actions and 2 hand actions (finger splay, fisting). Holsti (2007), concluded that the BIIP improves the accuracy of pain assessment for preterm infants by combining theoretically derived, developmentally relevant hand movements and sleep/wake states with anatomically derived facial actions.

FLACC Revised includes scoring the face from ‘no particular expression’ to ‘occasional grimace’, to ‘frequent and constant frown’. It scores the legs from ‘relaxed normal position’ to ‘restless or tense’, to ‘kicking’. The activity level is scored from ‘lying quietly’ to ‘squirming’ to ‘rigid’.

5.1.2 Multidimensional Infant Pain Assessment Tools

Five different multidimensional infant pain assessment tools were recurring in the literature review. They were the Premature Infant Pain Profile (PIPP), Cry Requires oxygen Increased

vital Signs Expression Sleeplessness (CRIES), Children and Infants Postoperative Pain Scale (ChIPPS), Neonatal Infant Pain Scale (NIPS) and the Neonatal Pain Agitation and Sedation Scale (N-PASS).

PIPP is considered to be the most suitable scale for the study of acute pain in newborns by many researchers and clinicians. It measures the following physiological parameters: heart rate and oxygen saturation. Additionally, it measures one behavioral aspect; the facial expression. Specifically PIPP incorporates three very specific facial actions adapted from the NFCS which are found to significantly contribute to facial expression (Schiavenato, 2008).

CRIES measures the infant's cry from 'no cry' to 'inconsolable high pitch cry'. It also looks at oxygenation needs based on oxygen saturation of less than 95% from 'no oxygen required' to 'greater than 30% oxygen required'. It also measures increased vital signs such as heart rate and blood pressure from 'both HR and BP unchanged' to 'HR and BP are increased by greater than 20% from the baseline'. Expression is measured by listing 'no grimace present' to 'grimace and grunt are present'. Lastly, it evaluates the sleeplessness from 'child has been continuously asleep' to 'child has been awake constantly'.

ChIPPS measures the infant's cry from none, to moaning, to screaming. Facial expression is measured from relaxed smiling to wry mouth to grimacing. Posture of the trunk is evaluated as neutral, variable, or rear up. Posture of legs is scored as neutral, kicking, or tightened. And motor restlessness is scored as none, moderate, or restless.

NIPS measures facial expression, crying, breathing pattern, arm/leg movement and the state of arousal. Facial expression is marked as either relaxed or contracted. Cry is either absent, mumbling, or vigorous. The breathing pattern is marked as relaxed or different than basal. Arms and legs can be scored as relaxed or flexed/stretched. Alertness is scored as sleeping/calm or uncomfortable.

N-PASS scores crying irritability, behavior, facial expression, arms and legs tone, vital signs including heart rate, respiratory rate, blood pressure, and oxygen saturation. The sedation stage is marked as negative number values and the pain/agitation are scored 1-2.

In a cross-validation of the following three multidimensional pain scales: CRIES, ChIPPS and NIPS in terms of validity, reliability and practicality NIPS was the only tool which was appropriate on the basis of coverage, content and relevance. Overall, NIPS was the most satisfactory pain scale. NIPS has an ease and feasibility of use, and the ability to differentiate the severity of pain (Suraseranivongse, 2006).

5.2 Management of Pain in Infants

While managing pain can be approached from many angles, there is a general description that can be applied for the treatment of any type of pain: identification, minimization and elimination of possible cause, and treatment with a combination of pharmacologic and non-pharmacologic therapies (Ebert & Kerns 2010, 377).

It has been proven that infants who receive inadequate treatment for pain during surgery, produce stress hormones which increase catabolism, immunosuppression and hemodynamic instability (Mazur et al. 2013).

Infants are more sensitive to pain than adults and more susceptible to the long-term effects of painful stimulation. Therefore, inadequate treatment of pain may be associated with increased clinical complications and even mortality (Twycross et al. 2009, 9).

5.2.1 Non-Pharmacological Methods

Used either alone or combined with drug treatment, non-pharmacological strategies are indeed an important aspect of neonatal pain management. It should be noted, however, that these methods are not always substitutes for pharmacological treatment, but are rather complementary strategies in the pain management of infants (Kabiri, 2012).

Infant pain associated with single procedures can be treated with non-pharmacological techniques which are safe and have demonstrated effectiveness in relieving mild-to-moderate pain. Parental involvement is usually required for the following methods: non-nutritive sucking, oral administration of sucrose, breastfeeding, and kangaroo care (skin-to-skin contact) and swaddling (Hall, 2012).

The non-nutritive sucking of a pacifier may have a decreasing effect on hyperactivity and regulating the infant's discomfort. Its effects include decreased heart rate, increased oxygenation, and respiratory and gastrointestinal functions improvement (Da Motta, 2015).

Oral administration of sucrose is indicated for procedures like capillary blood collection, naso/oropharyngeal and endotracheal aspiration, passage of gastric/enteral feeding, lumbar puncture, venous or arterial puncture, urinary catheterization, and intramuscular injections. Areas related to pleasure capable of promoting physiological and sensory effects are stimulated by the mechanism of oral administration of sucrose (Da Motta, 2015).

Breastfeeding is the preferred nutritional sucking for procedural pain management. The presence of endorphins in the breast milk has analgesic effects for medically stable infants during

heel lance and venipuncture. Breastfeeding can also effectively reduced behavioral and physiological responses during or following painful procedures (Da Motta, 2015). A study conducted by Kabiri (2012) showed that the most effective combination that can be recommended in non-pharmacological care is sucking a teat combined with administration of glucose 30%.

Kangaroo care, also known as skin-to-skin contact is safe, more effective than no treatment, and beneficial during the treatment of procedural pain. In practice, skin-to-skin contact requires that the mother or other caregiver be present (Harrison & Bueno, 2015).

Swaddling is recommended as long as the infant is clinically stable and adequately monitored. The gentle stimulation of swaddling provides stimuli to the thermal receptors that can compete with pain and stress, being more effective when performed before any painful procedure (Cignacco et al. 2009). When wrapped in a blanket or contained during painful procedures, infants cry for less amount of time, they have stabilized sleep-wake cycle and have fewer changes of heart rate (Twycross, 2009). A firm containment that still allows some movement, sends the central nervous system a continuous stream of stimuli that can compete with painful stimuli by modulating pain perception and facilitating self-regulation in less intensive painful procedures (Cignacco, 2009).

It's worth noting that the nurse's communication with the infant can also be used as a non-pharmacological pain management intervention. In a hospital setting, it is important that the nursing staff in the neonatal unit can communicate effectively with the newborn and be able to provide personalized and holistic nursing care focused on the minimization of pain, as there is no quality in nursing care without communication (De Melo et al. 2013). The nurse's local touches and caresses of the infant, the pressure exerted by that touch on the body, and the time spent in contact are ways to communicate with the infant.

The Hospital for Sick Children affiliated with the University of Toronto suggested many ways to alleviate and manage pain in children. Some of them include: warm baths, warm water bottles and heating pads and the sense of touch. For example a mother touching an infant in pain is helpful in reducing the infant's anxiety and pain. Gentle exercise can be useful to help protect muscles from injury and encourage healing in injured areas. Infants can be distracted with colorful mobiles and mirrors.

5.2.2 Pharmacological Methods

The use of opioids is the most common pharmacological method used in modern NICU's mechanically ventilated newborns. And the most frequently used drug for analgesia in ventilated neonates is morphine (Hall, 2012). Unfortunately, some preterm infants may develop tolerance. Hypotension in neonates is a common side-effect of morphine. Fentanyl, which is an

opioid analgesic, is 50 to 100 times more potent than morphine. It is used often due to its ability to provide rapid analgesia with fewer side effects. Methadone, with minimal side effects, is a potent analgesic with a rapid onset of action and a prolonged effect (Hall, 2012). Other opiates include short-acting drugs like sulfentanil, alfentanil, and remifentanil which are useful for short procedures such as intubations. These could also be used for short neonatal surgery or other procedures with anticipated rapid recovery (Hall, 2012).

Continuous opioid infusion (COI) remains the analgesic therapy of choice in the NICU. COI is recommended by the American Academy of Pediatrics (Czarnecki et al. 2014). Though it may seem obvious that less opioid is better, negative effects from undertreated pain may be even more harmful than the unknown consequences of opioids use (Czarnecki et al. 2014). Parent/Nurse Controlled Analgesia (PNCA) is an accepted, safe and effective treatment of pediatric pain (Czarnecki et al. 2014). PNCA may be a beneficial and effective alternative to COI for pain management in post-surgical infants in the NICU by providing a more individualized care. Parent/Nurse Controlled Analgesia (PNCA) permits flexible dosing, rapid titration in response to pain and an increase in parental participation (Czarnecki et al. 2014). This shows that infants treated with PNCA benefit from this method of opioid administration. COI treated infants might receive more opioid than necessary for good pain management, putting them at risk for serious short-term and long-term effects (Czarnecki et al. 2014).

The benzodiazepines, which are usually used in NICUs to sedate and provide muscle relaxation, are anxiolytic drugs that have limited analgesic effect (Hall, 2012) Midazolam is the most commonly used benzodiazepine in the NICU. Midazolam provides sedative effects in mechanically ventilated neonates, but it should be used with caution because of reported adverse effects (Hall, 2012). Lorazepam, a longer-acting drug, has been used successfully in neonates for seizure control (Hall, 2012).

Whenever sedation is required without analgesia, chloral hydrate is commonly used in neonatal intensive care. Hall (2012) states that this drug should be used with caution in infants due to increased incidence of apnea and desaturation.

The anesthetic agent propofol, leads to shorter intubation times, higher oxygen saturations and less trauma. However, caution should be practiced when using propofol in young infants because clearance is inversely related to neonatal and postmenstrual age (Hall, 2012). Ketamine is a highly potent anesthetic with very little study in its effect on neonates (Hall, 2012).

Local anesthetics like lidocaine are commonly used for penile blocks during circumcisions (Hall, 2012). Topical anesthetics on preterm neonates with thin skin puts them at risk for methemoglobinemia. Due to increased thickness of the skin, topical anesthetics have not proved to be effective in providing pain relief for the heel lance (Hall, 2012).

Hall (2012) also notes that acetaminophen has proved to be useful for the treatment of mild pain, alone or with conjunction of other pain relief.

6 Discussion

6.1 Nurses' Attitudes and Perceptions About Pain in Infants

Nurses attitudes and perceptions about infant pain may have an effect on the nurse's assessment and management of their tiny patients. Historically, pain has often been under-treated in children. This is a reflection of attitudes and values that surround both pain and children (Schechter et al. 2002, 16). Nurses will not be willing to consider using pain assessment tools if they don't first believe the infant is capable of feeling pain. Also, nurses in busy NICUs might convince themselves that there are other tasks that have priority over determining whether or not an infant is experiencing pain.

6.2 Collaboration Between Healthcare Professionals

Collaboration is considered to be the basis for effective pain management practices (Stevens et al. 2011). In inter-professional collaboration, different professional groups work together to advance health care. This idea is based on an inclusive philosophy that values the expertise and contributions of multidisciplinary health care team members, and enables negotiated agreements on patient care decisions. Inter-professional collaboration came about as a response to sources of conflict that can arise when different professionals work together, such as power dynamics, communication patterns and varied approaches to patient care (Stevens et al. 2011).

Health professionals need to work interdisciplinary and effectively to address the nature of pain when assessing and managing patients with complex problems such as infants (Carr et al. 2010, 181). The effective management of infant pain requires nurses to collaborate with each other, with physicians, and with the infant's parents (Kenner & Lott 2013, 581). Inter professional education (IPE) is needed to improve the collaboration and the quality of care. (Carr et al. 2010, 181).

It is also important that each health service strategizes ways to minimize the number of painful or stressful procedures, and provides non-pharmacological or pharmacological effective

relief in all procedures performed. In addition, the team must be constantly mobilized for preventing pain and using relief methods (Da Motta, 2014).

6.3 Professional Development

The nurse's educational levels and knowledge have a significant effect on the assessment and management of pain in infants. To effectively address this problem, training programs on knowledge of pain in neonates, adverse effects, measurement of pain, and pharmacological and non-pharmacological relieving interventions are recommended. (Asadi-Noghabi, 2014). Not only do training programs enhance the knowledge and attitudes of nursing personnel, but they could lead to optimal pain management in neonates as well. Areas of opportunities for development include participating in research or quality improvement activities by providing feedback and attending pain conferences to evaluate pain care (Stevens et al. 2011).

6.4 Application of Findings

A well-planned program which includes consistent coordination, facilitation, and using local leaders and project teams to elicit a beneficial change in practice would be an excellent way to apply the findings (Hall, 2012).

Inter-professional collaboration can only be achieved when everyone is committed and engaged in the betterment of treatment by applying established findings. In order to make use new established findings, it would be beneficial to have clear guidelines and protocols in place.

7 Conclusion

Since it has been established that pain in newborns is often unrecognized and under-treated, the nurse's role in the assessment of pain is of extreme importance. Infants do feel pain, and analgesia should be prescribed when indicated during their medical care (Twycross et al. 2009, 9).

Poor communication, lack of accountability and responsibility for pain management, and poor team working highlights the fact that health professionals need to work interdisciplinary together effectively to address the nature of pain when managing patients with complex problems such as infants (Carr et al. 2010, 181).

Inter-professional education is required to improve the collaboration and the quality of care as it has a central role and requires health professionals to be prepared for inter-professional

working (Carr et al. 2010, 181). Effective infant pain management requires nurses to collaborate with each other, with physicians, and with the infant's parents (Kenner & Lot 2013, 581). Nurses caring for the infant in pain must care for the infant's family as well by educating parents on their infant's pain cues. It is important to provide parents with consistent information about pain assessment and management.

Two primary goals of nursing care are comfort provision and pain relief. To accomplish these goals, neonatal nurses must first prevent pain whenever possible, secondly, they must assess pain in their neonatal patients who cannot verbalize their experienced pain, and thirdly, they must provide relief or reduction of pain through the implementation of non-pharmacological and/or pharmacological measures. Lastly, they must assist the infant in coping when pain cannot be prevented (Kenner & Lott 2013, 581).

Nurses should communicate assessments and recommendations in a concise and objective manner. Also, in a joint effort with responsible healthcare team members, they must advocate for pain relief strategies. Neonatal nurses must be current about professional standards and clinical guidelines related to pain assessment and management in neonates (Kenner & Lott 2013, 581).

A local quality improvement approach to managing unit and organization specific challenge could conceivably allow for rapid introduction of improvement strategies and their immediate evaluation, given the pressing need for improvements in pain care practices. This could also provide opportunities to discuss with current local initiatives that are faced with similar barriers (Stevens et al. 2011).

In conclusion, the effective assessment and management of pain in infants requires a joint effort from the entire multi-disciplinary team, as well as the infant's parents. Nurses have a crucial role, acting as a liaison between parents and physicians. Additionally, nurses are the medical professionals in the front line to witness the patient's suffering and pain, giving them greater responsibility to act upon their observations. Poor communication between all parties involved, lack of accountability and responsibility for pain management and ineffective teamworking are impediments to efficient pain management in infants.

8 Ethical Considerations

This literature review respected and followed the general principles of scientific research at all times. Throughout this review, Laurea's referencing guidelines (King 2013) were applied. There were no ethical issues encountered during the completion of this thesis.

9 Trustworthiness

A trustworthy and non-biased conclusion was reached by following the qualitative content analysis method, which included inductive data analysis.

10 Limitations

Although the authors made every effort to extract only top quality references, systematic literature reviews were needed to construct the theoretical basis of the findings. Due to the English language inclusion criteria, the authors acknowledge that studies conducted in other languages that could have presented additional facts, were not considered during this review.

11 Recommendations

Recommendations are aimed at health care professionals in general, we recommend that future researchers compile an evidence-based guideline in the assessment and management of pain in infants and that more extensive research be conducted in order to confirm our findings in other parts of the world which may hold different cultures and beliefs regarding this delicate topic.

References

Arias, M. C. C. & Guinsburg, R. 2012. Differences between uni-and multidimensional scales for assessing pain in term newborn infants at the bedside. Online Brazilian Journal of Nursing. Article from EBSCO. Accessed 6 September 2016.

Asadi-Noghabi, F., Tavassoli-Farahi, M., Yousef, H. And Sadeghi, T. 2014. Neonate pain management: what do nurses really know? Glob J Health Sci. 2014 Jul 14;6(5):284-93. doi: 10.5539/gjhs.v6n5p284. PubMed PMID: 25168978; PubMed Central PMCID: PMC4825505. Accessed September 2016

Bellieni, C. V. 2012. Pain assessment in human fetus and infants. AAPS J. 2012 Sep;14(3):456-61. doi: 10.1208/s12248-012-9354-5. Epub 2012 Apr 18. Review. PubMed PMID: 22528505; PubMed Central PMCID: PMC3385812. Accessed September 2016

Blackstone, A. 2012. Principles of Sociological Inquiry: Qualitative and Quantitative Methods (v. 1.0). Maine: Saylor Foundation

Carr, E., Layzell, M. & Christensen, M. Advancing Nursing Practice in Pain Management (1). Hoboken, GB: Wiley-Blackwell, 2010. ProQuest ebrary. Web. 15 September 2016.

Children and Pain. Hauppauge, US: Nova Science Publishers, Inc., 2009. ProQuest ebrary. Web. 16 September 2016.

Cignacco, E., Hamers, J., van Lingen, R.A., Stoffel, L., Büchi, S., Müller, R., Schütz, N., Zimmermann, L. and Nelle, M. 2009. Neonatal procedural pain exposure and pain management in ventilated preterm infants during the first 14 days of life. Swiss Med Wkly. 2009 Apr 18; 139(15-16):226-32. doi: smw-12545. PubMed PMID: 19418306. Accessed September 2016

Czarnecki, M. L., Hainsworth, K., Simpson, P. M., Arca, M. J., Uhing, M. R., Varadarajan, J. and Weisman, S. J. 2014. Is there an alternative to continuous opioid infusion for neonatal pain control? A preliminary report of parent/nurse-controlled analgesia in the neonatal intensive care unit. Paediatr Anaesth. 2014 Apr; 24(4):377-85. doi: 10.1111/pan.12332. Epub 2014 Jan 13. PubMed PMID: 24417623; PubMed Central PMCID: PMC4331187. Accessed September 2016

Da Motta, G. C. P. & Cunha, M. L. C. 2014. Prevention and non-pharmacological management of pain in newborns." Revista Brasileira De Enfermagem 68, no. 1 (2015): 123-127. Accessed From Laurea FINNA on 12 September 2016

De Melo G. M., Brasil de Almeida RebouÃ§as C, Moreira LeitÃ£o Cardoso M, Martins Farias L. Nursing team communication with regard pain in newborns: a descriptive study. Online Brazilian Journal of Nursing [serial online]. September 2013; 12(3):462-470. Available from: CINAHL with Full Text, Ipswich, MA. Accessed September 20, 2016.

Ebert, M. H. & Kerns, R. D. Behavioral and Psychopharmacologic Pain Management. Cambridge, GB: Cambridge University Press, 2010. ProQuest ebrary. Web. Accessed 16 September 2016.

Elo, S. & Kyngäs, H. 2008. The qualitative content analysis process. Journal of Advanced Nursing 62(1), 107.

Hall RW. Anesthesia and analgesia in the NICU. Clin Perinatol. 2012 Mar; 39(1):239-54. doi: 10.1016/j.clp.2011.12.013. Review. PubMed PMID: 22341549; PubMed Central PMCID: PMC3612887. Accessed September 2016.

Harrison, D., Bueno, M. & Reszel, J. Published in: Research and Reports in Neonatology 01 January 2015, Vol.2015 (default), pp.9-16 Accessed 6 September 2016.

Harrison, T. M. Family-centered pediatric nursing care: state of the science. J Pediatr Nurs. 2010 Oct; 25(5):335-43. doi: 10.1016/j.pedn.2009.01.006. Epub 2009 Apr 10. Review. PubMed PMID: 20816555; PubMed Central PMCID: PMC2965051. Accessed September 2016.

Holsti L, Grunau RE. Initial validation of the Behavioral Indicators of Infant Pain (BIIP). Pain. 2007 Dec 5; 132(3):264-72. Epub 2007 Mar 23. PubMed PMID: 17382473; PubMed Central PMCID: PMC2225385. Accessed September 2016.

Holsti, L., Grunau, R.E. & Shany, E. Assessing pain in preterm infants in the neonatal intensive care unit: moving to a 'brain-oriented' approach. Pain Manag. 2011 Mar 1; 1(2):171-179. PubMed PMID: 21874145; PubMed Central PMCID: PMC3161414. Accessed September 2016.

Hsieh, H.F. & Shannon, S.E. 2005. Three Approaches to Qualitative Content Analysis. Qualitative Health Research. 15 (9), 1277-1288.

International association for the study of pain (IASP). Taxonomy of pain. Accessed 15.09.2016 http://www.iasp-pain.org/Taxonomy?navItemNumber=576

Johns Hopkins Medicine. 2016. Johns Hopkins Nursing Evidence-Based Practice Model. Appendix C: Evidence Level and Quality Guide. http://www.hopkinsmedicine.org/evidence-based-practice/_docs/Appendix%20C%20image.jpg Accessed September 2016.

Jeong, I. S., Park, S. M., Lee, J.M., Choi, Y.J. & Lee J. Perceptions on pain management among Korean nurses in neonatal intensive care units. Asian Nurs Res (Korean Soc Nurs Sci). 2014 Dec; 8(4):261-6. doi: 10.1016/j.anr.2014.05.008. Epub 2014 Nov 10. PubMed PMID: 25529908. Accessed September 2016

Kabiri, M. 2012. Analgesic Effect of 30% Glucose, Milk and Non-nutritive Sucking in Neonates. Journal of Pain Research 2012.default (2012): 573-577. Accessed 12 September 2016

Kananen, J. 2015. Online Research for Preparing Your Thesis: A Guide for Conducting Qualitative and Quantitative Research Online. Jyväskylä: JAMK University of Applied Sciences Publications.

Kenner, C. & Lott, J. Comprehensive Neonatal Nursing Care: Fifth Edition (5). Secaucus, US: Springer Publishing Company, 2013. ProQuest ebrary. Web. 16 September 2016.

Mazur, A., Radziewicz Winnicki, I. & Szczepański, T. Pain management in children. Ann Agric Environ Med. 2013;Spec no. 1:28-34. Review. PubMed PMID: 25000838.

Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009) Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med. Figure 1. Flow of information through the different phases of a systematic review. http://dx.doi.org/10.1371/journal.pmed.1000097.g001

Munn, Z., Tufanaru, C. & Aromataris, E. 2014. Data Extraction and Synthesis: the steps following study selection in a systematic review. The American Journal of Nursing, 114 (7) 49-53.

Polit, D.F. & Beck, C. 2014. Essentials of Nursing Research: Appraising Evidence for Nursing Practice. 8th Edition. Philadelphia: Lippincott, Williams & Wilkins.

Schechter, N. L., Berde, C. B. & Yaster, M. Pain in Infants, Children, and Adolescents (2). Philadelphia, US: LWW, 2002. ProQuest ebrary. Web. 16 September 2016.

Schiavenato, M. Facial expression and pain assessment in the pediatric patient: the primal face of pain. Journal for Specialists in Pediatric Nursing [serial online]. April 2008; 13(2):89-97. Available from: CINAHL with Full Text, Ipswich, MA. Accessed September 20, 2016.

Siu, C. & Comerasamy, H. 2013.Doing a Research Project in Nursing & Midwifery: A Basic Guide to Research Using the Literature Review Methodology

Slater, R., Cantarella, A., Franck, L., Meek, J. & Fitzgerald, M. How well do clinical pain assessment tools reflect pain in infants? PLoS Med. 2008 Jun 24; 5(6):e129. doi: 10.1371/journal.pmed.0050129. PubMed PMID: 18578562; PubMed Central PMCID: PMC2504041. Accessed September 2016.

Speziale, H. J. S & Carpenter, D. R. 2007. Qualitative Research in Nursing: Advancing the Humanistic Imperative. 4th Edition. Philadelphia: Lippincott Williams & Wilkins

Stevens, B., Riahi, S., Cardoso, R., Ballantyne, M., Yamada, J., Beyene, J., Breau, L., Camfield, C., Finley, G. A., Franck, L., Gibbins, S., Howlett, A., McGrath, P. J., McKeever, P., O'Brien, K. and Ohlsson, A. The Influence of Context on Pain Practices in the NICU: Perceptions of Health Care Professionals. Qual Health Res, 2011; vol. 21: pp. 757-770 Accessed September 2016

Strandas, M. & Fredriksen, S. T. Ethical challenges in neonatal intensive care nursing, Nursing Ethics, 2015; vol. 22: pp. 901-912. Accessed September 2016

Suraseranivongse S, Kaosaard R, Intakong P, Pornsiriprasert S, Karnchana Y, Kaopinpruck J, Sangjeen K. A comparison of postoperative pain scales in neonates. Br J Anaesth. 2006 Oct; 97(4):540-4. Epub 2006 Aug 1. PubMed PMID: 16885171. Accessed September 2016.

Taddio A, Shah V, Wang J, Parikh C, Smart S, Ipp M, Riddell RP, Franck LS. Usability and knowledge testing of educational tools about infant vaccination pain management directed to postnatal nurses. BMC Med Educ. 2015 Mar 12; 15:45. doi: 10.1186/s12909-015-0305-6. PubMed PMID: 25881321; PubMed Central PMCID: PMC4490667. Accessed September 2016.

Teing, L. 2007. Systematic Review Made Simple for Nurses. SGH Proceedings, 16 (2) 105 http://www.utc.edu/nursing/pdfs/classes/4410/systematic-review-made-simple.pdf Accessed September 2016

The Hospital for Sick Children affiliated with the University of Toronto (www.sickkids.ca/default.asp) http://coinnurses.org/resources-3/position-statements/

Tollison, C. David. Handbook of chronic pain management, Williams and Wilkins, Baltimore USA, 1989.

Twycross, Alison, Dowden, Stephanie, and Bruce, Liz, eds. Managing Pain in Children: A Clinical Guide. Hoboken, NJ, USA: Wiley-Blackwell, 2009. ProQuest ebrary. Web. 28 December 2015. Accessed September 2016

Tyler, Donald C., Eliot J Krane. Pediatric pain, Raven Press, Ltd. New York, 1990.

Vetlesen, Arne. A Philosophy of Pain. London, GB: Reaktion Books, 2009. ProQuest ebrary. Web. 15 September 2016.

Wilson S, Ramelet A, Zuiderduyn S. Research priorities for nursing care of infants, children and adolescents: a West Australian Delphi study. Journal of Clinical Nursing [serial online]. July 2010; 19(13/14):1919-1928. Available from: CINAHL with Full Text, Ipswich, MA. Accessed September 20, 2016.

Tables

Appendix 1

Data Extraction Form

Authors, Year	Title	Level of Evidence (Johns Hopkins)	Aim	Conclusions
Arias, M. C. C. and Guinsburg, R. (2012)	Differences Between Uni- and Multi-dimensional Scales for Assessing Pain in Term Newborn Infants at the Bedside	Experimental Study, Level I Quality A	To assess the level of agreement between behavioral and multidimensional pain assessment scales in term newborn infants undergoing an acute nociceptive stimulus.	Behavioral scales Neonatal Facial Coding System and the Behavioral Indicators of Infant Pain are more sensitive for pain indication on a neonate than the multidimensional Premature Pain Profile Scale.
Suraseranivongse, S., Kaosaard, R., Intakong, P., Pornsiriprasert, S., Karnchana, Y., Kaopinpruck, J. and Sangjeen, K. (2006)	A Comparison of Postoperative Pain in Neonates	Experimental Study, Level I Quality A	To cross-validate three pain scales: CRIES, CHIPPS, and NIPS	Concurrent validity was established from the positive correlations among all scales. All scales generated very good agreement with routine decisions to treat post-op pain.
Holsti, L. and Grunau, R. E. (2007)	Initial Validation of the Behavioral Indicators of Infant Pain	Experimental Study, Level I Quality A	To design a unidimensional scale that would combine comparatively specific, individual, and behavioral indicators for assessing acute pain in infants.	The BIIP scale is reliable in determining pain in pre-term infants.

Slater, R., Cantarella, A., Franck, L. Meek, J. and Fitzgerald, M. (2008)	How Well Do Clinical Pain Assessment Tools Reflect Pain in Infants	Experimental Study, Level I Quality B	To assess how cortical hemodynamic activity correlates with pain indicated on a pain infant profile assessment tool.	Facial expression correlated best with cortical activity, however, in some cases cortical pain responses were still recorded in some infants who did not display a change in facial expressions.
Cignacco, E., Hamers, J., van Lingen, R.A., Stoffel, L., Büchi, S., Müller, R., Schütz, N., Zimmermann, L. and Nelle, M. (2009)	Neonatal Procedural Pain Exposure and Pain Management in Ventilated Preterm Infants During the First 14 Days of Life	Experimental Study, Level I Quality A	To present the type and frequency of procedures, and to determine the amount of analgesia given in 2 Swiss NICUs.	Total number of procedures: 38, 626. Of which 75.6% were considered painful. 99.2% received either non-pharmacological and/or pharmacological agents. 70.8% received orally administered glucose as preemptive analgesia.

Mekkaoui, N., Issef, I., Kabiri, M. and Barkat, A. (2012)	Analgesic Effect of 30% Glucose, Milk and Non-Nutritive Sucking in Neonates	Experimental Study, Level I Quality A	To appraise non-pharmacological management practices concerning pain brought about by blood sampling in newborns in a Moroccan NICU.	Oral administration of 30% glucose while sucking gave better control of pain.
Czarnecki, M. L., Hainsworth, K., Simpson, P. M., Arca, M. J., Uhing, M. R., Varadarajan, J. and Weisman, S. J. (2014)	Is There an Alternative to Continuous Opioid Infusion for Neonatal Pain Control? A Preliminary Report of Parent/Nurse Controlled Analgesia in the NICU	Experimental Study, Level I Quality B	To compare infants treated with morphine PNCA to infants treated with fentanyl COI in a Midwest U.S. hospital, measuring opioid consumption, pain scores, adverse events frequency and ensuing methadone use.	The morphine PNCA infants received less opioid than the fentanyl COI infants, both groups had low daily average pain scores, still, median scores differed, no telling difference in adverse events frequency nor methadone use.
Stevens, B., Riahi, S., Cardoso, R., Ballantyne, M., Yamada, J., Beyene, J., Breau, L., Camfield, C., Finley, G. A., Franck, L., Gibbins, S., Howlett, A.,	The Influence of Context on Pain Practices in the NICU: Perceptions of Health Care Professionals	Qualitative Study, Level III Quality A	To explore the health care professionals' perceptions of pain practices in NICU.	Three themes stood out: (a) collaboration and support for evidence-based practice, (b) risk to autonomous decision making, and (c) intricacy in care delivery.

McGrath, P. J., McKeever, P., O'Brien, K. and Ohlsson, A (2011)				
Jeong, I. S., Park, S. M., Lee, J. M., Choi, Y. J. and Lee, J. (2014)	Perceptions on Pain Management Among Korean Nurses in Neonatal Intensive Care Units	Qualitative Study, Level III Quality A	To explore the perceptions among nurses of neonatal pain and the associated use of pharmacologic measures (PMs) and non-pharmacologic comfort measures (CMs) in (NICUs).	Korean nurses in the NICU were found to generally underestimate the need of pain relief measures and utilize PMs or CMS.
Asadi-Noghabi, F., Tavassoli-Farahi, M., Yousef, H. And Sadeghi, T. (2014)	Neonate Pain Management: What do Nurses Really Know?	Qualitative Study, Level III Quality B	To assess the knowledge, attitude and performance vis-à-vis pain management by nurses in Bandar Abbas University Hospital NICUs.	Nurses performed low in the assessment, measurement, and relief of pain.
Taddio, A., Shah, V., Wang, J., Parikh, C., Smart,	Usability and Knowledge Testing of Educational Tools About In-	Qualitative Study, Level III	To appraise usability and effectiveness of educational tools about infant vaccination pain management directed to postnatal nurses.	Demonstrated usability and knowledge uptake from a nurse-directed educational pamphlet and video about managing infant vaccination pain.

S., Ipp, M., Riddell, R. P. and Franck, L. (2015)	fant Vaccination Pain Management Directed to Postnatal Nurses	Quality B		
De Melo, G. M., Reboucas, C. B. A., Cardoso, M. V. L. M. L. and Farias, L. M. (2013)	Nursing Team Communication with Regard (to) Pain in Newborns: a descriptive study	Qualitative Study, Level III Quality B	To assess verbal and nonverbal communication of nursing staff with newborns during arterial punctures and calcaneus, from a health promotion standpoint.	Observed nurses practiced effective verbal or nonverbal communication with newborns, which promotes holistic and humane care in the hospital setting, with a focus on health promotion.
Mazur, A., Winnicki, I.R., Sczepanski, T. (2013)	Pain Management in Children	Qualitative Review, Level III Quality B	To discuss the complexities of the measurement of pediatric pain while reviewing the better known pain assessment scales.	Healthcare professionals must recognize that pain treatment and prevention is of high importance even when the child is too young to report their pain
Bellieni, C. V. (2011)	Pain Assessment in Human Fetus and Infants	Qualitative Review, Level III Quality B	To compile from scientific literature on the signals that the fetus and newborns produce which could be indicators of pain.	Indeed possible to decipher pain expressions in the phases of life. The patients' age should not play a factor when deciding to manage pain. Every patient of any age, including infants have that fundamental right.
Holsti, L., Grunau, R. E. and Shany, E. (2011)	Assessing Pain in Preterm Infants in the NICU: Moving to a 'Brain-Oriented' approach	Qualitative Review, Level III	To determine measures of more accurately assessing pain in infants with the use of NIRS and EEG	Improvements in NIRS and EEG technology will allow for a more accurate measurement of cortical somatosensory activation. Although reliable, these technologies will

		Quality B		not replace bedside tools to measure pain without taking into account the full context.
Harrison, T. M. (2010)	Family Centered Pediatric Nursing Care: State of the Science	Qualitative Review, Level III Quality B	To determine the importance of FCC in pediatric nursing care.	Families are receptive and even value the partnership with the health professionals that are caring for their child. Although nurses support this concept, many find it difficult to implement this philosophy in care.
Da Motta, G. C. P. and Cunha, M. L. C. (2014)	Prevention and Non-Pharmacological management of pain in newborns	Qualitative Review, Level III Quality B	To present the main non-pharmacological interventions for the relief of pain in newborns in the NICU	Breastfeeding, oral administration of glucose/sucrose, non-nutritive sucking, skin-to-skin contact, swaddling and facilitated tucking are the available methods of non-pharmacological treatment for pain. NICU staff should have knowledge of these practices and put them to use.
Schiavenato, M. (2008)	Facial Expressions and Pain Assessment in the Pediatric Patient: The Primal Face of Pain	Qualitative Review, Level III Quality B	To examine the role of facial expression in the assessment of pediatric pain through a comparison of tools employing facial expression methodology.	The PFP assessment tool provides an explanation to the utility and deficiency of facial pain scales and facial expression during the assessment of pain. The review found that the assurance of facial expression to assess pain in school-age children is not precise.

Strndas, M. and Fredriksen, S. D. (2015)	Ethical Challenges in Neonatal Intensive Care Nursing	Qualitative Review, Level III Quality B	To determine the types of ethical challenges neonatal nurses face in their daily care of critically ill newborns.	Ethical challenges are encountered during interactions with the neonate's family and with coworkers, finding balance between authority and sensitivity. Findings show that acting in the best interest of the neonate should be of utmost importance.
Wilson, S., Ramelet, A., Zuiderduyn, S. (2016)	Research priorities for nursing care of infants, children and adolescents: a West Australian Delphi study	Qualitative Review, Level III Quality B	To identify research priorities for infant, children and adolescents care at a West Australian children's hospital.	Two important findings: the identification of strategies to reduce medication incidents and the improvement in pain assessment and management.
Hall, R. W. (2012)	Anesthesia and Analgesia in the NICU	Qualitative Review, Level III Quality B	A review of the different pharmacological agents used in the NICU for anesthesia and analgesia.	Placing a protocol treatment plan for the procedures and conditions encountered in the NICU using nonpharmacological and pharmacologic treatment.
Harrison, D., Bueno, M. and Reszel, J. (2014)	Prevention and management of pain and stress in the neonate	Qualitative Review, Level III Quality B	To present a short review of methods used to assess neonatal pain and the ways of managing pain.	Breastfeeding, skin-to-skin care, and sweet solutions are used for procedural pain reduction. Although, there are challenges to using these strategies in the clinical setting.