

Assessment of NICU Nurses' Knowledge Regarding Use of Kangaroo Care for Pain Reduction in Heel Lancing For Premature Neonates in Ksa

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I. Introduction and Background

What does 'premature' mean? The word premature refers to an infant born before 37 weeks gestation. The new-born infant can be classified into three groups; the term infant: an infant born between 37 and 40 weeks gestation; the near-term infant: a neonate born between 34 weeks and 36 weeks gestation; and, extremely premature infant: born before 26 weeks gestation. In addition, the international classification according to infant weight is: low birth weight (LBW): an infant weighing less than 2500g at birth; very low birth weight (VLBW): an infant weighing less than 1500g at birth; and, extremely low birth weight (ELBW): an infant weighing less than 1000g at birth (Gregson and Blacker, 2014).

The bond between parents and their baby creates a unique relationship. This relationship begins during the prenatal period, when the foetus is developing in the mother's uterus, and continues after the birth (Wagg, 2013). 35 years ago, Kangaroo Care (KC), or skin-to-skin contact, was well known, especially in developing countries (Flynn and Leahy-Warren, 2010). It is practised by placing the neonate in an upright position on his/her mother's chest between her breasts, wearing a small hat and nappy (Nirmala, Rekha and Washington, 2006; Marín Gabriel et al., 2009; Takahashi et al., 2011). This approach was first used to reduce neonate morbidity and mortality rates from severe illness (Wagg, 2013). In 1978, KC was adopted in Columbian hospitals primarily due to overcrowding in the neonatal intensive care unit (NICU) and general lack of facilities (Charpak and Gabriel Ruiz-Peláez, 2007). Paediatricians encouraged mothers to hold their babies who were born prematurely or had low birth weight (LBW), as skin-to-skin contact immediately after birth helps babies stay calm, keeps their body warm, maintains their heart rate and respiration rate, and also helps decrease stress hormone levels. In addition, it helps initiate breastfeeding by stimulating the release of prolactin and oxytocin hormones that are important for breastfeeding (United Nations Children's Fund [UNICEF], 2013).

Subsequently, during the following 30 years, the KC experience was reviewed and trialled in other developing countries. One of the more significant findings of the research trials is evidence that KC decreases the risk of sepsis and mortality rates in premature and low birth weight neonates. Furthermore, it increases the infant's growth and development, stimulates breastfeeding, and mother–infant bonding. The World Health Organization (WHO), 2010, has now issued practical guidelines to introduce and encourage KC in other countries to create awareness and to educate citizens in the practice as well as providing resources.

The aim of the guidelines provided by Family Centred Care (FCC) in the UNICEF Baby-Friendly Hospital Initiative (BFHI) is support for families in caring for their baby through education of the benefits of KC and positive touch (PT) by the neonatal nurses. However, infants who are admitted into the NICU because of prematurity or LBW have difficulty receiving physical contact from their parents because of the incubator. Premature or LBW infants are exposed to 10 to 16 painful procedures (Mosayebi et al., 2014; Pagni, Kellar, and Rood, 2019); the most painful procedure that premature infants can experience in the NICU is heel lancing (Johnston et al., 2019). Early exposure to pain and stress can cause significant complications, which can have immediate or long-term effects. The effects can be physical, such as an increased risk of developing intravascular haemorrhage (IVH), or can have emotional or cognitive impacts. Therefore, nurses need to use effective interventions that can reduce pain during these procedures, especially heel lancing in preterm infants (Pagni, Kellar, and Rood, 2019).

Preterm neonates spend several weeks or months of their lives in the NICU. During this time, he or she experiences many invasive procedures without analgesics or pain killers. Researchers have studied the effect of KC intervention on pain in preterm infants during heel lancing and have compared this with standard care, which is to position the premature infant in the prone position during the procedure. This procedure begins when

the nurse applies a warmer on the infant's heel after which she punctures his/her heel with a lancet to draw the blood sample (Akcan, Yiğit, and Atıcı, 2009). In addition, the nurse assesses the pain before, during and after the procedure to identify, review and critically appraise the evidence from the experiment that KC is effective in reducing pain during the heel prick procedure (Mosayebi et al., 2014; Johnston et al., 2019 and Pagni, Kellar, and Rood, 2019).

There are a number of barriers to implementing KC including heavy staff workload, and insufficient education or experience. In addition, lack of organizational support and absence of clear protocols are obstacles to implementation. However, the most significant barriers to KC are irregular attendance of mothers in the NICU, and their feelings and fears about cuddling their infants. Some barriers relate to the lack of nurses' information, knowledge and experience of KC; for example, how to start and when, the correct position of the infants, and engaging mothers' involvement through encouragement and support. Therefore, nurses must have confidence in their own abilities and judgement to take the right action at the right time if any critical issues occur (Mayers and Hendricks-Munoz, 2014).

- Premature neonates experience higher levels of pain during the heel lancing prick procedure because of the lack of practice in Kangaroo Mother Care.

The purpose of this study is to assess and evaluate NICU nurses' knowledge, perception and beliefs about the effectiveness of KC during painful procedures, especially heel prick.

II. Literature Review

Premature neonates who need neonatal intensive care in the NICU and health care management are exposed to many painful procedures in the first two weeks of their life (Chidambaram et al., 2013). The procedures that neonates can be exposed to in the NICU range from minor, temporary but painful procedures, such as heel lancing, to more invasive procedures, such as respiratory intubation. During hospitalization, they may also experience acute and prolonged pain related to the healing process from different types of procedures, for instance chest tube insertion (Martinez, 2016). It is vital, therefore, to apply appropriate care and management of pain in premature neonates from two aspects; these are the ethical angle; and improving short-term and long-term outcomes. They have been tried both pharmacologic and non-pharmacologic treatment to reduce premature neonates' pain. Kangaroo care (KC), also known as skin-to-skin contact (SSC), can promote autonomic stability and increased bonding between a mother and her baby, and can also reduce pain (Chidambaram et al., 2013).

A few recent studies have been conducted on the effectiveness of KC in reducing pain among premature infants during the heel prick procedure. However, few studies have been conducted on NICU nurses' knowledge about the effects of KC in reducing pain during the heel prick. All preterm neonates admitted to the NICU are routinely exposed to several invasive therapeutic and diagnostic procedures that cause pain. The most painful procedure that neonates can experience in the NICU is the heel lancing procedure, which can also cause tissue damage. Premature new-borns undergo between 10 and 16 painful procedures per day, with the repeated heel prick accounting for between 55% and 86% (Mosayebi et al., 2014; Younis and Mahmoud, 2016).

The nervous system of the foetus begins migration at seven weeks of gestation and is fully developed at the twentieth week of gestation, and at 28 weeks gestation the captive nerve endings are equal to those of an adult. Thus, premature neonates are able to feel pain and remember it (Mosayebi et al., 2014 and Bhandekar and Malik, 2018).

A major public health concern worldwide is pain. Reducing pain regardless of age is a human right. Pain not only includes physiological effects, such as changes in vital signs, but also metabolic effects, such as release of stress hormones. Preterm neonates can, therefore, experience emotional and behavioural issues during childhood related to repetitive pain stimuli (Mosayebi et al., 2014; Younis and Mahmoud, 2016 and Bhandekar and Malik, 2018). Health care givers are responsible for providing appropriate interventions to preterm neonates to reduce their pain during invasive procedures and make the experience more tolerable (Martinez, 2016). After the foetal period, the first sense that develops between the new-born and his/her mother is contact stimulation. Thus, KC is effective in reducing pain, not only through touch stimulation but also through olfactory and auditory stimuli (Seo, Lee and Ahn, 2016).

The search strategy of the current literature was conducted using a database system. These were: the DCU library database, PubMed, Google Scholar and CINAHL. The inclusion criteria for the search included: kangaroo care and skin-to-skin contact as a nonpharmacologic intervention, premature neonates, which are those babies born after 25 weeks gestation and less than 37 weeks gestation, and, published after 2010. The keywords used to search were: preterm neonates, kangaroo care, kangaroo mother care effect, skin-to-skin contact, preterm pain, heel prick, non-pharmacological intervention, reduce pain, NICU nurses' knowledge and perception, mothers' perceptions, NICU nurses' beliefs and attitudes, and KC barriers and enablers.

This review of the literature includes thirteen articles. The selected studies explore and illustrate the effectiveness of KC intervention in reducing pain during heel lancing, and compare KC management with

alternative non-pharmacological interventions. Barriers and enablers to applying KC among mothers, and NICU nurses' perceptions, together with NICU nurses' knowledge about the KC effects in reading pain during heel lancing, are included. Two crossover trial studies, two randomized control trial studies, two quasi-experimental design studies, two systemic review studies, two quantitative descriptive design studies using questionnaires, one qualitative study, one single-blind crossover randomized clinical trial study, one cross-sectional descriptive survey design study, and one single centre prospective study and one prospective cohort study were included in the research and synthesis.

Two studies focused on the impact and effectiveness of KC in reducing pain level during heel prick in the NICU at the tertiary centre; they used the crossover trial. In addition, they used the premature infant pain profile (PIPP) as the assessment tool and measurement. This tool measures physiological response, which includes: heart rate, respiratory rate and oxygen saturation; and behavioural response, which includes: facial expressions, such as forehead and eyebrow frowns. PIPP scores range from 0 to 21. The highest PIPP score indicates that the preterm neonate is exposed to significant pain. If the PIPP score is more than 12, it indicates moderate to severe pain and that the premature neonate is in need of pharmacological treatment. Any PIPP scores between 7 and 12 points is considered as mild pain, indicating that the neonate needs non-pharmacological therapy (Chidambaram et al., 2013 and Seo, Lee and Ahn, 2016).

In the first study, the specific procedure implemented was the heel prick for blood glucose monitoring. Fifty premature neonates with a gestational age of between 32 and 36 weeks, weighing less than 2.5kgs, and haemodynamically stable were selected as participants for KC; fifty other premature neonates with similar criteria were selected as participants for the control group in the study. In both groups of the premature neonates, the PIPP assessment tool was used to assess and evaluate behavioural and physiological response to pain. The initial PIPP assessment was conducted fifteen minutes after establishing KC and before heel lancing. The assessment was then repeated at fifteen minutes after the procedure, and then again at thirty minutes after the procedure, and was similarly conducted on the control group as well. In this experiment all neonates were pricked by the same nurse; she used the same needle size, which was gauge 26. The preterm neonates were evaluated by the first and second authors, using the PIPP tools for assessment (Chidambaram et al., 2013).

In 2016, researchers from South Korea repeated the same experiment using a crossover trial to prove the effectiveness of KC in reducing pain during heel lancing, although the number of participants of premature neonates was lower than in the previous study but used similar criteria. In this study to assess preterm neonates' responses after starting KC and before the heel prick the timing was ten minutes, with three minutes during and after lancing (Seo, Lee and Ahn, 2016). However, the researchers in both studies reached the same result, which was the PIPP scores for the KC group were significantly lower than those of the control group. In the first study, the authors reported that the mean PIPP scores at 15 and 30 minutes after heel lancing for the KC group were 4.33 and 3.84, respectively. The mean PIPP scores for the control groups were 5.76 at 15 minutes and 5.24 at 30 minutes, which were significantly higher than KC. (Chidambaram et al., 2013).

Furthermore, in the second study, the researchers found that the mean PIPP scores for the KC group were 4.162 and 6.363 for the control group during the heel prick. At 1 and 2 minutes after heel lancing the PIPP scores were 135 for the KC group, and 152 for the control group, demonstrating that the PIPP scores for KC were significantly lower than for the control group. Additionally, in this study, they measured the duration of crying as an indicator for pain in premature neonates, and identified that the crying period was longer in the control group than in the KC group (Seo, Lee and Ahn, 2016).

In a similar study, a single blind crossover randomized clinical trial, was conducted to assess the effects of KC for a short period of 15 minutes on pain severity caused by heel prick procedure in premature neonate admitted to the NICU. 64 preterm neonates participated in the study, having been selected according to specific criteria, such as gestational age between 30 and 36 weeks, in a stable condition without the need for respiratory assistance, and having no congenital deformities. The researchers divided the participants into two groups; the KC group, who practised skin-to-skin contact with their mothers, and the control group, who received standard care by swaddling and being placed in the prone position inside incubators. Both groups were observed and assessed 15 minutes before and during the heel prick, and then again 2 minutes after sampling using the PIPP tool. The second trial was conducted within four days of the first, with the groups swapping places. An expert who was blinded to the study then analysed the data collected on heart rate and oxygen saturation, which had been recorded and monitored by pulse oximetry. Video recordings were also made to note facial expressions in response to the pain. The result of this study proved the effectiveness of KC in reducing pain during the heel prick, according to the significant difference in PIPP scores between the KC group and the incubator care group (Mosayebi et al., 2014).

Another study conducted on neonates in two hospitals in Egypt aimed to assess and evaluate the effects of KC on physiological measurements and responses to pain during the heel prick procedure in premature neonates. The researchers used a quasi-experimental design in this study. Forty-five premature neonates were participants in this study; twenty-five participants were from Menoufia University Hospital and the remainder from the Paediatric Hospital Cairo University, which is considered a conventional sample. The forty-five

premature neonates from the two settings had the same inclusion criteria, namely: gestational age between 30 and 36 weeks, weight ranging from 1.5 kgs to 2.5 kgs, medically stable, free from congenital abnormalities, and not having received analgesics within the previous 24 hours. In this study, the researchers compared the physiological response of the forty-five preterm neonates over two days; the first day with the incubator group and the second day with the KC group in order that a comparison could be made for the same baby twice in the two groups. The total time for the procedure was thirty minutes; ten minutes for KC, five minutes during the heel prick, ten minutes after the heel prick and the final five minutes to record the measurements. The incubator group underwent the same procedure. The results show a significant difference in pain response of premature neonates between the two groups. The KC group result revealed a mild to moderate pain response (40% to 55.6%) and the incubator group revealed a severe pain response (73.3%), which shows that KC has a significant positive impact on preterm neonates' response to pain (Younis and Mahmoud, 2016).

A recent study was conducted in the NICU at a tertiary teaching hospital in India by Bhandekar and Malik in 2018. The study purpose was to evaluate the effectiveness of KC versus conventional care in reducing pain in premature neonates during minor procedures, using a prospective study design. Eighty preterm infants who were participants in this study were between 28 to 37 weeks gestation, weighed less than 2000 grams, were haemodynamically stable, and needed blood sampling. The participants were divided into two groups; the KC group and the control group. The assessment was conducted before sampling by one minute over thirty seconds using the PIPP tool. The blood was then collected by the resident paediatric expert, who used gauge 24 for extraction of blood for both groups. The measurements were taken about thirty minutes before heel prick procedure, then during the heel lancing, and at 1 minute, 3 minutes and 5 minutes after the heel prick procedure for both the KC group and the control group. By the end of the study, the researchers found that the mean PIPP score for the control group was significantly higher compared with that of the KC group. Therefore, KC is a non-pharmacological intervention that can be used for pain reduction during the heel prick, has low cost, and is safe for premature neonates and their parents (Bhandekar and Malik, 2018).

Another recent study, conducted in Saudi Arabia by Albishry et al. in 2018, took a slightly different approach using the quasi-experimental design. The study took place in the NICU at the Maternity and Children's Hospital (MCH) in Jeddah city. The purpose of this research was to assess the effectiveness of KC on preterm neonates with health progression in the NICU. Thirty premature neonates were selected to be participants in this study according to specific criteria including gestational age between 28 and 36 weeks, and preterm neonates weighing more than 1000g. The KC intervention was applied to medically stable infants within the first 48 hours to 5 days after birth. The study consisted of two phases; the aim of the first phase was to evaluate and educate NICU nurses about the effectiveness of KC. The nurses were randomly selected, and those who agreed to participate in the study were provided with a special training programme, which included lectures, workshops and handout materials. A competency checklist was distributed to the nurses at the end of the education programme for evaluation. In the second phase, mothers of preterm neonates who fit into the criteria were approached. KC intervention was practised for thirty minutes during the procedure and the nurses measured the premature neonates' physical and behavioural responses before and after the procedures. Lately, the researchers were calculating the length of stay in NICU for premature neonates. The researchers found that the premature babies who were provided with KC during the procedures had a stable health condition, and gained weight faster, but they had a longer period of hospitalization compared to the global studies (Albishry, 2018).

There are many successful non-pharmacological interventions for pain relief in premature neonates, such as using music, breastfeeding and non-nutritive sucking. However, evidence from many studies has proved that KC is more effective in reducing pain during painful procedures compared to alternative non-pharmacological interventions. According to Hannah from the USA, who conducted a systemic review study in 2016 with the aim of reviewing current studies that examined the use of non-pharmacological pain interventions, and improving understanding of the side effects of pain on preterm neonates, only thirteen out of the sixty studies met the inclusion criteria. The research also evaluated the strategies to identify which had the most significant effect on reducing pain in premature neonates and reducing poor health outcomes. The review study compared four non-pharmacological interventions, namely: facilitated tucking care; KC; gentle human touch, and non-nutritive sucking. The result of this study showed that KC is more effective in pain reduction during the heel prick than other alternative interventions and proves that KC does not only affect behavioural response but can also reduce autonomic pain response in premature neonates (Martinez, 2016).

Another recent study on the effects of KC during the heel prick compared with other non-pharmacological interventions was conducted in 2018. In this study, 200 premature neonates admitted to level III in the university affiliated NICU were the participants in a randomized controlled trial, divided into four groups: KC group, KC with music group, music group and control group. The researchers used the PIPP tool and a video recorder to measure the responses. The results showed that the KC group and the KC with music group displayed lower PIPP scores during heel lancing than the control group and the music group. The mean score of the KC group was 7.7, and the KC with music group 8.5 versus 11.5 for the control and music groups.

This result demonstrates that KC has a significant impact on decreasing pain experienced during the heel prick in preterm neonates (Shukla et al., 2018).

There are a number of barriers and enablers to KC intervention. In 2017, Chan et al., 2017. conducted a systemic review on the barriers and enablers to KC implementation. The researchers included eighty-six qualitative studies that focused on the health team's perspectives. The six themes of barriers and enablers that they identified are: Buy in: health care workers need to understand the benefit of KC and accept it; Social support and empowerment: staff need encouragement and help to implement KC in pain management; time: staff need training courses to learn and practise KC in the correct way with confidence; medical concerns: regarding the health condition of premature neonates and their mothers; and finally, is access and cultural norms (Chan et al., 2017).

One of the recent qualitative studies that focused on the barriers and enablers to KC was conducted by Alenchery et al., 2019 in the level III NICU at St. John's Medical College Hospital, which is tertiary care in Bangalore, India. The participants in this study included 19 consultants and resident experts, 14 paediatricians and 8 nurses. The researchers reported that, after reviewing the tapes of the focus group discussions and in-depth interviews, the medical team and nurses had gained important information about KC and its benefits. The major barriers they identified are: shortage of nurses, time constraints, lack of information regarding KC criteria and eligibility, safety and security concerns, unit issues, and adverse events during KC practice (Alenchery et al., 2019).

Two descriptive studies focused on neonatal nurses' knowledge and premature neonates' mothers regarding the use of KC intervention to reduce pain during painful procedures. The first study, conducted in China, explored nurses' knowledge using a quantitative descriptive design through a national survey with 90 items classified into four categories: knowledge, perception, practice and barriers, which was distributed to 861 neonatal nurses. Their aim was to examine current NICU nurses' beliefs, knowledge and practice regarding KC intervention in China. The study result showed that 47.7% of NICU nurses who implemented KC intervention had a better understanding of the benefits of KC and practised it during painful procedures. However, those NICU nurses who did not practise KC displayed some resistance toward implementing KC intervention, and needed more education to improve their knowledge and practice (Zhang et al., 2019).

The second study was a quantitative descriptive study among preterm neonates' mothers' level of knowledge about KC intervention in reducing pain during painful procedures in premature neonates. The study was conducted in Calabar South, a Local Government Area of Cross River State in Nigeria. The survey was answered by 100 participants, who were randomly selected. The researchers found that 24 of the mothers had little awareness of KC and held negative perceptions towards its practice; however, 50 mothers agreed to practise KC and strongly agreed that the health care team plays an important role in increasing awareness and providing information about the benefits of KC to the parents of premature neonates (Alberta, Mary and Jane, 2018).

III. Conceptual Framework

In this proposal, social cognitive theory (SCT), developed by the psychologist Albert Bandura in 1977, will be used as the framework (ThoughtCo, 2019). SCT was chosen because it addresses the cognitive, emotional and behavioural aspects for understanding behavioural changes. Also, the concept of SCT provides different ways for conducting new behavioural research about health education. The SCT framework is a suitable choice for this proposal because it provides design, implementation and evaluation programmes. Moreover, it illustrates how people can develop and maintain a specific behaviour, and provides basic strategies for intervention. SCT is dependent on three factors: environment, people and behaviour. These factors influence each other; in other words, the environment factor includes into social factors, such as family members or colleagues, and the physical environment, such as room size and privacy, which affects a person's behaviour. In addition, the behaviour factor includes self-efficacy, described as part of the interrelationship between the three factors: people, behaviour and environment (ThoughtCo, 2019). In this proposal, there is a correlation between self-efficacy and enhanced skills and increased NICU nurses' knowledge about the effectiveness of KC as pain relief during the heel prick for premature neonates, and improved self confidence in implementing KC as pain management intervention for premature neonates during the heel prick.

SCT is applied according to three factors. Firstly, the people factor: educating NICU nurses and increasing their knowledge about the KC effects on pain reduction during painful procedures, especially the heel prick, and applying the KC intervention during heel lancing to observe neonates' response to pain to prove the effectiveness of KC, will increase the nurses' knowledge and enhance their skills. Thus, NICU nurses' attitude and behaviour will be improved and, consequently, they will provide better quality care with increased self-confidence. Regarding the environmental factor, the NICU is a tertiary unit at KFMC in KSA, which is a suitable setting because it provides good room size, comfortable chairs for mothers, and provides privacy by using partitions. These are considered physical factors; the social factors are better educated nurses. As a result,

the environmental factors influence the NICU nurses' behaviour toward the practice of KC during heel lancing in preterm neonates. Lastly, the correlation between nurses' knowledge and unit facilities will influence the nurses' behaviour, such as self-efficacy.

IV. Methodology

- **Research Design:**

The study purpose is to evaluate the level of NICU nurses' knowledge about implementing KC as a pain management intervention during the heel lancing procedure in preterm neonates. The quantitative approach will use a randomized control experimental design to enable the researcher to identify a sample and generalize to a population. The basic aim of an experimental design is to examine the impact of intervention or treatment from the outcome. It is controlled by dividing the sample into two groups: one receives treatment and the other does not (Creswell, 2014). An electronic survey containing twenty-two items will be sent to the level III NICU nurses at KFMC via their e-mail beforehand and then again three months after attending an in-service education programme on the effectiveness of KC as pain relief during heel lancing in preterm neonates. The programme includes: lectures, training with practice and handout materials, and implementing KC as a pain management intervention for premature neonates during the heel prick. The PIPP tool will be used with participants who answered the pre-test questionnaire to measure the neonates' behavioural and physical responses.

Quantitative methods offer an effective way to measure NICU nurses' knowledge pre- and post-test by analysing the data from the questionnaire and the PIPP tool measures using statistics. The numbers can be described by figures, graphs or tables. Also, this study will use the OpenEpi programme to estimate the number of nurses and the number of premature neonates who are expected to participate in the study (Creswell, 2014).

- **Setting:**

This study will be conducted in the NICU, which has a 44-bed capacity and provides care to all levels of neonatology patients, at King Fahad Medical City (KFMC), which is a tertiary hospital. KFMC opened on 05/10/2004 and is located at the centre of Riyadh city in KSA. It is a medical complexes institution with a total capacity of 1,200 beds. Moreover, it has a number of technical management teams who are highly qualified and efficient, and whose goal is to make KFMC a benchmark in medical care. KFMC receives patients from all regions and all levels of treatment and care. Qualified employees and professionals from different disciplines provide care and assistance to more than 30,000 inpatients and 500,000 outpatients, estimated annually. Additionally, KFMC's priority is to spread information and knowledge, and encourage a culture of development and achievement in the community. KFMC provides opportunities for staff, students and trainees for scholarships at the best international universities. In addition, it hosts a number of international scientific conferences and workshops. KFMC has achieved national recognition, and is accredited by the Central Board of Accreditation of Health Institutions (CBAHI) and Joint Commission International (JCI). KFMC will continue to apply the same approach in order to achieve its goal to be both a regional and global benchmark in specialized medical services (KFMC, 2019).

- **Sample:**

This study will include a convenience sample of around 121 nurses who work in level III NICU at KFMC, and 119 preterm neonates and their mothers. These are estimated numbers of samples calculated by the OpenEpi programme according to the total number of NICU nurses working in KFMC, which is 175. The total number of premature neonates admitted to the NICU in KFMC from the beginning of 2019 until the end of May, 2019 is 171 (KFMC, 2019). The inclusion and exclusion criteria are: NICU nurses who answered the pre-test questionnaire, and are willing to participate in the KC and control condition procedures. For the premature neonates: born between 28 weeks and 36 weeks of gestation, had Apgar scores >7 at 5 minutes of birth, breathing without assistant, without any type of congenital anomalies, without Grade III or IV intra-ventricular haemorrhage or peri-ventricular leukomalacia, and do not need surgery, and have not received paralytic, analgesic, or sedative medications within 48 hours. Unstable ventilated infants with a fraction of inspired oxygen (FiO₂) above 40% will not be eligible for KC, according to the clinical manual guidelines and the staff. The mothers who are in a good health condition and able to hold their premature neonates in the KC position will be eligible to participate in the study. The protocol must be explained to mothers who need to be educated about the two conditions, including the importance to not disturb their new-borns for 15 minutes to have a true baseline state.

- **Consent:**

An informed consent form will be designed and will include all important information, such as risks and benefits, study purpose, methods of the study, time, duration, and place of the study. A statement that allows the participants to change their minds at any time and that their decision will not affect any treatment will be

included. In addition, a brief introduction about the researcher will be provided to enable the NICU nurses to participate voluntarily. Similarly, in order that neonates' parents can decide to participate voluntarily in the study without fear of exposure to risk, to reassure privacy for mothers, and to respect anonymity and confidentiality, no neonates names or medical numbers will appear on the datasheet.

V. Data collection

Data will be collected by means of a questionnaire and PIPP tool measurements. The questionnaire contains twenty-two multiple choice items (see Appendix A). The questions start by collecting demographic data including: age, gender, nationality, ethnicity, position, qualifications or education level, and experience, to report reliability or validity, and how the perceptions of nurses affect care provision between junior and senior staff. This is followed by general information about KC, after which the benefits of KC will be explained, and finally, their knowledge of the effectiveness of KC in reducing pain during the heel prick will be gathered. This questionnaire was developed by the researcher and revised by a NICU consultant. The questionnaire will be used pre- and post- attending the education programme which include: two to three lectures per year, two hours per lecture and delivered by PowerPoint presentation and video and given by NIDCAP professionals. And KC intervention to assess level III NICU nurses' knowledge about and attitudes toward the effects of KC as a pain management intervention, and how frequently they use KC during invasive procedures, especially heel lancing, as pain relief during the heel prick before and after attending the education programmes. The electronic survey will be distributed to level III NICU nurses through their e-mail. The survey contains twenty-two multiple choices items and is easy for participants to use; they are able to skip a screen, move forwards or backwards, and are unable to submit until all the questions have been answered. Also, participants can only answer the survey once. In this study, privacy will be provided to all participants who can be confident that no names or identification information will be used. All data will be stored with the researcher in a private secured file and will be destroyed after the study is completed and the results will be finalized within a year.

In addition, the PIPP tool will be used to gather and organize the physiological and behavioural responses of premature neonates who participate in the study before the heel lancing procedure in both the KC group and the control group as baseline, and during and after the heel prick procedure in order to recognize the differences between KC and control care during painful procedures.

- **Procedure:**

This will apply to each who undergoes heel prick procedure for blood testing for medical purposes in either the incubator position or in the KC position on admission or within a minimum of 24 hours from admission to a maximum of 14 days' stay in the NICU.

In the KC practice, the premature neonate with diaper-clad will hold upright between his/her mother's breasts, to provide a maximum skin-to-skin contact between mother and her baby. The baby will be covered by a blanket and the mother's clothing. The baby will remain in this position around 15 minutes prior to the heel lancing procedure.

In the control group, the new-born will be placed inside the incubator in a supportive position, and will be swaddled with a soft and warm blanket with heel accessible, around 15 minutes prior to the heel prick procedure. Supine, prone or side lying midline position are options as long as it is supportive and recommended for preterm neonates.

- **The heel lancing procedure:**

1. Assessment of the baseline pain level using PIPP. 1 minute of baseline measurement will be collected at the end of the 15 minutes in both groups.

2. The heel warming phase not more than 1 minute. The heel is then will be swabbed with alcohol and pricked with a lancet. The instant of heel prick is the point of baseline change and will be determined and analysed in 30 seconds up to 1 minute blocks from that instant. An adhesive bandage will be applied to the prick site immediately when all blood that is needed has been procured. At this point will indicate the end of sampling procedure. Return to baseline will then be calculated as the time from adhesive bandage application until baseline heart rate is achieved.

Cardio-respiratory monitoring of heart rate and transcutaneous oxygen saturation of the preterm will be performed throughout the session.

- **Measures:**

The primary outcome of PIPP measurement is to measure the pain including physiological such as, heart rate and behavioural like facial expression. The physiological scores will be calculated depending on heart rate and oxygen saturation changes from the baseline. The scores will be totalled and will range from 0-21. If there are two points different between the conditions will be considered clinically important.

VI. Data Analysis

The descriptive statistics for the survey of twenty-two questions will analyse level III NICU nurses' attitude and knowledge about implementing KC as a pain management intervention during heel lancing for premature neonates, pre- and post- applying the KC procedure and the education programme. A convenience sample will be analysed using the OpenEpi programme to estimate the sample size, which is about 121 nurses and 119 premature neonates. Microsoft Excel will be used to organize the data. For data entry and statistical analysis survey and PIPP measures, the Statistical Package for Social Sciences (SPSS) software version 22.0 will be used. Also, tables will be employed to illustrate the data as appropriate. If the P values are less than 0.05, this will be considered a significant result.

Evaluation

The researcher will compare the PIPP tool measurements and results between KC care and control care before, during, and after the heel prick procedure. Also, NICU nurses' knowledge before and after the in-service education programme, workshop and implementation of KC intervention during the heel prick will be assessed by pre- and post-test survey that will be sent to their e-mail. Finally, the correlation between increased awareness of the effectiveness of KC for pain reduction and implementing KC as a pain management intervention during pain procedure in preterm neonates will be identified.

VII. Discussion

Premature birth is a major cause of neonatal death worldwide. KC has recently become an important development in care provision to preterm neonates (Albishry, 2018).

Usually, premature neonates are admitted into the NICU due to their prematurity and health condition for many weeks, and are exposed to both minor and more invasive painful procedures as part of their care management during their stay. Interventions include orogastric tube or central catheter insertion, venipuncture and endotracheal intubation; however, the most painful procedure is the heel prick for blood test. In fact, often, for most of these procedures no analgesia or adequate pain relief is administered (Bhandekar and Malik, 2018). However, prolonged and repeated exposure to pain and stress have behavioural and physiological effects that can be short-term or long term, and can have negative impacts on the sensory processes, the Hypothalamic-Pituitary-Adrenal (HPA) axis, on neurodevelopment, and on behavioural organization (Chidambaram et al., 2013).

Pharmacological and non-pharmacological measures have been used to reduce and relieve pain in painful procedures. According to the studies and evidence, opioids, oral acetaminophen and topical anaesthetics are not effective in premature neonates and have many side effects. In addition, to date, no studies have focused on their safety in premature neonates. Various non-pharmacological measures are available; for instance, swaddling, pacifier use, rocking, breastfeeding, KC, music, massage and touching. However, there are numerous studies that focus on the efficacy of KC in reducing pain during painful procedures. The researchers conducted a meta-analysis study on the effect of KC on reducing pain response before, during and after the procedure in preterm neonates between 28 and 36 weeks gestation, compared with incubator care or standard care. They found that premature neonates have better outcomes with KC intervention; for example, sepsis, hypothermia and hypoglycaemia rates were reduced, breastfeeding was established earlier, physiological signs improved, and PIPP scores decreased with KC during pain stimuli. PIPP tool is a behavioural measurement for pain in premature neonate and also, for term neonate. The PIPP scores can be range from 0 to 21; a lower score indicates less pain behaviour in the preterm neonates. The PIPP measure was significantly lower after the heel prick in KC than in incubator care. Maintaining the KC position for 20 minutes led to changes in blood cortisol levels in premature neonates and increased the release of beta-endorphins, which reduce stress. Pain response was decreased during deep sleep in premature neonates, which was noted during KC (Bhandekar and Malik, 2018).

In this study, the researcher will assess nurses' knowledge about the effects of KC intervention on pain in preterm neonates during heel lancing, and will compare their knowledge before and after education sessions using pre- and post-test surveys. In addition, the effects of KC management in reducing pain during the heel prick in premature neonates will be evaluated and compared with standard care, which is to position the premature babies in the prone position during the procedure.

This procedure begins when the nurse applies a warmer on the infants' heel after which she punctures his/her heel with a lancet to draw the blood sample (Mosayebi et al., 2014).

119 preterm neonates were selected to participate in the study according to the OpenEpi programme calculation, along with 121 level III NICU nurses. The calculation depended on the number of premature neonates who were under 37 weeks gestation, and were admitted to the NICU in KFMC from the beginning of 2019 to the end of May 2019, which was 171. The total number of NICU nurses was 175. The premature neonates were selected based on specific criteria, which included between 28 and 36 weeks gestation,

haemodynamically stable, and without the need of respiratory assistance. This study's evaluation will be based on the methods used for selecting the participants; the first group will use KC as the intervention, and the second group, the control group, will use standard care. The nurses will also use a measurable and reliable pain scale known as PIPP. In the KC intervention, infants are placed in an upright position between their mothers' breasts with a nappy and head hat only to provide maximum skin-to-skin contact between them; the babies are then covered with a blanket, and, to keep them more secure and warm, they are then wrapped in their mother's clothes. After that, the mothers will be asked to hold their babies in that position for 30 minutes before starting the heel prick procedure, and to try to avoid touching their infant's head with their face during the procedure. In order to keep the study blind, the mothers will be asked to avoid speaking to their infants. On the other hand, in the standard care group, the preterm neonates are placed in the prone position wrapped in a blanket with heel access, and are kept in the same position for 30 minutes before the procedure. This position was selected for two reasons; the first, because it is recommended for premature neonates, and the second, because it has a similar component to KC. The PIPP tool will be used during the heel prick to measure pain in 119 preterm neonates (Mosayebi et al., 2014).

The PIPP tool is a measurable pain scale applicable to full-term and preterm infants. It is composed of seven indicators for pain measurement, of which three are behavioural responses: in the facial expressions, crying and sleep disturbances; two are physical responses: oxygen saturation and heart rate; and the last two are contextual responses: behavioural state and gestational age. Each indicator is scored from 0 to 3, with 21 the maximum score. A lower PIPP score indicates lower pain. In PIPP, the difference of 2 points in the same situation can be considered a significant change (Mosayebi et al., 2014).

The researchers will send an electronic survey of twenty-two items as a pre-test for level III NICU nurses in KFMC through their e-mail about the effects of KC in reducing pain during heel lancing. The result is expected to be low relating to previous study findings. In the second step, in-service education sessions about the effects of KC in reducing pain during the heel prick and painful procedures will be conducted with workshops, after which the nurses will be sent a post-test to re-evaluate their knowledge.

There are many barriers to implementing KC including heavy staff workload and insufficient education or experience. Furthermore, the lack of organizational support and absence of clear protocols are obstacles to implementation (Chan et al., 2017 and Alenchery et al., 2019). However, the most significant barriers to KC are irregular attendance of mothers in the NICU, and their feelings and fears about cuddling their infants. Other barriers include the condition of the infant, discharge time from the NICU and from the hospital, and the lack of follow up with mothers after discharge from hospital. Other factors that can be considered barriers to KC are the NICU environment, service offered, social conditions, and lack of essential equipment. The seriousness of the infant's condition can prevent KC intervention; for instance, where infants are connected to mechanical ventilation on high pulse settings, intercostal catheters or umbilical arterial catheters, or are receiving nitric oxide, as well as infants under surgical conditions or who are immediately post-operative, who require more observation and critical care (Melbourne, 2019). Some barriers relate to the lack of nurses' information, knowledge and experience of KC; for example, how to start and when, the correct position of the infants, and involving mothers through encouragement and support. Therefore, it is essential that nurses have confidence in their own abilities and judgement to take the right action at the right time if any critical issues occur.

In recent years, there has been increasing interest in health promotion; this has been defined as "a process aimed to change social, environmental and economic status to enhance individual and public health" by Naidoo and Wills (2009). To achieve these changes, it is essential to increase awareness and skills within society that enhance individuals' behaviour and empower communities by improving organizational, economic and political status that support health (Green, 2010).

VIII. Conclusion

To sum up, KC was initially implemented in Mozambique but quickly spread throughout developing countries. It was introduced to mothers of premature infants in 1984. Studies conducted in low income countries found that KC not only has significant benefits for premature babies but also for full-term infants. Today, many hospitals worldwide implement KC, or skin-to-skin contact, in NICUs for mothers and their babies, where KC has proved highly beneficial in regulating body temperature and maintaining heart and respiratory rates. Premature neonates are exposed to a number of painful procedures and stress that can affect them physiologically and emotionally. However, although a note of caution has been raised in a recent analysis regarding a potential decrease in oxygen saturation levels, there are significant benefits of KC for parents and their infants. The reviewed studies show that preterm infants receive great benefits from implementing KC before, during, and after the heel lancet procedure, and that it is applicable to many invasive and painful procedures. Also, it is a non-pharmacological intervention and low-cost pain relief.

The most important role of neonatal nurses is to encourage parents to practise skin-to-skin contact in a relaxed and comfortable setting; for example, by providing a comfortable chair, and giving them as much time

as they need. From the outcome of the reviewed evidence, an essential variable: the time and duration of KC, has become clear.

There are many barriers that can affect and prevent KC intervention. Therefore, to promote and improve an infant care programme, especially for premature neonates, action should be taken to address the barriers mentioned above, and increase the duration of KC. It is essential to empower families and staff through educational workshops and training courses in order to increase awareness of the benefits and engender confidence in the practice of KC.

The purpose of this study is to evaluate the level of NICU nurses' knowledge about the impact of KC in reducing pain during heel lancing and painful procedures in KFMC. Given that previous studies show that neonatal nurses' attitude, knowledge and practice of KC is relatively low, the researcher expects that NICU nurses in KFMC will have little knowledge about the effectiveness of KC in reducing pain during painful procedures. However, no data are available as yet because this is only a proposal. Therefore, this study plans to evaluate nurses' knowledge by conducting both a pre- and post- educational programme test. The researcher believes that three to six months of educational programmes and workshops for NICU nurses is an optimal period to increase their awareness of the effects of KC on pain management. Lastly, neonatal nurses must be well trained and have sufficient knowledge and skills to explain this procedure clearly and correctly to parents, and to encourage them to participate in KC.

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Appendix Appendix A

This questioner creates to assess NICU Nurses knowledge about the effectiveness of Kangaroo care in reducing pain during heel prick.

The questionnaire contains twenty-two multiple choice items. The questions start by collecting demographic data including: age, gender, nationality, ethnicity, position, qualifications or education level, and experience, to report reliability or validity, and how the perceptions of nurses affect care provision between junior and senior staff. This is followed by general information about KC, after which the benefits of KC will be explained, and finally, their knowledge of the effectiveness of KC in reducing pain during the heel prick will be gathered.

Demographic Data

- 1.Gender:** a) Male Female
- 2.Age:** a) 24 – 29 b) 30 – 35 c) 36 – 40 d) 41 and above
- 3.Nationality:** a) Arabian b) Asian c) Urbina d) USA
- 4.Ethnicity:** a) Muslim. b) Kristina c) Others...
- 5.Qualifications:** a) Diploma. b) Bachelors c) Master. d) Doctorate
- 6.Position:** a) Staff nurse. b) Charge nurse. c) Nurse manager. Other.....
- 7.Experience:** a) 1 – 5 years. b) 6 – 10 years. c) More than 10 years

8.Did you hear about kangaroo care?

- a) Yes. b) No. c) Not sure.

9.Chose the best definition of kangaroo care?

- a) Continuous and prolong skin-to-skin contact between preterm/ low birth weight babies and their mothers.
- b) Is a special technique between the premature/ low birth weight newborns and their mothers, by maintain continuous and prolong skin- to-skin contact to provide warm and support early breastfeeding.
- c) Skin-to-skin contact between newborn and his mother.

10.Chose the correct position of kangaroo care?

- a) Place the premature neonates between his mother breast in upright position, turn face to the side, with arm and legs flexed.
- b) Place the premature neonates between his mother breast with head in upright position with hyperextend neck to keep air way open.
- c) Place the premature neonates between his mother breast in upright position with arm and legs extended.

11.Who are eligible to practice kangaroo care?

- a) Term and preterm neonates b) preterm neonates only. c) Preterm and low birth weight newborns.

12.Dose kangaroo care has benefit?

- a) Yes. b) No. c) I do not know
- If you answered yes can you mention 4

- 1.....
- 2.....
- 3.....
- 4.....

13. Dose kangaroo care provide warm to premature neonate?

a) Yes. b) No. c) I do not Know.

14. Dose kangaroo care help in improve health outcomes of premature neonate?

a) Yes. b) No. c) I do not Know.

15. Dose kangaroo care help in reduce period of hospitalization of premature neonate?

a) Yes. b) No. c) I do not Know.

16. Dose kangaroo care improve wellbeing of premature neonate?

a) Yes. b) No. c) I do not Know.

17. Dose kangaroo care has impact in reducing premature neonate mortality rate?

a) Yes. b) No. c) I do not Know.

18. Dose kangaroo care help in establish and exclusive breastfeeding?

a) Yes. b) No. c) I do not Know.

19. Dose kangaroo care increase the bond between premature neonate and his/her mother?

a) Yes. b) No. c) I do not Know.

20. Dose kangaroo care has effect in reduce pain during heel prick?

a) Yes b) No. c) I do not know.

If Your answer yes, answer the following questions:

21. How frequent should apply kangaroo care during heel prick procedure?

.....

22. Can be use kangaroo care for other painful procedure as pain relief intervention?

.....

This is the end of survey, Thank you.

Norah Saad Alqaydhi. "Assessment of NICU Nurses' Knowledge Regarding Use of Kangaroo Care for Pain Reduction in Heel Lancing For Premature Neonates in Ksa." *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*, 9(6), 2020, pp. 10-21.