NURSES' JUDGEMENTS OF PAIN INTENSITY IN TERM AND PRETERM NEWBORNS

SUBMITTED BY: CARLA RUTH SHAPIRO

December 1990

A thesis presented to the University of Manitoba
in partial fulfilment of the requirements for
the degree of Master of Nursing

Winnipeg, Manitoba

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BY

CARLA RUTH SHAPIRO

A thesis submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF NURSING

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Carla Ruth Shapiro

DEDICATION

TO MY HUSBAND BARNEY

FOR HIS ENCOURAGEMENT AND SUPPORT.

ABSTRACT

The purpose of this research was to examine nurses' judgements of pain intensity in term and preterm infants, and to explore and describe the cues that are used to assess the possible presence of pain in newborns.

This study utilized a new methodology for assessing nurses' inferential judgements of pain intensity - videotapes of term and preterm newborns accompanied by written vignettes, visual analogue scales, and open-ended questions. Data were collected from a group of 45 N.I.C.U. nurses employed at one large, university affiliated tertiary care hospital in Winnipeg, Canada.

Both parametric and non-parametric analyses revealed significant differences in nurses' pain intensity determinations, with nurses assigning higher scores and rankings to a fullterm group vs. a preterm group. Vocalizations, body movement, and facial expression were the most frequently identified cues reported as indicative of pain in newborns.

This data indicated that nurses' pain intensity judgements are influenced by the vigour and richness of the infant's behavioral response. The premature group were deemed to be suffering less, when in fact both groups had undergone the same noxious procedure. Lack of recognition of pain in premature neonates may result in unnecessary suffering, increased morbidity and mortality for this vulnerable group.

Recommendations for nursing practice, education, and research are made based upon the study results.

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CHAPTER I

INTRODUCTION

Purpose of the Research

The purpose of this research was to examine nurses' judgements of pain intensity in term and preterm infants, and to explore and describe the cues that neonatal nurses use to assess the possible presence of pain in newborns. This type of study has only recently been reported in the literature (Jones, 1989; Pigeon, McGrath, Lawrence, & MacMurry, 1989), and has been identified as an area deserving of further research (Craig & Grunau, 1989).

Recent work in the area of newborn behaviour and development indicates that differences exist between fullterm and preterm infants. Fullterm and preterm infants may therefore behave differently in response to a painful stimulus.

Craig and Grunau (1989) have stated " More work needs to be undertaken in identifying the cues that are salient to particular judges, and the sources of bias that influence judges' attributions of pain to neonates." (p.38). Heightening nurses' awareness of the signs and symptoms of pain and increasing individual appreciation of how personal factors play a role in decision making, may lead to more accurate perceptions by nurses of neonatal pain. This may result in an improved quality of care with decreased suffering, morbidity, as well as the prevention of possible alterations in neural development and subsequent pain perception.

Statement of the Problem

Every day, babies are born who will have to endure pain within the first minutes, hours, days, or months of their lives. Technological advances are enabling infants with life threatening conditions to survive. However, the numerous lifesaving treatments, invasive procedures, and therapies are often accompanied by pain.

Historically, the human newborn was regarded as incapable of experiencing and interpreting pain. This traditional viewpoint was grounded in the belief that the fetus and newborn were neurologically incomplete, lacking the anatomical and/or functional components of pain perception. Current evidence refutes that perspective (Anand & Hickey, 1987). It indicates that pain pathways and cortical centers required for pain perception and transmission are present in the fetus, preterm neonate and fullterm newborn infant. Thus, the concept of nociception (perception by the nerve centers of injurious influences or painful stimuli) applies to the neonate (Anand & Hickey, 1987; Berry & Gregory, 1987; Dale, 1986; Fitzgerald, 1987; McGraw, 1941; Owens, 1984; Owens & Todt, 1984; Richards, 1985; Swafford & Allan, 1968).

The pain experience is composed of several contributing constituents: an event that activates the nervous system and initiates pain sensation; nociception or the perception of a noxious stimulus; cognition, evaluation, or interpetation of pain; and

pain expression, response or behaviour. Pain can be defined as "an unpleasant sensory and emotional experience, associated with actual or potential tissue damage" (International Association for the Study of Pain, 1979, p.250).

Alleviating pain and suffering and providing assistance to those who are helpless and incapable of independent functioning, undoubtedly rank high in clinical nurses' lists of priorities for patient care. Yet, assessing pain is no easy task (Johnson, 1977; Meinhart & McCaffery, 1983).

The measurement of clinical pain is also a difficult problem at best (Stewart, 1977). This is due to the subjective nature of the experience, as well as the limited number of valid and reliable instruments that measure the experience. Pain sensation cannot be directly observed. Therefore, its presence and the nature of a pain experience must be inferred indirectly. Instruments currently available to help measure pain can be classified into three main categories: subjective assessment procedures; behavioral observational procedures; and physiologic measures. Examples of subjective assessment or self-report procedures include the ' McGill Pain Questionnaire' (Melzack, 1975), and ' The Oucher' (Beyer, 1984). These tools focus on the individual's perception of his or her pain experience. Behavioral observational tools in which the investigator rates or quantifies the subjects' pain based upon certain activities or behaviours include ' The Infant Pain Behaviour Rating Scale' (Craig, McMahon, Morrison & Zaskow, 1984), and the ' CHEOPS' scale (McGrath, et al 1985). These instruments focus on the infant's or child's response to a painful event.

Most acute pain states are associated with a pattern of physiological arousal which may include: increase in heart rate, blood pressure, respiratory rate, and muscle tension; diaphoresis; dilated pupils; hyperglycemia; pallor, and a decrease in transcutaneous oxygen tension or oxygen saturation measurements. However, these physiological responses are nonspecific and do not necessarily imply the presence of pain. Because of their heavy dependence upon verbal communication and comprehension, self report tools designed to evaluate pain in adults or children are generally inapplicable to neonates (Beyer & Knapp, 1986; Chapman et al, 1985; Jerrett, 1985; McGrath et al, 1985; McGuire, 1984; Meinhart & McCaffery, 1983; Melzack, 1975; Olsson & Parker, 1987; Stewart, 1977).

The assessment of pain in the premature or critically ill newborn is further complicated by a number of factors. The premature infant or "fetal neonate" is neurodevelopmentally immature in comparison to the full-term newborn (Als, 1986; Fanaroff & Martin, 1983). Thus, the behaviour patterns manifested in response to a stressful or painful stimulus may differ. As Franck (1989) comments " The immature central nervous system has a limited ability to withstand stress, and the absence of response may only indicate the depletion of response capability and not lack of perception" (p. 66). Other factors that make pain assessment in preterm and ill newborns more difficult include: varying gestational age and neurobehavioural organization; alterations in levels of consciousness (i.e. from alert and awake to unconsciousness); and the use of drugs such as neuromuscular blocking agents which provide chemical paralysis, or inotropic agents which support heart rate and blood

pressure. Neonatal nurses must therefore look carefully for means of identifying and quantifying pain suffered by their patients.

Is the concept of pain response in neonates valid? Do newborns merely react reflexively to painful stimuli, or do they in fact communicate to us with a learned behavioral response? Craig and Grunau (1989) state " Pain in the neonate is not exclusively reflexive and should be conceptualized as an experiential state that is variable across time and situations, and subject to influence by the biologic and environmental context in which it occurs" (p. 29). They go on to say that the newborn infant is predisposed to adapt and learn through experience. " Painful events induce a state of attentional arousal, a condition which optimizes learning." (p.34). One could therefore speculate that infants do learn from painful experiences and this will have an impact on subsequent behaviour or response.

While the immediate withdrawal of a limb following a heel lance may be a reflexive reaction to the painful stimulus, complex behavioral patterns such as facial grimacing, gross motor movement, or crying are not. They are discrete expressions of human emotion in response to a noxious stimulus (Izard, Huebner, Risser, McGinnes, & Dougherty, 1980). In her article on infants' responses to painful stimuli, Dale (1986) states that infants use numerous behaviours to communicate their emotional and physical states, but their behaviour in response to painful stimuli has not been well documented. Furthermore, she suggests that nurses may fail to recognize and interpret these behaviours correctly.

A classic study by Baer, Davitz, and Lieb (197O) examined the inferences of professional practitioners with regard to patient communication. As the authors stated: " Through speech and through other behaviours a patient endeavours to communicate distress or pain. Through inferences and interpretations, the practitioner makes a judgement or in other ways reacts to these signals" (p.388). The study found that doctors and nurses inferred less pain than social workers, and all groups inferred more pain from verbal than from nonverbal communications. These results indicate the heavy reliance placed upon direct verbal cues in the assessment of pain. Since pain assessment in infants relies heavily upon behavioral, physiological, and other nonverbal cues, this study by Baer and colleagues has implications related to nurses' judgements of pain in the nonverbal neonate.

The implications are that nurses may attribute less pain to a newborn than to a child or adult, and that the nurses' inferences about pain in neonates may lack validity.

The growth of knowledge about the fetus' neurodevelopment and the newborn's capabilities has led to a focus upon the likely adverse effects of pain in neonates. Many short-term effects of pain can currently be identified. These include physiological, hormonal, metabolic, and biochemical effects, as well as alterations in sleep-wake cycles, interactions with caregivers, and activities of daily living such as feeding and self-repositioning (Anand et al, 1985; Anders & Chalemian, 1974; Brown, 1987; Dixon et al, 1984; Emde et al, 1971; Hindmarsh & Sankaran, 1985).

Animal studies indicate that distorted or inappropriate sensory input during a period of critical brain and nervous system development may pose serious and lasting long-term effects. (Als, 1984; Anders & Zeanah, 1984; Dobbing, 1975; Duffy, Mower, Jensen, & Als, 1984; Fillion & Blass, 1986; Spinelli & Jensen, 1979; Tyson, 1984; Wiesel & Hubel, 1963). For example, studies done with prematurely delivered kittens deprived of normal visual stimulation in one eye resulted in permanent visual impairment in that eye (Wiesel & Hubel, 1963).

Other experimental demonstrations of visual system plasticity have taken the opposite approach and utilized periodic sensory overstimulation rather than conditions of sensory deprivation (Spinelli & Jensen, 1979). These researchers reported that kittens who received mild electrical shocks to one forearm during the first few months of life exhibited anatomical changes. Histologic examination revealed increased dendritic branching in the corresponding area of the cerebral cortex. These data may have direct implications for premature human infants. It may be that repetitive exposure to noxious or painful stimuli in a neurodevelopmentally immature preterm infant can result in permanent alterations in neural development and subsequent pain perception.

A study by Als and her colleagues (1986) has revealed that medical and developmental outcomes of very low birthweight premature infants can be enhanced by individualized nursing care that emphasizes stress reduction. The authors hypothesize that "stress avoidance may improve developmental outcomes by preventing active inhibitions of CNS pathways due to inappropriate inputs during a

highly sensitive period of brain development." (p.1131). Further research in the field of neural plasticity and long-term follow-up studies are needed to ultimately answer this question, but the experimental animal literature and recent work with low birthweight premature infants brings warnings that may have implications for the management of pain in infants.

If exposure to painful stimuli in the neonatal period may result in various adverse effects, then ensuring pain control in these infants could lessen the possibility of these problems. How can we ensure that hospitalized newborns receive effective pain control? Pain management may be considered as a continuum. On one end is the ideal, where administration of analgesics or other pain relief measures are based upon a thorough and consistent assessment of patient cues, clinical problem solving, and evaluation of patient response. On the other extreme is haphazard management, depending on the whim and personality of each individual nurse.

Nurses use various nonpharmacologic measures to manage infant pain. These include repositioning, swaddling, holding and rocking, providing tactile stimulation and pacifiers (D'Apolito, 1984; Franck, 1987). These nursing measures may help lessen mild pain and the short term pain of simple, brief procedures. However, it is questionable whether they can deal effectively with the intense pain resulting from surgery or invasive procedures such as chest tube insertion. Although it is the physician's responsibility to prescribe drugs, it is the nurse who is frequently left to decide how often and when to administer them. In the event the physician does not order analgesia for an infant that the nurse deems to be in pain, it is incumbent upon

the nurse to serve as a patient advocate by effectively communicating her findings, and requesting an analgesic order.

The dilemma of pain--its assessment and management in the newborn --is a matter of vital import to neonatal nurses. Since the relief of pain significantly contributes to the infant's physical and emotional wellbeing, the assessment and management of pain must be considered as a major goal of nursing care in the hospital nurseries.

The purpose of this research was to examine nurses' judgements of pain intensity in term and preterm infants, and to explore and describe the cues that neonatal nurses use to assess the possible presence of pain in newborns. Findings of this study may serve as a basis for future research, and have implications for nursing education. Based upon the results of this study, educational packages can be designed to raise neonatal nurses' awareness of pain assessment and management techniques for newborns. This in turn may serve to improve the quality of nursing care for these infants, promoting their recovery and perhaps future wellbeing.

Conceptual Framework

The conceptual framework for this study is derived from the work of Davitz & Davitz (1981). In their book entitled Inferences of Patients' Pain and Psychological Distress, they state:

" An inference made from observations requires a cognitive process that either explicitly or implicitly takes the following general form: observation of cues; interpretation of these cues in terms of experience of suffering; judgement of other person's suffering." (p.12).

Figure 1 (based on Davitz & Davitz, 1981) presents a schematic illustration of the way in which nurses may infer pain in infants.

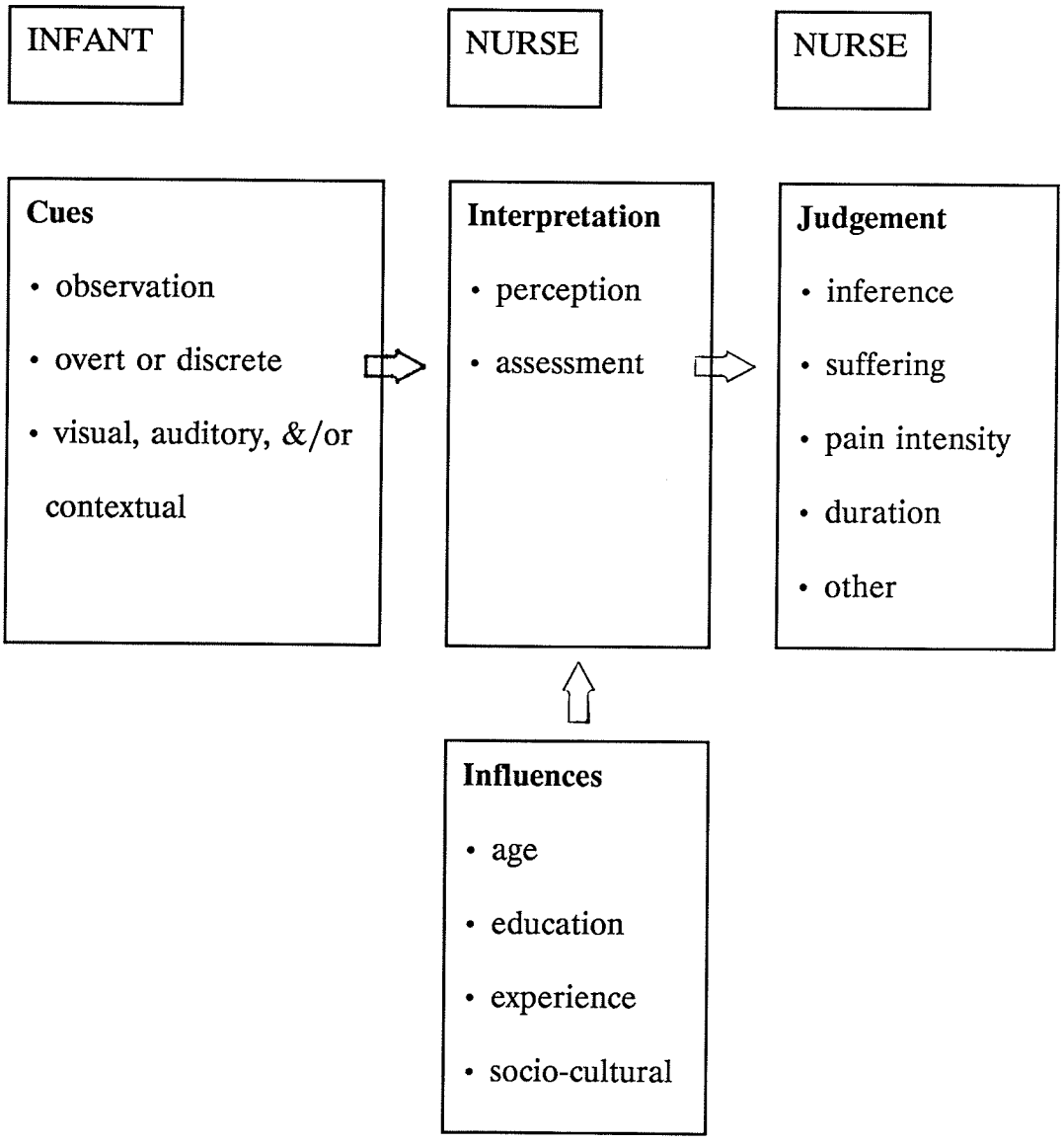

FIGURE 1: NURSES' INFERENCES OF NEWBORN'S PAIN

An unpleasant sensory experience which initiates pain sensation in the infant may be followed by a variety of physiological and/or behavioral responses. These provide the observant nurse with cues as to the infant's state, condition or experience. Some of these cues may be blatantly overt such as crying and facial grimacing. Others may be far more discrete and difficult to discern. Examples of more subtle cues are mottling of the skin, changes in muscle tension, or respiratory pattern. The infant's pain expression thus provides the nurse with visual and auditory cues that intimate its current condition.

Knowledge of context also provides valuable information that is useful in decision making. For example, knowing that the infant has just undergone a surgical procedure can lead one to reasonably assume that pain will generally be present for the first 48 hours. Franck (1989) stated that a nurse must rely on empirical knowledge of noxious stimuli. " What is painful to an adult is painful to an infant unless proven otherwise." (Franck, 1989, p. 66).

Following the observation and perception of available cues, the information is processed and interpreted by the nurse in terms of suffering. Suffering can be defined as the bearing or undergoing of pain, distress, or injury.

The term suffering refers not only to the severity of the pain experience, but also to the degree that the pain disturbs or distresses the patient. According to Meinhart & McCafferey (1983), the assessment of the degree of suffering in the patient requires some understanding of the relationship between the intensity of the pain sensation, the patient's tolerance, and expressive style (or pain behaviour).

The interpretation of the infant's cues in terms of the experience of suffering is influenced by a number of factors. These include the nurse's age, level of education, experience, and sociocultural background (Davitz & Davitz, 1981).

Finally, the nurse makes an inferential judgement about the infant's experience. One of the decisions to be made is that of pain intensity. Pain intensity or severity is just one of the many descriptive qualities or characteristics of pain. Other dimensions of the pain experience to be determined include pain location, duration, quality, and chronology. This study examined pain intensity as it is considered the most difficult characteristic to assess accurately, but is a key factor in providing nursing care.

Johnson (1977) states that pain intensity reflects a combination of both the sensation experienced, and the distress caused by the sensory component. She goes on to say that while pain threshold (the point where pain is perceived) is relatively uniform, the tolerance or response level varies among individuals and within the same individual at different times.

In this study, the investigator examined the cues N.I.C.U. nurses identified as indicating pain in newborns. Potentially relevant cues in newborns include nonverbal behaviours, physiological signs, nature of the infant's health state, and characteristics of the patient such as gestational age. Some of these cues will be overt and easily recognizable, whereas others may be discrete and more difficult to discern.

Craig & Prkachin (1983) state that nonverbal indicators of pain such as crying, facial expression, body posture, and movement are important determinants of observers' judgements of others' distress in natural and clinical environments.

According to these authors, " There is considerable reason to believe that observers, formally trained or otherwise, have success in using nonverbal cues about pain in others, although the precise nature of the cues and the manner in which they are perceived and interpreted are not understood." (p.175).

The interpretation of cues as evidence of suffering will be influenced by the individual nurse's characteristics. Information such as nurses' age, level of education, years of nursing experience, and ethnic background was therefore collected.

The inferential judgements of neonatal suffering were made in this study by having nurses carry out pain intensity ratings both for term and preterm infants. A healthy fullterm newborn may respond to a painful procedure with a full array of easily observable cues. A frail preterm infant undergoing the same procedure may not express his pain with the same vigour, yet may experience the same degree of pain. Do nurses believe that term infants experience more intense pain than preterm infants undergoing the same procedure? This study attempted to answer this question.

Hypotheses

The following hypotheses were examined in this descriptive study:

Hypothesis #1.

There is no difference in nurses' pain intensity ratings between term and preterm infants undergoing the same procedure.

Hypothesis #2.

There is no difference in the cues identified by N.I.C.U. nurses as indicating pain in term versus preterm infants.

Definition of Terms

1. pain intensity - a characteristic of pain that reflects the relative strength or severity of the noxious stimulus.
2. term infant - a newborn infant of 37 - 40 weeks gestation.
3. preterm infant - a newborn infant of less than 37 weeks gestation.
4. cues - any stimulus or signal that guides behaviour.
5. N.I.C.U. nurse - a registered nurse who is employed in a neonatal intensive care unit in a tertiary care centre.

Summary

The purpose of this study was to examine nurses' judgements of pain intensity in term and preterm infants, and to explore and describe the cues that neonatal nurses use to assess the possible presence of pain in newborns. The rationale for conducting this study arose from a lack of knowledge about this topic, which had recently been identified in the literature as an area deserving further research. The assessment and measurement of pain in this population poses a particular problem to nurses due to the subjective nature of the experience and the lack of a valid and reliable instrument to measure pain in this age group.

Differences in levels of neurodevelopment in preterm infants and variation in response capacity further complicate the nurse's task. Many short-term effects of pain on the newborn have been identified, and there is some cause for concern as to possible long-term effects as well.

The study was guided by a conceptual framework derived from the work of Davitz & Davitz (1981), which examined nurses' inferences of patient's pain and psychological distress. This study focused specifically on the pain experience of hospitalized neonates, both fullterm and preterm.

If the indicators of pain in newborns can be clearly identified, this information can be utilized in the development of a thorough and standardized assessment framework. This would be of value in assisting nurses in working towards their goal of achieving optimal patient comfort and wellbeing. The next chapter will review related research.

CHAPTER II:

Literature Review

Pain has always plagued mankind, but significant pain research has only been pursued within the past two decades (McCaffery & Beebe, 1989; Taylor, 1987). According to McCaffrey & Beebe, the study of pain was not seriously pursued until the introduction of the Gate Control Theory by Melzack and Wall in 1965. Since that time, pain control has become a priority for health care professionals of many disciplines and progress in the field of algology (the study of pain) has occurred. This is reflected by the founding of professional organizations such as The International Association for the Study of Pain (IASP) in 1974, and the publication of journals devoted specifically to pain management and research. Such publications include The Journal of Pain and Symptom Management, and Pain.

Although there is now a sizeable body of literature on the assessment and management of pain in adults (and to a lesser degree in children), there was scarcely any literature on the subject of pain and the neonate until the late 198O's. The first International Symposium on Pediatric Pain took place in Seattle, Washington in July 1988. A consensus development conference on pain sponsored by the National Institute of Health (NIH) in May 1986 noted deficiencies in the clinical management of pain. In particular, they referred to the problems of undermedication of patients, (especially children) and inadequate education of health professionals (Engber, 1986).

A computerized search of the nursing, medical, and psychological literature from 198O until 1990 found few references on the topic of pain in infancy. Nursing conferences geared to providing continuing education to neonatal nurses have only recently begun to include presentations devoted to the topic of pain in the neonate. Unpublished studies about pain in infancy including a masters thesis and preliminary reports of recent research were located by this investigator through personal communications and correspondence with several active researchers in the field (both in Canada & the U.S.A.).

Pain in Adults

Pain specialists generally classify pain into two major categories - acute and chronic (McCaffery & Beebe, 1989). Acute pain may be defined as pain that subsides as healing takes place, with a duration of less than six months. It may be of sudden or gradual onset, and of any intensity from mild to severe. Examples of acute pain include postsurgical pain, labour pain, a fractured bone, or the pain of a myocardial infarction.

Chronic pain can be defined as pain that exists over a prolonged period of time, usually greater than six months. Examples of conditions that may result in chronic pain include rheumatoid arthritis, severe burns, and cancer.

Nursing contributions to pain research can be categorized under several broad headings - assessment and evaluation, measurement methods and instruments, and management or pain control. Within each of these broad categories, nursing research on pain in adults considers both acute and chronic pain conditions.

The assessment of pain in adults has been well described by numerous authors (Camp, 1988; Camp & O'Sullivan, 1987; Fridh, Kopare, Gaston-Johansson, & Norvell, 1988; Halferns, Evers, & Abu-Saad, 1990; McCaffrey & Beebe, 1989; Meinhart & McCaffery, 1983). Some research has considered nurses' assessments of pain and compared them to the patients' own perceptions (Camp, 1988; Camp & O'Sullivan, 1987). A study by Camp & O'Sullivan (1987) examined 84 nurse-patient dyads to obtain descriptions of pain from medical, surgical, and oncology patients. These descriptions were then compared with the documented pain assessment recorded by the nurse caring for each patient. Neither the descriptions of pain nor the amount of information documented about that pain differed significantly across the three groups. However the researchers found that for each of the three groups, nurses reported significantly less than 50% of the descriptive content that patients provided (i.e. location, quality, pattern, etc.)

In a later study that focused specifically on cancer patients, Camp (1988) again attempted to gauge agreement between the assessment of pain as recorded by nurses and the perceptions of patients. Patient interviews and chart audits of the nurses' notes of 30 nurse-patient dyads revealed that the nurses' documentations were not always in agreement with the cancer patients' descriptions. Both of these studies found that disparities exist between nurses' documented assessments of their patients' pain, and the patients' own descriptions.

The determinants of pain assessment by nurses were examined in a recent study by Halferns, Evers, & Abu-Saad (1990). In this quasi-experimental study, pain

assessment by nurses and patient perception were studied in relation to patient and nurse characteristics. Nurses were randomly assigned to one of 24 descriptions of a hypothetical patient. These vignettes were varied by duration of pain, presence of physical pathology, nature of the pain, and signs of depression. Two hundred and sixteen nurses in the Netherlands were asked to rate the intensity of the patient's pain on a 10-point scale, and then judge the 'sort of person this patient is' on a 7 point Likert scale of personality traits.

Results showed that Dutch nurses attributed more pain to the hypothetical patient when physical pathology and symptoms of depression were present. The duration and type of pain did not appear to play a role in the inferences of patients' pain in this study. Finally, nursing experience was found to be important in pain assessment, with first year nursing students attributing less pain than senior students and registered nurses.

One prospective study attempted to determine the factors associated with more intense labour pain (Fridh, Kopare, Gaston-Johansson, & Norvell, 1988). Demographic data were collected from a convenience sample of 50 healthy primigravidas and 88 healthy multiparas. Pain intensity was rated using a visual analogue scale at three different phases of labour.

These researchers reported that a number of factors correlated with higher intensity of pain in labour. Some of the factors found to be associated with more intense labour pain in this study included parity, younger age, less education, and a spouse with negative or indifferent feelings toward the pregnancy.

A number of studies have evaluated pain measurement methods and instruments (Carr, 1990; Davis, 1989; Gaston-Johansson & Asklund- Gustafsson, 1985; Melzack, 1975). In a recent study of patients' expectations and experiences with postoperative pain, Carr (1990) utilized a visual analogue scale to measure 21 patients' pain, pre- and post-operatively. A patient questionnaire further explored the pain experience, and a review of all analgesia prescribed versus actually given was also undertaken. A significant difference between preoperative expectations of pain and postoperative experiences were found. The results confirm that postoperative pain is poorly controlled, and hospitalized patients fail to receive adequate pain relief.

The development and evaluation of instruments to assist with the measurement of chronic pain experience have been reported (Davis, 1989). Davis (1989) reported on the development and testing of a new instrument for the measurement of chronic pain - the Chronic Pain Experience Instrument (CPEI). When tested on a group of 160 patients with rheumatic disease, the CPEI demonstrated high internal consistency, adequate stability, and moderate construct validity. The researcher suggested that further testing be done prior to the clinical application of this tool.

Using the McGill Pain Questionnaire (Melzack, 1975), a visual analogue scale, and a pain, ache, hurt questionnaire (developed by the investigator), nurse researchers in Sweden conducted a baseline study for the development of an instrument which separates the pain experience into sensory and affective

components (Gaston-Johansson & Asklund-Gustafsson, 1985). Word descriptors were classified as either sensory (i.e. crushing) or affective (ie. unbearable).

The respondents were asked to rate the intensity of each of the concepts pain, ache, and hurt on a visual analogue scale. They were then given a list of 74 descriptors from the McGill Pain Questionnaire, and asked to select the words which best described each of the three concepts.

The study found that patients, nurses, and nursing students use the same words to describe pain experiences. Words selected to represent the concept pain had a statistically higher intensity than those selected to represent ache or hurt. There are qualitative differences between the concepts of pain, ache, and hurt. The authors suggested that similar studies be carried out in other cultures and languages.

Another area of pain research in adults concerns pain management, methods of pain relief, or control (Daake & Gueldner, 1989; Hargreaves & Lander, 1989; LaFoy & Geden, 1989; Storr, 1988). Research into the effectiveness of a variety of nursing interventions for pain management constitutes the bulk of work in this area.

Some researchers have worked with innovative ways to control postsurgical pain. Daake & Gueldner (1989) studied the effects of pleasant imagery instruction on a group of 32 individuals undergoing elective surgery. The patients were assigned to one of two experimental groups. The intervention group received procedural information and instruction in the use of imagery to control pain. The control group received procedural information only.

Scores on a visual analogue scale and recorded doses of analgesic consumption showed that the patients who used pleasant imagery perceived significantly less pain and consumed less pain medication than did the control group.

Another study (Hargreaves, 1989) examined the effects of transcutaneous electrical nerve stimulation (TENS) on incisional pain. Seventy-five subjects were randomly assigned to one of three groups - TENS, placebo-TENS, or no-treatment control. On the second postoperative day during a routine dressing change, patients were asked to evaluate their pain using a visual analogue scale. Results indicated that the subjects who received TENS reported a significantly lower level of pain after the dressing change than those subjects in either of the other two groups.

Common painful problems of the postpartum period have been studied by some researchers. Prevention of nipple tenderness and breast engorgement in the postpartum period were studied by Storr (1988). Twenty-five patients served as their own controls by preparing one nipple and massaging the breast on one side, but not on the other side. Nipple tenderness and breast engorgement were recorded on 5-point scales. Analysis of the data revealed that tenderness and engorgement were decreased in the prepared, massaged breast.

A repeated measure experimental design was used to assess the effectiveness of a warm versus cold sitz bath (LaFoy & Geden, 1989). Sensation, distress, edema, and hematoma ratings were obtained pre- and posttreatments. Both therapies were found to be effective, with the cold bath being more successful in reducing edema.

In summary, an extensive body of research exists related to the topic of pain in adults. The main content areas of this work are assessment, measurement, and management of pain. Both acute pain and chronic pain conditions have been studied. Research in the area of pain in adults relies heavily upon the self-report method and the patient's ability to communicate verbally. Thus, this body of work is largely inapplicable to neonatal pain.

Pain in Children

The burgeoning interest in the field of pediatric pain is exemplified by the recent publication of two texts devoted specifically to pain in children, (McGrath & Unruh, 1987; Ross & Ross, 1988) as well as an increase in research reports and articles (Beyer & Byers, 1985). Nursing research in the specialized area of pediatric pain, like that in adults, can be categorized under the broad subheadings of assessment, measurement, and management.

The assessment of pain in children is even more challenging than in adults. While the cornerstone of pain assessment in adults is the self-report, children may be reluctant or unable to verbally communicate their pain. Eland & Anderson (1977) found that some children who were capable of providing a self-report of pain hesitated to do so for fear of the consequences. Children may deny the presence of pain when questioned by a nurse, to avoid getting an injection with an analgesic.

Childrens' difficulties in expressing pain may also be due to their level of development, cognitive ability, or verbal capacity. Abu-Saad & Holzmer (1981)

indicated that verbal reports, even with children 9-15 years are insufficient in themselves to provide an accurate pain assessment.

Studies of pain assessment in children have been reported (Atchison, Guerico, & Monaco, 1986; Mills, 1989). Pain, in the pediatric burn patient, nursing assessment and perception were examined in a survey conducted among staff nurses on a children's burn unit (Atchison, Guerico, & Monaco, 1986). Most of the nurses agreed that patients experience pain varying from mild to severe, depending on the type of burn, individual pain threshold, and specific procedures performed on the patient. The majority felt that analgesia was often inadequate, and expressed feelings of helplessness and anxiety when asked how their patient's pain affects them.

Mills (1989) carried out a qualitative study to describe the behaviours of infants and toddlers experiencing acute pain, and the changes in those behaviours over a three year period. Data sources included observation, parent interviews, and chart audits. Three pain behaviour categories were developed - motor movement, communication, and facial expression. The author concluded that predictable changes in pain behaviour occur within infancy and toddlerhood.

Many pediatric pain studies explore the use of various innovative, developmentally appropriate pain assessment tools and seek to evaluate the validity of these instruments. Abu-Saad & Holzmer (1981) used five different instruments in an attempt to determine the concurrent validity of a visual analogue type pain scale in school-aged children. Nurses recorded the frequency of body movements, facial expressions, and vocalizations. These were then correlated with physiological signs

such as pulse rate, blood pressure, respiration rate and chart audits of analgesic administration. The researchers found that the children's subjective responses on the pain scale appeared to correspond to the other objective observable indicators of pain.

Aradine, Beyer, & Tompkins (1988) examined the validity of the 'Oucher'. This instrument was designed to assess children's perceptions of pain intensity. The tool consists of a numerical scale and six corresponding photographs of children's faces. Construct validity was determined by comparing children's postsurgical pain scores before and after receiving analgesia. Scores on two other concurrently administered tools (Hester's Poker Chip Tool and a visual analogue scale) provided further support to the content and construct validity of the 'Oucher'.

Other clinically oriented instruments to measure pain in children have been developed (McGrath et al, 1985; Varni & Thompson, 1985). The Children's Hospital of Eastern Ontario Pain Scale (CHEOPS) is a valid and reliable method of measuring the behavioral component of postoperative pain in young children (McGrath et al, 1985). Six behaviours are observed and scored once every 30 seconds in order to determine a pain rating. Declines in the pain ratings can be observed in response to the administration of analgesic medication.

The Varni/Thompson pediatric pain questionnaire is a multidimensional instrument. A visual analogue scale is used by the child to measure ongoing and worst pain. The child then is asked to select colours to represent different intensities of pain, and indicate the location and severity of his or her pain by colouring on a

body outline. The child is also asked to select words from a list which describe his pain. Finally, parents' opinions about their child's pain experience are solicited. This instrument has recently been tested on a small group of children with chronic musculoskeletal pain from juvenile rheumatoid arthritis and found to provide satisfactory evidence of reliability and validity (Varni, Thompson, & Hanson, 1987).

A number of studies have focused upon different strategies to manage pain in children (Broome & Lillis, 1989; Gedaly-Duff, 1988; Rauen & Ho, 1989). Gedaly-Duff (1988) examined three different means of preparation prior to a dental injection to determine if one method was more effective than the others in reducing young children's pain-distress. Fifty-eight children between the ages of 3-8 years were randomly assigned to either a verbal, verbal-visual, or a control group. Pain-distress reactions were measured using autonomic, observational, and self-report instruments during and after the injection. No significant differences were found in this study among the groups.

Rauen & Ho (1989) studied a group of children and adolescents ranging in age from 10-19 years who received patient-controlled analgesia (PCA) following surgery. PCA is a method of self-analgesia whereby the patient is in control of his or her own pain relief. The use of this method of analgesic administration is based upon the philosophy that the patient is the best judge of his or her own pain experience. The route of PCA administration may vary from oral to IV using a special infusion pump. Patient controlled analgesia was found to be safe, effective, and appropriate for most subjects in this study.

Finally, a recent meta-analysis was conducted by Broome & Lillis (1989) to summarize the overall effects as well as scope of pediatric pain management research. The authors found that the majority of this body of research focused upon the preparation of relatively well children for acute pain experiences of short duration. This report has definite implications for future nursing research, identifying the need for more work to be done on sick children, and those experiencing chronic pain.

In summary, a growing body of research in the area of pain in children exists. A greater emphasis is placed upon the observation of physiological signs and behavioral responses to pain in children than in adults. A number of developmentally appropriate, valid and reliable pain assessment tools for children are described. These instruments still require some level of comprehension and participation by the child. While this body of work comes closer to the area of pain in infants and neonates, it nevertheless is not entirely applicable.

Pain in Neonates

Knowledge about pain within the neonatal population has been relatively limited to date. Current textbooks of pediatrics, neonatology, neonatal nursing, pediatric anesthesia, and pain, make little or no reference to the subject of pain in neonates (Behrman & Vaughn, 1983; Fanaroff & Martin, 1983; Korones, 1981; Smith, 198O; Wall & Melzack, 1984).

This nearly total lack of information can be explained by the traditional scepticism that neonates experience pain, the lack of tools to measure pain in neonates, and ethical constraints against inflicting experimental pain (precisely controlled and delivered non-therapeutic noxious stimulation) to human newborns. According to Owens: " No such studies can be found with infants as subjects since McGraw's work in the early 194O's when she used a pinprick as the noxious stimulus" (Owens, 1984, p. 217).

Since then, researchers have utilized an alternative methodology to study acute pain in infancy - naturalistic observation of babies undergoing painful procedures in the course of routine medical care. The most frequent opportunity to study pain response in full-term male infants is at the time of circumcision (Holve, Bromberger, Groveman, Klauber, Dixon, & Snyder, 1983; Maxwell, Yaster, Wetzel, & Niebyl, 1987; Porter, Miller, & Marshall, 1986; Strang, Gunnar, Snellman, Condon, & Kestenbaum, 1988; Williamson & Williamson, 1983). In one controlled double blind study, Holve and colleagues (1983) compared dorsal penile Xylocaine block, a placebo block, and no block conditions. They found that the dorsal penile block with local anesthetic resulted in a 50% decrease in tachycardia during the procedure and 50% less crying than the other two groups.

Similar findings were reported by Strang and colleagues (1988). In their controlled double-blind study, subjects were also randomly assigned to one of three groups for circumcision - lidocaine injection, saline injection, or no injection. Results revealed that during the procedure,babies in the lidocaine group cried 23% of the

time, while babies in the saline and control groups cried 68% and 71% of the time. The researchers also found that the babies who received an injection, be it local anesthetic or saline, did not cry more than the babies in the no-injection group during an observation period prior to the procedure. This finding is important as some physicians hesitate to use a local anesthetic because they believe that the injection itself causes the infant pain.

The studies of circumcision document the spectre of both behavioral and physiological signs of distress experienced by newborns undergoing this procedure. These include crying, effects on sleep-wake cycles, and changes in physiological variables such as heart rate, blood pressure, transcutaneous oxygenation status, and serum cortisol levels. The benefits of utilizing a local anesthetic (dorsal penile nerve block) for this procedure to reduce behavioral distress, offset the adrenocortical stress response, and decrease pain are also described.

Infant responses to other painful procedures such as heel lance and immunization have also been documented (Fisicelli, Karelitz, Fisicelli, & Cooper 1974; Grunau & Craig, 1987; Harpin & Rutter, 1982; Johnson & Strada, 1986; McGraw, 1941; Owens & Todt, 1984; Rich, Marshall, & Volpe, 1974). Harpin & Rutter (1982) demonstrated that infants at 37 weeks gestation exhibited increased palmar sweating in response to a heel lance. Changes in palmar sweat levels may be a useful non-invasive way to measure pain in neonates. Further research needs to be carried out with infants of various gestational ages to determine the usefulness and validity of this technique.

Owens & Todt (1984) also examined the neonatal response to a heel lance in a group of healthy fullterm infants. These researchers focused upon the variables of heart rate and crying time. Data analysis revealed that infants who received a heel lance reacted consistently with increased heart rates and crying times in comparison to those infants who were exposed to stroking of the heel.

Findings of these studies once again indicate that there are physiological responses to pain in neonates, including changes in heart rate and oxygenation status, an increase in palmar sweating, as well as variation in facial expression and cry. All of the above studies have attempted to observe and describe newborns' responses (both physiological and behavioral) to painful stimuli.

Pain Measurement in Infancy

Another area of research is pain measurement. Measurement and assessment are two distinct areas of study in pain research. Measurement refers to an attempt to operationalize and quantify specific elements of the pain experience (eg. intensity) through the use of objective standards. Assessment is a much broader endeavour which encompasses the interplay of different factors on the experience of pain, and requires the availability of well validated measurement instruments.

In an attempt to measure pain in infants, researchers have examined a variety of responses to assumed painful stimuli. In general, pain measurement or assessment

approaches in infants fall into two main categories - behavioral and physiological. Behavioral responses include crying, facial expressions, and body movements.

Behavioral Approaches to Pain Measurement

Crying is the most basic mode of communication in neonates. The presence or absence of crying can convey a variety of information about the infant's condition to the caregiver, including pain, hunger, fatigue, boredom, etc. Several researchers have focused their attention on infant crying, in an attempt to determine specific acoustical features that characterize the pain response (Johnston & Strada, 1986; Michelsson, Jarvenpaa, & Rinne, 1984; Porter, Miller, & Marshall, 1986; Wasz-Hockert, et al, 1964; Wasz-Hockert, Michelson, & Lind, 1985; Zeskind & Lester, 1981).

Parameters of infant crying that have been studied with the aid of highly sophisticated technology include time, frequency, and intensity. Computer generated sound spectrographs have been utilized for this purpose, and it would appear that a specific pain cry does exist. The pain cry has been described as initially high-pitched, followed by periods of apnea, dysphonia, and then a gradual return to a more rhythmic rising and falling melodic cry of lower pitch.

Although a pain cry in healthy fullterm newborns can be electronically differentiated, the practical value of this in the clinical situation is questionable, and

at this time even experienced caregivers are unable to reliably distinguish a pain cry without some knowledge of context (Owens, 1984).

In the last ten years, there has been considerable research effort directed at developing an instrument to measure pain in infants through the observation of facial expression (Grunau & Craig, 1987; Izard, Huebener, Risser, McGinnis & Dougherety, 1980; Izard, Hembree & Huebner, 1987). Izard's system of facial expression coding classifies an emotion based upon the configuration of the face. Nine different emotional expressions in young infants can be reliably classified by both trained and untrained adult observers. These are anger, sadness, interest, joy, surprise, disgust, contempt, fear, and pain. The 'pain face' has the brows lowered and drawn together with a bulge or furrow between them, the nasal root is broadened and bulged, the eyes are tightly closed, and the mouth is angular or squarish.

Johnston & Strada (1986) used this facial coding system in their multidimensional descriptive study of acute pain responses in infants receiving immunizations. They found that the facial expression of pain was consistent amongst this group of 14 infants ages 2-4 months. Eleven of the babies showed the perfect facial configuration of pain, while the other three infants had 2 of the 3 components. As well, excellent inter-rater reliability was achieved between the two trained observers in this study.

Grunau & Craig (1987) have developed a facial coding system for infant pain based upon the Facial Action Coding System of Ekman & Friesen (1978). Grunau

& Craig's measurement technique differs from that of Izard and colleagues in that it does not assume templates of emotion or preconceived categories of affective response. Rather, it systematically describes facial expression in terms of specific facial muscles and movement. This neonatal facial coding system scores nine facial movements: brow bulge, eye squeeze, naso-labial furrow, open lips, stretch mouth (vertical), stretch mouth (horizontal), lip purse, taut tongue, and chin quiver (Grunau & Craig, 1987).

They utilized the neonatal facial coding system in their study of 140 healthy fullterm infants undergoing a heel lance. In this study, the constellation of facial changes to swabbing of the heel differed substantially from the response to a heel lance. The effect of sleep/wake state on infant responsivity to a painful stimulus was also examined in this study. The investigators found that response to a heel lance was dependent upon state, with infants in a quiet sleep state showing less evidence of taut tongue and stretch mouth than infants in a quiet awake state. Although discrete facial activity appears to be a valid and reliable measure of pain expression, the clinical utility of this tool is questionable.

Body movement is another behavioral component of pain to be measured (Craig, McMahon, Morrison & Zaskow, 1984; Dale, 1986; Franck, 1986). Craig's Infant Pain Behaviour Rating Scale was developed for assessing pain behaviours in infants and toddlers ages 2-24 months. Items in this scale included crying, facial activity, and movement of the limbs and torso.

Dale (1986) videotaped ten healthy infants receiving immunizations and studied vocalizations, facial expressions, bodily movements, and heart rate. By means of a content analysis, she described the predominant behaviours of infants ages 2 - 4.5 months during injections. In response to the injections, all infants cried and initially opened their mouths wide. The predominant behaviours observed in over 50% of her subjects fell into four categories: vocalizations, facial expressions, autonomic reactions, and body movements. A wide array of body movements were described including movement of the head, torso, and limbs. Dale identified several limitations to her own study. These included: incomplete visualization of facial expressions, interference with body movements because of necessary restraining for the procedure, lack of a previously developed coding system to qualitatively evaluate the data, and a small sample size. The study pointed to the need for further study of pain in infancy--and the need for a tool to assess it.

Franck (1986) carried out a pilot study in which she demonstrated a new method by which quantitative data on pain responses in infants could be obtained and evaluated - photogrammetry. The responses of ten healthy newborn infants to a routine heelstick were videotaped, and then viewed through a grid calibrated to the actual distance of the baby from the camera lens. By measuring the distance of the leg movements across the grid and the time elapsed, the latency of withdrawal of the lower limbs following heel lance and the associated crying could be measured. The infant's responses consisted of two components: immediate withdrawal of both legs,

followed by facial grimacing and crying. This pattern of response can be compared to the first and second pain experienced by adults.

The transmission of a pain sensation is carried out by two specific types of peripheral nerve fibres. A-delta fibres, which are myelinated rapid conducting fibres, are associated with sharp pain or 'first pain'. The second type of peripheral sensory fibres associated with pain conduction are the C-polymodal fibre. These smaller, unmyelinated, slow conducting fibres are associated with aching or burning pain which is often referred to as 'second pain'. (Meinhart & McCaffery, 1983, p.37). Photogrammetry was found to be an effective method for obtaining quantitative data regarding the behavioral response of infants to a discrete noxious stimulus.

Physiological Approaches to Pain Measurement

A number of studies have utilized a physiological measurement approach to pain in neonates. The main limitation with studies that rely solely upon physiological responses to measure pain is that these autonomic reactions are not specific, and may not differ from those to other stressors besides pain.

Examples of physiological parameters used to measure pain are heart rate, respiration rate, transcutaneous po2, sweat response, and serum hormone levels (Anand, Sippell & Aynsly-Green, 1987; Beaver, 1987; Brown, 1987; Dale, 1986; Franck, 1986; Gedaly-Duff, 1989; Harpin & Rutter, 1982; Owens & Todt, 1984; Porter, Miller & Marshall, 1987; Rawlings, Miller & Engel, 198O; Strang, Gunnar,

Snellman, Condon & Kestenbaum, 1988; Talbert, Kraybill & Potter, 1976; Williamson & Williamson, 1983). Cardiac and respiration rates, and blood pressure are commonly reported variables in studies of infant pain. The measurement techniques are non-invasive and simple to carry out. Heart monitors and infant blood pressure cuffs are readily available for use in most hospital settings, and there are well established norms for infants.

Williamson & Williamson (1983) reported that infants who received a local anesthetic had a lower heart rate than those who did not receive an anesthetic block. Owens & Todt (1984) demonstrated an increase in heart rate following heel lance in 20 2-day-old newborns. In contrast to this, Johnson & Strada (1986) noted an initial decrease in heart rate in their study of 14 infants undergoing immunization at ages 2 and 4 months. Dale (1986) reported both increases and decreases in heart rate following immunization. The results of these studies, done on small groups of well infants of various ages are thus equivocal. A change in heart rate in either direction may indicate the possibility of pain in a newborn. While this information is necessary in the assessment process, it is not sufficient evidence in and of itself to imply the presence of pain.

Some researchers have utilized transcutaneous oxygen (tcPo2) monitors in their study of infants' response to pain. Rawlings, Miller, and Engel (1980) assessed the effects of pain from circumcision in a group of ten healthy newborns. They reported a drop in the tcPo2 both during and immediately following the procedure.

In her study of premature infant's response to touch and pain, Beaver (1987) also reported a decrease in transcutaneous oxygenation status for both touch and pain.

Harpin & Rutter (1982) examined the effects of emotional sweating on the palms of infants undergoing heel lance. In infants of 37 weeks gestation and greater, palmar sweating increased significantly during the procedure and returned to baseline as the infant settled. This non-invasive method of measurement provides another potential index of pain in newborns. Further research needs to be done to establish normal values in premature infants of various gestational ages.

The effects of distress on the adrenal cortical response have been studied in infants undergoing circumcision, and in preterm babies undergoing surgery for ligation of a patent ductus arteriosus (Anand, Sippell & Aynsley-Green, 1987; Anand et al, 1985; Strang, Gunnar, Snellman, Condon & Kestenbaum, 1988; Talbert, Kraybill & Potter, 1976). These studies have clearly demonstrated a hormonal stress response in both term and preterm neonates. This response is characterized by increases in catecholamines, cortisol, and other corticosteroids, and a decrease in insulin secretion. These hormonal changes, which can result in serious consequences to a neonate, can be blunted by the appropriate use of anesthetic agents. However, at present these biochemical measures of pain are not readily available to nurses in the clinical setting.

In summary, a number of researchers have recently attempted to measure pain in infants utilizing behavioral and or physiological approaches. Crying, facial expression, and body movement have all been studied in the neonatal population.

Physiological variables such as heart rate, oxygenation status, palmar sweat response, and serum hormone levels have also been examined. To date, these studies have generally focused upon small groups of healthy fullterm newborns or infants beyond the neonatal period of life who have been exposed to brief procedural pain. Little is known about the premature infant's response to painful stimuli, or the effects of prolonged or chronic pain on newborns.

The previously cited research on pain in neonates has focused on the infant's responses to painful stimuli as observed or measured by social scientists, physicians, or nurse researchers. While these studies have contributed important baseline information to a previously unexplored area, they did not concern themselves with the clinical usefulness of this information to the bedside staff nurse.

In contrast to those earlier works, one recently published study has explored the behavioral symptoms and physiological signs of pain in newborns from a nursing perspective (Jones, 1989). The data collection instrument used was a Pain Sensitivity Questionnaire which was distributed to 109 neonatal nurses in a tertiary care university-affiliated hospital in the American Midwest. The nurses were provided with a list of 34 physiological signs and behavioral symptoms suggestive of the possibility of pain in a newborn. A five point Likert type rating scale (from never to always) was used to score how frequently nurses would look for each particular sign when assessing a fullterm, healthy newborn. A large number of the listed signs were identified by the nurses as useful in assessing the possible presence of pain in a

newborn. However, only three of the 34 possible symptoms were selected with a high frequency. These were fussiness, crying, and grimacing.

Limitations of this study as identified by Jones herself include the use of a non-probability convenience sample, and questionable reliability of the Pain Sensitivity Questionnaire. Despite these concerns, this study is important because it provides support for the physiological signs and behavioral symptoms of pain in newborns as reported in earlier research, and serves as a basis for further nursing research.

Many gaps remain in our knowledge of the experience of pain in newborns. There are few references in the literature to pain in seriously ill neonates, preterm infants, or those experiencing intense pain and pain of long duration (Anand, Sippell & Aynsley-Green, 1987; Beaver, 1987; Berry & Gregory, 1987; Porter, Miller & Marshall, 1987). Anand and associates (1987) conducted a randomized trial of fentanyl anesthesia in preterm babies undergoing surgery for ligation of patent ductus arteriosus, and examined the effects on the stress response. They found major hormonal responses to the surgery in the non-fentanyl group (who received nitrous oxide and curare) when compared to the babies who received fentanyl. The infants in the non-fentanyl group were more likely to require increased ventilatory support following surgery and to experience circulatory and metabolic complications post-op. The authors concluded that the postoperative outcome of preterm babies undergoing surgery could be improved through the use of a potent narcotic, analgesic, and anesthetic agent (i.e. fentanyl) which would serve to decrease the systemic stress response.

Berry and Gregory (1987) have also addressed the issue of premature infants' need for anesthesia for surgery. They too believe that premature neonates require an appropriate amount of anesthesia both to reduce pain perception and prevent hypertension (which can result in an increased incidence of intraventricular hemorrhage).

The use of local anesthesia in controlling the adverse effects of pain from a lumbar puncture in sick newborns has also been recently reported (Porter, Miller & Marshall, 1987). Preliminary data suggest that lidocaine may increase physiologic stability and therefore reduce adverse effects of this invasive medical procedure in sick neonates.

Using the Gate Control Theory as her framework, Beaver (1987) attempted to determine whether a simple, noninvasive technique would decrease the pain response in a group of eight premature infants. The infants were exposed to either touch only, heel lance only, or heel lance plus stroking of the leg. Physiological variables of heart rate, blood pressure, and transcutaneous oxygenation status were documented both prior to and following the treatment. The author found that the combined heel lance accompanied by stroking of the leg caused the greatest increase in heart rate and blood pressure, with a corresponding decrease in oxygenation status.

The combination of painful stimulus and touch was therefore more aversive to the premature infants than that of a heel lance alone. In this small group of infants, it did not appear that stroking of the leg helped to moderate the pain response. Although Beaver's results did not support the Gate Control Theory of pain

modulation in this group of premature infants, the study nevertheless provides an important first step in the exploration of an innovative, non-invasive pain management technique.

Given the varying levels of neurodevelopmental sophistication between term and preterm babies, one might also anticipate differences in both behavioral and physiological responses to pain (Als, 1982; Als, 1986; Als, Lester, & Brazelton, 1979; Gorski, Davison & Brazelton, 1979). Als has described a synactive model of neonatal organization which can be used as a framework for the assessment of neurobehavioural development in the premature infant. This model focuses upon the continuous interplay of five sub-systems of functioning: autonomic, motor, state organizational, attentional-interactive, and self-regulatory systems. In comparison to full-term infants, premature infants are more fragile, less physiologically stable, and more easily taxed by manipulation or environmental stimulation. They are less robust, alert, responsive or organized than fullterm newborns (Als & Brazelton, 1981; Als, 1986). Examples of premature infants' autonomic responses to the stress of a painful procedure may include apnea, colour changes, yawning, hiccoughing, passing a bowel movement, or spitting up. They may become motorically flaccid, hypertonic, or may twitch. State related stress signals include roving eye movements, gaze aversion, and strained fussing or crying. Premature infants may have a delayed response time to a noxious stimulus or may not respond at all due to limited inner resources. In summary, the behaviour of premature infants in response to painful

stimuli differ from those of fullterm infants. Neonatal nurses must be aware of these differences and alert to these cues in order to accurately assess pain in newborns.

Factors Influencing Nurses' Decisions to Administer Analgesics

A number of studies have examined the factors that influence nurses' decisions to administer analgesics to their patients--both children and adults (Burokas, 1985; Beyer, DeGood, Ashley & Russell, 1983; Cohen, 198O; Eland & Anderson, 1977; Gadish, Gonzales & Hayes, 1988; Halfens, Evers & Abu-Saad, 1990; Marks & Sachar, 1973; Mather & Mackie, 1983; Schechter, Allen & Hanson, 1986). Possible factors that hamper nursing interventions include: concern about the side effects of narcotic analgesics, including respiratory depression, hypotension, and tolerance to narcotics; inadequate knowledge about analgesic medications and their effects; nurses' goals for pain alleviation (e.g. partial versus total relief); lack of an accurate understanding of the pain experience in children; priorities of patient care--lifesaving measures as a priority over pain relief; underprescription of analgesics by physicians; and the difficulty in assessing pain in infants and young children due to lack of a valid and reliable tool.

Undertreatment of Pain in Adults

The undertreatment of pain in adults has been reported in some classic studies. Structured interviews of 37 medical inpatients being treated with narcotic analgesics for pain found that 73% of them continued to experience severe or moderate distress (Marks & Sachar, 1973). This was attributed in part to physicians' lack of knowledge about these drugs and the prescription of inadequate dosages.

In her study of 109 postoperative patients, Cohen (1980) also found that 75.2% of the patients interviewed on the third post-op day were in moderate or marked pain. Chart reviews of these patients indicated that they were receiving less narcotic analgesics than they could receive. She concluded that nurses were overly concerned about the possibility of addiction, that their knowledge about drugs was inadequate, and that complete pain relief after surgery was not their major goal.

Undertreatment of Pain in Children

The undertreatment of pain in children has also been studied. Mather & Mackie (1983) examined the incidence of postoperative pain in 170 Australian children and also found evidence of inadequate pain management. They reported that for 16% of the children, no analgesic medication was ordered. When a narcotic analgesic was prescribed by the physician on a PRN basis, the dose was frequently

too low, and the drug was not administered in 39% of the cases. Nursing staff appeared to prefer giving non-narcotic analgesics in comparison to opioids when given a choice.

The need for pain relief measures in infants and children was considered to be unimportant in the past. Swafford and Allen (1968) expressed the opinion that " Pediatric patients seldom need medication for the relief of pain. They tolerate discomfort well." (p.133). Since that time, there has been an increased concern about the adequacy of pain control in children. A number of studies have looked at postoperative pain control and compared analgesic prescription and administration between children and adults.

Eland and Anderson (1977) evaluated the experience of 25 children ages 4-8 years who were hospitalized for surgery. They found that 13 of the 25 children never received any medication for pain throughout their hospitalization. The authors then matched 18 of these children with 18 adults with identical diagnoses. They found that while the children received a total of 24 analgesic doses, the adults received 671!

Similar findings were reported by Beyer et al (1983) and Schecter, Allen and Hanson (1986). In their study comparing 50 children and 50 adults following cardiac surgery, Beyer et al showed that the children received only 30% of the analgesic doses possible, while the adults received 70%. Six children were prescribed no postoperative analgesics, and overall the children were prescribed fewer potent narcotics. Schecter and colleagues also found that adults received a greater number of doses of narcotics than did children.

In her report on nurses' knowledge of pain issues Watt-Watson (1987) stated: " The most difficult nursing problems in pain assessment were cited as judging the intensity of pain and the real need for analgesics, particularly with patients having communication problems and when the patient 'seems comfortable,' 'asleep,' or 'is not complaining." (p. 208).

In a study related to nurses' knowledge of pain assessment and management, Burokas (1985) examined factors affecting nurses' decisions to medicate pediatric patients after surgery. Her study consisted of two parts: (1) a survey of 134 nurses that explored and identified factors affecting nursing decisions in medicating pediatric patients after surgery; and (2) a chart review of 4O pediatric patients after surgery to document actual numbers of analgesics administered to pediatric patients undergoing thoracic and abdominal surgery.

A number of interesting findings emerged from this study. A total of 14 different factors were listed by the nurses as being most influential in medicating patients post-op. The top four listed were: evaluation of vital signs; type of surgery; severity of pain; and nonverbal behaviours. Results also revealed that only 12% of the nurses reported complete pain relief as their goal. This finding confirms that of Cohen (1980), and of Rankin & Snider (1984) who found that the goal of more than half of the nurses they studied was to reduce cancer pain rather than relieve it. While nurses in the study by Burokas were not influenced by their own personal pain experience, having offspring who had experienced pain did influence nurses to choose to medicate pediatric post-op patients more frequently.

An important strength of this study was the use of two different methodologies to collect data--a survey which incorporated clinical vignettes, and a chart review of actual patients. The rich data collected from the dual methodology pointed out that while in theory nurses may recognize that pain exists in infants, this does not necessarily result in the administration of narcotic analgesics in clinical practice.

One limitation of this study is the wide range in age of the 4O pediatric surgical patients whose charts were audited. Only 2/4O were neonates; 8/4O were infants > 4 months and < 1 year of age; 16/4O were preschoolers, and the remaining 14/4O were school aged children. Children in varying age groups communicate their pain in different ways, according to their level of neurodevelopment. A replication of this study that limits the sample population to one age group (e.g. neonates) and increases the sample size would provide more valid and useful data.

Demographic Characteristics

Some researchers have looked at demographic characteristics of nurses such as age, experience, and education, and considered how they influence assessments and interpretations of pain and suffering (Davitz & Davitz, 1981; Dudley & Holm, 1984; Halferns, Evers, & Abu-Saad, 1990; Lenburg, Burnside & Davitz, 1970). In one study nursing students assessed pain as more severe than experienced nurses did (Lenburg, Burnside & Davitz, 1970). In contrast to this, a more recent study by Halferns, Evers & Abu-Saad (1990) found that first year nursing students attributed

less pain to a hypothetical patient than third and fourth year students and registered nurses.

Davitz & Davitz (1981) carried out an exploratory study which was designed to investigate some possible relationships between individual differences in nurses and their inferences of suffering. A statistically significant relationship was not found between years of experience and inferences of patient suffering. However, the findings did reveal that a nurse's cultural background is an important determinant of beliefs about pain and psychological distress.

Dudley & Holm (1984) also investigated the impact of a number of nurse characteristics on assessments of patient pain and psychological distress. Correlational analysis was used to determine the significance of relationships between years in practice, age, educational preparation, and cultural background with scores on the Standard Measure of Inferences of Suffering. No statistically significant correlations between these variables were found.

Nevertheless, the authors concluded that despite the failure of their investigations to demonstrate significant relationships between these factors, the literature supports the belief that personality and cultural variables do influence a nurse's judgement (Davitz, Davitz & Higuchi, 1977; Davitz & Davitz, 1981). As stated by Davitz, Davitz & Higuchi (1977) " Since cultures differ in customs, values, and ways of perceiving and interpreting various phenomena, one would expect nurses from various cultures to differ in their inferences of suffering associated with illness and injury." (p.63).

Watt-Watson (1987) focused on the variable of educational preparation and nurses' knowledge about pain assessment and narcotic administration. She found that the educational preparation of graduate nurses (diploma versus BScN) and number of years of experience were not significantly related to scores attained on a pain knowledge questionnaire. Misconceptions and lack of knowledge were evident for the total sample of nurses. The author concluded that there is a need for more formal content in nursing curricula on pain assessment approaches and analgesic administration.

Cultural Influences

Like many other aspects of human behaviour, an individual's response to pain is influenced by sociocultural factors. Cultural influences and the role of psychological factors on illness behaviour, pain tolerance and expression have been studied both by social scientists and nurse researchers.

One of the pioneer studies of cultural response to pain was carried out in the early 1950's by Zborowski (1969). Zborowski spent three years in a veterans hospital in New York City intensively studying the responses to pain in four groups of male patients. The 146 men studied were of Jewish, Italian, Irish, and Anglo Saxon origin.

Through participant observation, formal, and informal interviews, Zborowski found that the Jewish and Italian patients manifested a greater degree of pain expression than the other two groups. He concluded that there are interethnic

differences in the meaning of and response to pain, and these responses are learned and patterned as part of one's cultural heritage.

While the findings of this classic study are frequently referred to, they contain a number of limitations. The relatively small sample studied was comprised entirely of males - men who had participated in and survived a war. Another limitation of this study was the fact that the majority of this hospital's population were of lower and lower-middle class economic background. Thus, the conclusions of this work are limited to a very small spectre of the population. Nevertheless, it is an interesting work that has served as a basis for further research.

In his 1966 study entitled Culture and Symptoms - An Analysis of Patients' Presenting Complaints, Zola also found cultural differences in pain tolerance and behaviour. His study, which employed an open-ended interview as well as some more objective measures of patient responses (e.g.checklists and attitudinal scales) examined the illness behaviour of 144 Irish and Italians who presented at an E.N.T. clinic in Boston. Zola concluded that not all people react similarly to the same disease process, but found a striking pattern of response that varied with the ethnic background of the patient. (Zola, 1966).

A more recent study by Lipton and Marbach (1984) provides further evidence indicating that attitudinal factors influence responses to pain within cultural groups. In the five ethnic groups that were studied, these researchers concluded that while the groups were generally similar in their reported responses to pain, each group

differed with regard to the factors influencing their responses (e.g. degree of assimilation into American society, duration of pain, etc).

Cultural values (i.e. having a "stiff upper lip" in the face of adversity) and the socialization process have a strong bearing on the code of behaviour surrounding a painful event. This is clearly illustrated in a study of the Bariba of Benin West Africa (Sargent, 1984). Interviews with 120 women of reproductive age, observations of both home and clinic deliveries, conversations with indigenous midwives, and unstructured interviews on pain indicated that the Bariba idealize stoicism in response to pain. The absence of manifest behaviour in response to painful events such as childbirth signal courage and honour - values crucial to the identity of this society. Role modelling by family members and other culturally relevant figures serves to teach norms and standards of acceptable behaviour within a community (Craig, 1986).

Pain threshold refers to the point at which a person perceives a stimulus as being painful. While lower pain threshold levels tend to be fairly uniform amongst individuals, upper pain tolerance levels and pain expression are variable. Pain tolerance can be defined as the amount of pain that a person is willing to endure before complaining of pain.

Clark and Clark (1980) compared the responses to noxious transcutaneous stimulation between a small group of Nepalese sherpas and English speaking trekers. They found that the Nepalese were just as sensitive to the inflicted stimulation as the Westerners. However, the sherpas were more tolerant of it, and required higher intensities before they would report pain. The researchers suggested that this

stoicism might be due to the sherpas harsh living conditions, strong Buddist beliefs, the chewing of betel nuts, and ethnocultural differences in what is considered acceptable behaviour in response to pain.

Extensive studies on nurses' inferences of patients' physical pain and psychological distress were carried out by Davitz and Davitz (1981). Their classic work examined the issue of nurses' judgements of pain from two perspectives: the ethnic background of the patient; and the ethnic background of the nurse.

Their series of studies dealing with the effect of patient's ethnic background on the nurses' judgements of pain and suffering concluded that:

" 1. Ethnic background of the patient was an important determinant of nurses' inferences of suffering. This was true for both physical pain and psychological distress.

2. In general, for both dimensions of suffering, nurses saw Jewish and Spanish patients as suffering the most, and Oriental and Anglo Saxon/Germanic patients as suffering the least." (Davitz & Davitz, 1981, p.39).

These findings suggest that nurses tend to stereotype patients according to ethnic background. This practice can have serious implications for nursing, resulting in overtreatment of individuals belonging to certain groups, and undue suffering for members of others.

Cross-cultural differences in nurses' inference of suffering have also been studied (Davitz, Davitz & Higuchi, 1977). The theoretical basis for this work rested

upon the assumption that attitudes about suffering in others are culture bound and at least in part socially learned. The researchers state: " Since cultures differ in customs, values, and ways of perceiving and interpreting various phenomena, one would expect nurses from various cultures to differ in their inferences of suffering associated with illness and injury." (p.63).

Participants in this study consisted of 544 female registered nurses who were employed in the following countries: U.S.A., Japan, Puerto Rico, Korea, Thailand, and Taiwan. A questionnaire was translated into the five foreign languages and used to obtain data. The results of this study supported the hypothesis that nurses from various countries differ in their inferences of suffering.

The findings of this study may have important implications for the practice of nursing within a heterogeneous community, where immigrant nurses are very much a part of the work force, and the patient population under their care can be just as varied. Still, one must keep in mind that this study was carried out in foreign countries, and the results can not be generalized to nurses of various ethnic backgrounds living and working in Canada for example. The beliefs of the latter may be a reflection of the broader Canadian perspective and of commonly shared experiences. Nevertheless, one's ethnic identity may have an influence on professional decision making and practice.

Recent nursing studies address the area of pain and cross-cultural differences (Abu-Saad, 1984; Martin & Belcher, 1986). Abu-Saad (1984) carried out a study examining cultural group indicators of pain in school age children. Using semi-

structured interviews, she explored how Arab-American, Asian-American, and Latin-American children perceive, describe, and respond to painful stimuli.

The results of this inquiry indicated that the most common causes of pain in children are likely to be universal amongst children of all cultural groups, such as falling off a bicycle, having a stomach ache, or the death of a family member. However, Arab and Latin-American children tended to use sensory words to describe pain (i.e. burning, stinging), while Asian-American used words more in the affective and evaluative domains (i.e. sad, horrible) .

Martin & Belcher (1986) examined the influence of cultural background on nurses' attitudes towards pain, care of the dying, and cancer treatment. Three culturally diverse groups of nurses were studied - American, South African English and Zulu. Statistically significant differences were found in responses to a number of survey questions. A disproportionately high number of Zulu nurses felt that men experienced more pain than women. A significant difference was also found in the question about behavioral cues that may indicate the presence of pain. The South African English nurses viewed a quiet patient as one experiencing the most pain, while the Americans and the Zulu considered screaming as the indicator of extreme pain. The investigators suggested that the South African English nurses' responses may have reflected the Anglo value of a 'stiff upper lip'.

In summary, there is an extensive body of social science literature that focuses on pain and ethnicity. A number of nursing research reports have also been published in this area. While many of the studies are of limited applicability due to

methodological inadequacies, there nevertheless appears to be variation in the manner in which pain is interpreted and communicated amongst people of different cultural backgrounds. While caution must be utilized to prevent stereotyping, an appreciation of cultural and individual variability in behaviour can be valuable, and is one vital component of the nursing assessment of the patient in pain.

Reliability and Validity of Nurses' Judgements

Researchers have focused their attention on the reliability and validity of nurses' judgements and observations by comparing nurses' recorded assessments of pain with the perceptions of pain as described by their patients (Camp, 1988; Camp, & O'Sullivan, 1987; Molzahn & Northcott, 1989; Teske, Daut & Cleeland, 1983). These studies provide evidence that significant discrepancies exist between the perceptions of adult patients and care providers. Nurses tend to underestimate the amount of pain a patient is experiencing. This implies that nurses' judgements about pain experienced by others may not be valid. If there are incongruencies between nurses' assessments of pain in adult patients who are able to verbally communicate their subjective feelings, than the potential for major discrepancies in the assessment of non-verbal patients such as infants is even greater.

Given that pain is a complex, multidimensional, subjective experience about which nurses must make inferential judgements, it may never be possible for totally valid judgements to be made. Nevertheless, nurses can strive to close the gap between patients' subjective experiences and professional assessments.

Nurses' Perceptions of Pain In Neonates

Recently, a few studies have examined nurses' perceptions of pain and suffering in the neonatal intensive care unit (Penticuff, 1989; Pigeon, McGrath, Lawrence & MacMurray, 1989). The work of Penticuff was based upon content analysis of interviews of 20 nurses in three N.I.C.U.'s over a six year period. These nurses all reported experiencing emotional distress when the therapies that infants under their care received resulted in infant suffering without proportional benefit. Infant suffering resulted in a variety of acts of advocacy, ranging from changes in nursing care to requests that the medical plan of care be reviewed.

Pigeon and colleagues (1989) used a questionnaire to examine the perceptions of neonatal nurses of the indicators and causes of different intensities of pain as observed in a neonate under their care. She reported that nurses use similar classes of behaviour to indicate pain, such as state, cry, and limb movement, but the frequency of their use varies for different levels of pain. For example, state was generally used in defining the absence of pain or for mild pain, while crying and limb movement were more frequently used in defining moderate or severe pain. A wide range of sources of pain were identified in this study including electrode removal, hunger, heelprick, loud noises, and bright lights.

Summary

In summary, a review of the literature pertinent to the study of pain in adults, children, and infants has been carried out. Several studies that have utilized naturalistic observation of babies undergoing painful procedures such as circumcision, heelstab, and immunization have been described.

The area of research related to pain measurement has been delineated, and differentiated from the concept of pain assessment. Behavioral responses to pain in infants that have been studied include crying, facial expressions, and body movement. Studies that have utilized a physiological approach to pain measurement have considered parameters such as heart and respiration rate, transcutaneous oxygenation status, palmar sweat response, and serum hormone levels. To date, these studies have generally focused on healthy full-term newborns who have been exposed to a procedure resulting in a brief episode of pain.

The literature related to the assessment of preterm infant behaviour and development has been reviewed. Als' synactive model of neonatal organization plays an important role in this area. This area of research is pertinent to this study in that it provides a theoretical basis for the differences between behaviour in preterm and full-term neonates.

A number of studies have examined the factors that influence nurses' decisions to administer analgesics to their patients. Possible factors include concern about side

effects, inadequate knowledge about analgesic medications, the nurse's goal for pain management, and the difficulty in assessing pain.

The undertreatment of pain in both adults and children has been reported. Several authors have compared the treatment of adults to children and found that children receive less analgesic medication than adults undergoing similar procedures.

Demographic characteristics such as age, experience, educational preparation and cultural origins have been examined in relation to nurses interpretations of other's pain and suffering. Findings of these studies were equivocal with regard to the former three variables. Cultural background does play a role in perceptions and interpretations of events.

Nurses' interpretations of pain intensity and cues used to judge pain in neonates have only recently been described in the literature. To date, no research has been reported that has considered whether differences exist between how nurses judge and interpret pain in preterm infants in comparison to fullterm. The findings of this study could have important implications for both continuing education of nurses and the clinical management of preterm infants in hospital. It is these important and neglected areas that this research addressed.

CHAPTER III:

METHODOLOGY

Introduction

The dilemma of pain assessment and management in the newborn is of vital import to neonatal nurses. However, in order to achieve the goal of pain alleviation and enhancement of patient comfort, one must first recognize the possible presence of pain.

Since newborns are unable to communicate verbally their subjective feelings, and no reliable or valid tool is yet readily available to assess pain objectively in neonates, the nurse is left to make inferential judgements as to the infants' pain experience. These judgements are based upon the observation of a variety of physiological and behavioral variables (many of which are not unique to the expression of pain), and knowledge of the patient's condition.

The purpose of this study was to examine nurses' judgements of pain intensity in infants, and to identify the cues that neonatal nurses use to assess the possibility of pain in newborns.

Research Design

The purpose of this research was to explore, describe, and document nurses' judgements of pain intensity in infants, and infant pain cues. This study combined both quantitative and qualitative approaches in order to facilitate the achievement of that goal. At the time this research was proposed there was very little reported

literature on this subject. Therefore, the decision was made to begin by developing a knowledge base in this area.

Following the attainment of access to the Women's Centre at the Health Sciences Centre in Winnipeg and informed consent of both parents and hospital personnel (for further details see section titled Obtaining Informed Consent), videotapes of a convenience sample of 5 term and 5 preterm newborns undergoing a heel lance in one of the hospital nurseries were made. The videos were edited by the investigator in a professional videotape editing suite into standardized 60 second segments and vignettes about each of the infants were prepared. A panel of three nursing experts then evaluated the edited videotape and corresponding written vignettes to establish content validity of the ten individual segments. Visual analogue scales were incorporated into the study to measure the respondents' estimates of intensity of pain experienced by the ten infants presented.

Following the development and pilot testing of the videotape/vignettes and data collection forms, the actual study was carried out in a second large teaching hospital (St. Boniface General Hospital). The sample consisted of 45 volunteers who were registered nurses regularly employed in the N.I.C.U. of that institution. The entire N.I.C.U. staff (consisting of 55 nurses) had been invited to participate in the study through the placement of a poster in the nursery and small, informal, information sharing sessions by the investigator.

Over a two week period, the participants viewed the videotape combined with accompanying written vignettes in a hospital conference room, and data were collected by utilizing visual analogue scales, open ended questions, and a demographic information sheet. The resulting data were subjected to both quantitative and qualitative analyses. These included both parametric and non-parametric statistical procedures, and content analysis.

Obtaining Informed Consent

Informed consent was obtained for both phases of this study - the videotape development phase and the actual study with nurse participants. In preparation for the study on nurses' judgements of pain intensity in infants and identification of neonatal pain cues, the investigator prepared a number of videotape recordings.

Parents of newborn infants at the Women's Hospital at the Health Sciences Centre who were to undergo a heel lance as part of their routine care were approached by the investigator (see Appendix A). Prior to approaching any mother to request permission for videotaping, the investigator sought the opinion of the nurse caring for the mother, to ensure that the timing for this approach was appropriate. No parents of any infant who was in critical, terminal, or unstable condition were approached.

Parent's permission was sought to videotape their infant during a routine procedure. Information about the videotaping procedure and the study was provided both in writing and through discussion with the investigator (see Appendix B & C).

Written consent was also obtained from the lab technicians who were carrying out the heel lance on the participating infants in order to elicit their cooperation with the videotaping (see Appendix D).

With respect to the actual study of nurses' judgements of pain intensity, the investigator sought the support of the Director of Maternal/Child Nursing at St. Boniface Hospital, the Director of Nursing Research, and the Nursing Co-ordinator of the N.I.C.U. An invitation to participate in the study was posted in the unit one week prior to the commencement of data collection, as well as a sample copy of the consent form (see Appendix E).

The invitation to participate and consent form both stressed that participation was voluntary, that confidentiality would be maintained throughout, and that there would be no immediate direct benefit to the individual respondents from participating. Informed consent was obtained from all nurses participating in this study immediately prior to data collection.

Population & Setting

All eligible nurses employed in the neonatal intensive care unit (N.I.C.U.) at St. Boniface General Hospital (a large university affiliated, tertiary care hospital in Winnipeg), and who met the inclusion criteria were invited to participate in the study. N.I.C.U. nurses were selected to participate in this study as they are regularly involved in the care of infants who undergo painful procedures, and therefore have experience in this area. Inclusion criteria for the nurses were:

a. must be a Registered Nurse (R.N.)

b. must be a fulltime, or permanent part-time staff nurse

c. must be responsible for the care of newborn infants in the N.I.C.U.

As of January 1 1990, the total number of nurses who met the eligibility criteria was 55. No head nurses, assistant head nurses, nurse clinicians, or educators were eligible to participate in the actual test. Their exclusion was based upon the fact that they are not responsible for the day to day provision of nursing care to infants, and their inclusion could alter the homogeneity of the group under investigation.

Development of Videotapes

As a means of eliciting neonatal nurses' judgements of pain intensity in newborns and identification of newborn pain cues, the investigator prepared a number of videotape recordings. These videos were of term and preterm infants in the hospital nursery undergoing a heel lance. This particular procedure was selected for the purposes of this study as it is simple and frequently performed on all newborns. Videos such as these were not presently available to the investigator, thus necessitating the need to produce them. Limiting the videotaping to infants undergoing the same procedure allowed for standardization of the pain stimulus, thus decreasing the introduction of confounding variables into the analysis. Other possible sources of pain or discomfort that may have confounded the pain response include the presence of an endotracheal tube or surgical incision, so these infants were excluded.

Videotape recording has gained increasing acceptability as an aid to data collection. It provides both a visual and auditory record of behaviour that may be too complex to capture in words alone. A number of contemporary studies of pain in infancy have utilized videotape recordings (Craig, Grunau & Aquan-Assee, 1986; Dale, 1986; Franck, 1986).

Craig, Grunau & Aquan-Assee showed a videotape that serially presented the reactions of 72 healthy babies undergoing a routine heel lance to a group of 45 parents of young children. The infant's reactions had been categorized as high or low in cry pitch and high or low in the involvement of facial activity prior to this study's commencement in an earlier investigation by these researchers. It was made clear to the participants in this study that the infants were being subjected to a noxious stimulus, but its precise nature was not disclosed. This served to prevent any preconceived judgements about how painful a heel lance should be.

The participants viewed and listened to each infant for 9 seconds, and then rated the infants on two dimensions (intensity of the sensory experience, and amount of affective discomfort) using 15 cm. horizontal visual analogue scales. Analysis revealed that infants who had been classified as exhibiting high levels of facial activity were given the highest ratings on the visual analogue scales by the

parent/participants. The researchers concluded that facial activity serves as a crucial determinant of adult judgements of infant pain.

In Dale's 1986 study, 10 infants between the ages of 2 and 4 months were videotaped while receiving DPT injections. The videotapes were then viewed by the investigator and content analysis was carried out. The predominant behaviours identified in this group of infants were vocalizations, facial expressions, and body movements. This researcher commented that videotapes can be advantageous to research as they can be viewed repeatedly, allowing researchers to study subjects' behaviour in great detail.

Franck (1986) videotaped the responses of 10 healthy fullterm newborn infants undergoing a heel lance. The videotapes were then replayed on a monitor and viewed through a calibrated grid so that quantitative measures of leg movement versus time could be determined.

The major limitations to the use of videotape recordings include: technical drawbacks related to the use of the equipment; potential for bias due to lack of consistency and clarity in recording; the increased time commitment placed upon the investigator, in order to obtain informed consent from both a parent and lab technician prior to videotaping; the amount of time spent in the field while awaiting desired events to occur so that they can be recorded; the need for specialized videotape editing equipment (e.g. flying eraser heads), and the many hours required to edit the master tapes.

The strength of this methodology lies in its ability to provide a consistent, multidimensional experience for the respondents, which includes colour, sound, and motion. These are all important variables to be considered in the assessment of pain in neonates.

The potential limitations of this methodology were not major factors in this study, as the investigator had prior experience with video equipment. As well, by choosing to record a commonly performed procedure in a large teaching hospital, the investigator was able to obtain a satisfactory number of good quality videotapes over a relatively short time frame (two weeks). This investigator therefore concluded that the strengths of the use of videotape outweighed the deficits of this methodology.

To enhance the methodology further, brief written vignettes (based upon the infants' actual case histories) were developed by the investigator to accompany each video (see Appendix F). The vignettes allowed for the presentation of important contextual information such as gestational age, health status, or mode of delivery of each infant. These variables may have an effect on neonatal pain behaviour, and be of value to nurses in their assessment of infant pain (Grunau, Craig & Drummond, 1989).

Examples:

" Baby B. is a healthy 5 day old premature infant, delivered at 34 weeks gestation by C. section."

" Baby D. is a fullterm infant 2 days of age, receiving prophylactic I.V. antibiotics in view of maternal pyrexia."

Following ethical approval and the granting of access to the institution, the investigator met with the head nurses responsible for the normal and intermediate care nurseries, and medical head of neonatology. The research was discussed with them, and their support solicited. An information sheet about the project was posted outside the nurseries to inform nursing and pediatric staff about the videotaping. The investigator also contacted the head of clinical laboratory services to discuss the study, and copies of the consent to videotape form were forwarded to the lab. A meeting was held with the lab technicians responsible for obtaining blood samples by heel lance in the nurseries to explain the nature of the study to them.

Over a two week period, the investigator captured on film a total of 10 newborn infants (5 term and 5 preterm) before, during, and immediately after undergoing a commonly performed procedure - heel lance. All newborn infants must undergo this procedure during the course of their hospitalization for collection of blood for P.K.U./metabolic screen. As well, many infants require a heel lance to collect blood for glucose estimation or serum bilirubin.

In order to ascertain which infants would be having a required or routine heel lance on any given day, the investigator checked the lab requisitions in the normal and intermediate care nurseries on a daily basis. Once this information was received, the investigator approached each of the infants' mothers for permission to videotape (see Appendix A).

When an informed consent to videotape was obtained, the investigator informed the infant's nurse, and left a note on the lab requisition stating that

parental permission had been obtained to videotape the blood sampling procedure scheduled for the following day.

All videotaping was done by the investigator herself and took place both in the normal and intermediate care nurseries at Women's Centre. Thus, all of the infants filmed were either healthy newborns, or those with relatively minor medical problems. Criteria for inclusion were: that the infant was a patient in either of the selected nurseries; that the infant was in stable condition; that the infant was not already enrolled in other research studies.

A colour camera with a V.H.S. tape was supported on a tripod and used for video recording. Because there were often several lab technicians working in the nursery at the same time, the investigator was generally only able to film one baby each day. Given the crowded conditions in the nurseries and the sometimes limited electrical outlets available, the camera equipment was set up just prior to the lab technician entering the nursery, and removed as soon as filming was complete.

Following the successful videotaping of 10 neonates (5 term & 5 preterm), the investigator felt that sufficient footage had been obtained. The investigator then informed the director of nursing, medical head of neonatology, and head nurses that the project was complete, and they were thanked for their cooperation.

Using two video cassette recorders and a playback colour monitor, the investigator edited the original videotape down to ten 60 second segments and transferred it onto a second V.H.S.tape. Sixty seconds was chosen for several reasons: 1. the infants peak behavioral response could be easily viewed during this time period; 2. the investigator was concerned that the respondents might possibly become

irritated or upset if they had to view 10 crying infants for longer periods of time, thus influencing their responses; and, 3. for the sake of time constraints, the investigator wanted to make the data collection period as concise as possible so as to obtain optimal staff participation.

Segments of four fullterm and four preterm babies immediately following the heelstab (when the infant's response to the painful stimulus was at a maximum) were selected from the footage. In order to provide a control group of a 'no pain' situation, 60 second segments of both one fullterm and one preterm baby just prior to the painful stimulus were included.

A purposive sampling approach was utilized in the assignment of infants into either the intervention (post heel lance group) or control group (pre heel lance group). This was necessary in order to provide the best quality of videotape footage possible from both a visual and audio perspective, and ensure that the participants would view all of the infants from a similar focal length. Sixty seconds of a clear, unobstructed view of the infant without excessive background noise was not always possible following the heel lance. The investigator was interested in whether the nursing staff attributed a lesser degree of pain intensity to these two control group infants, or differentiated them in some way from the others in the written description of cues.

During the editing of the videotape, caution was exercised to ensure that at no point would it be evident to the viewer that the infant was undergoing a painful procedure. Thus, the respondents would not be able to differentiate the two control group infants from the other eight infants, and the judgements about pain intensity

would have to be purely based upon the behavioral cues presented and the written vignettes provided.

Establishing Validity and Reliability of the Videotapes

" The validity of an instrument is a determination of the extent to which the instrument actually reflects the abstract concept being examined " (Burns & Grove, 1987, p.293). Content validity verifies that the method of measurement actually measures and is representative of the expected content. To establish the content validity of the videotapes and vignettes, the videos and accompanying written vignettes were evaluated by a panel of three clinical experts and educators in the field of neonatal nursing.

This group included a clinical nurse specialist with a Masters Nursing degree, and two continuing education instructors. These nursing experts represented all three levels of patient acuity (normal, intermediate, and intensive care) and were chosen on the basis of their clinical expertise and interest in the study.

The experts were asked to appraise the videos and vignettes critically, and confirm that they were of good quality, and clearly representative of a typical situation encountered in clinical practice. They were then asked to help determine the minimum length of viewing time required to adequately meet the needs of the study. These experts agreed that 30 seconds of viewing time would be sufficient - longer than that was irritating and abrasive to the viewer. Through the above process, content validity was ascribed to the videotapes.

Reliability is concerned with the stability, consistency, and dependability of repeated measures. In an attempt to establish the reliability of the videotapes, the investigator edited the video footage to ensure that there was consistency in the content, presentation, and duration of each of the ten 30 second segments. Every effort was made by the investigator to eliminate inconsistencies that may have occurred during the videotaping process. Real time measurement equipment was also utilized to ensure precision of the videotape segments so that each segment was of the same duration as all the others.

The use of videotapes and accompanying written vignettes allowed the investigator to present all of the respondents with identical, reliable segments of infant behaviour to which they could respond.

Testing the Instrument

The next step involved determining the amount of time required between each infant's video segment in order for the nurses to rate the pain intensity and indicate their assessment criteria. Through trial and discussion it was suggested that once again, 30 seconds would be adequate for this purpose.

The instrument was then pretested by a different group of three nursing experts in the area of neonatal nursing. All three were continuing education instructors responsible for N.I.C.U., intermediate and triage nurseries, and normal nursery. A number of suggestions were made by these participants e.g. to include a sample indicating how to mark the visual analogue scale to ensure continuity, as well as some changes in the wording of the instructions to help clarify the task.

These revisions were incorporated, and pilot tested by a third panel of three neonatal nurses employed at an alternative tertiary care, university affiliated hospital. This group included the head nurse of the intermediate care nursery, the continuing education instructor for intermediate and normal nurseries, and the nurse coordinator of the transport team. Pilot testing was done in a different hospital than the one in which the actual study was carried out to decrease the likelihood of contamination of results on the actual test that might have occurred through inadvertent discussion about the videos and vignettes.

The pilot test confirmed that the videotapes were clear and interesting. Confirmation that 30 seconds of viewing each infant provided adequate exposure to the infant in order to elicit the information needed to answer the research questions was attained. The major limitation identified by this group was inadequate time allotment between each infant's segment to answer the research questions. In their collective opinion, 30 seconds did not provide enough time. In response to this concern, the investigator revised the tape so that a quiet black period of 45 seconds was inserted between each segment. The group agreed that an additional 15 seconds would provide the time necessary to read the written vignette and answer the two

research questions. The pilot testing also confirmed that the study could be easily completed within a 20 minute period.

In order to address the issue of possible response set bias, three different versions of the ten babies were prepared. A random numbers table was utilized for this purpose (see Appendix for format of versions I, II, and III). The edited videotape segments were duplicated using a professional editing suite in order to ensure good quality copies for versions two and three. Data collection forms were colour coded for each version (white, yellow, and green) to ensure that no errors occurred in the data collection, and that the format of infant presentation on the videotape matched the presentation of the written vignettes on the data collection form.

Instrumentation

Each of the 10 vignette/videotape combinations developed in the preparatory stage of this study was accompanied by a visual analogue scale (VAS)(Huskisson, 1983). Respondents were asked to use the scale to estimate the intensity of the pain experienced by the infant described.

McGrath and colleagues (1985) utilized visual analogue scales in their study to develop a behavioral scale for rating pain in children. They found that visual analogue scales can be used by nurses to rate the amount of pain children appear to

be in. " Comparison of the scale with nurses' ratings also provides support for the validity of nurses' ratings of children's pain using VAS " (McGrath et al, 1985, p.401).

Visual analogue scales have also been found to be reliable measures of pain intensity (McGuire, 1984; Revill, Robinson, Rosen & Hogg, 1976; Sriwatanakul et al, 1983). The visual analogue scale used in this study consisted of a 10 cm. horizontal line with anchors at each end. These end points denoted the extreme limits along the continuum of the concept being measured (pain intensity). The respondents were asked to place a stroke through the line to indicate the intensity of the pain. The score (with a range from zero to 10) was obtained by the investigator measuring the distance in centimetres with a ruler from the 'no pain' anchor to the point on the scale where the mark was placed.

Example:

'Please rate how much pain you believe that the infant described above is experiencing, by placing a stroke somewhere through the line.'

NO PAIN I_____I PAIN AS BAD AS IT COULD POSSIBLY BE

There are several strengths associated with this type of scale. It is clear and simple to both use and score. The lack of demarcations between the two extreme endpoints allowed for an unlimited number of choice points, and avoided artificial or the limited categories of a verbal descriptor scale. These factors have lead some

authors to conclude that visual analogue scales should provide more sensitive measures of pain intensity than descriptive scales (Sriwatanakul et al, 1983).

Finally, each vignette/video and visual analogue scale was followed by the question:

'What are the cues that lead you to that judgement? ' (please include any visual, auditory, and written clues)

Procedure for Data Collection

Following approval by the ethical review committee of the School of Nursing, and the granting of access by the institution, the investigator met with the co-ordinator of nurseries to discuss the study and elicit her support. A brief, informal meeting was held with the assistant nursing co-ordinator of the N.I.C.U. for the same purpose. Input from a variety of senior nursing staff in the unit was solicited to determine when the most suitable time to carry out data collection would be on each of the three shifts.

The investigator made the decision to schedule data collection periods on all three shifts because many of the nursing staff are permanent part-time employees who work permanent evening or night shift. The investigator hoped to gain optimal participation in the study by making it convenient for all staff members to participate.

Data collection was planned to take place over two consecutive weekends as well as some weekdays. By organizing the data collection periods in this way all staff members would be scheduled to be on duty during the data collection period. This

would serve to cut down on the risk of contamination of the results from respondent interaction, while at the same time maximizing staff members opportunity to participate during a regularly scheduled working shift. As well, by conducting the study over a relatively brief time frame, the risk of historical threats to internal validity (i.e. an inservice on pain assessment) which could influence the responses of the subjects could be avoided.

The investigator then put together a poster which provided a timetable of all proposed data collection time periods and dates, as well as a sample copy of the consent form. This poster was placed in the N.I.C.U. one week prior to the commencement of the study, inviting the nursing staff to participate in the study. At the suggestion of a senior nurse, the poster was initially placed in one location (on the door to the unit). However, when the investigator checked back in the nursery several days later, it was apparent that this spot was not ideal and the poster was not being noted by the nursing staff. Such being the case, it was moved to another location (by the scrub sink in the centre of the unit). Since all nursing staff in the unit must 'scrub in' at the start of each shift, this turned out to be a far superior location.

Prior to the start of each shift on a scheduled data collection day, the investigator placed a reminder note on the nurse's patient assignment sheet. The note simply said " Nursing research today in the 3A conference room at coffee break. All welcome."

Approximately 30 minutes prior to the scheduled data collection period, the investigator 'set up' in the conference room. All data collection sessions were

administered at the hospital in the same conference room down the hall from the nursery. This was organized to make the conditions of data collection as similar as possible for all participants. As well, this process may have served to improve the validity of the results, as the respondents were all in their 'working role' in the hospital setting, with a ' work mindset'.

Consent forms and data collection forms (appropriate to the version about to be shown) were put out on a central coffee table. The videotape was inserted into the player/monitor and tested to ensure that it was ready to begin and that the volume was adequate.

Of key importance for successful data collection in this study was flexibility of scheduling. The data collection periods and location had to be convenient for the participating nursing staff. Although coffee breaks were set at certain times during each shift, there was a certain degree of variability depending upon how busy the unit was. If a new admission arrived in the nursery, a resuscitation was in progress, or anxious parents arrived to visit an unstable infant, breaks were often missed completely or taken later in the shift if time permitted. The investigator therefore had to be present at the hospital, with access to the conference room and equipment throughout all scheduled data collection days, evenings, and nights.

When those nurses wishing to participate arrived in the conference room they were asked to help themselves to coffee, tea, and doughnuts which were provided by the investigator. By making these refreshments readily available a great deal of time was saved, as the nurses did not have to go down to the cafeteria for their coffee break. Thus, data collection could proceed promptly. Furthermore, the investigator

felt that providing these refreshments was a small way of thanking the staff for using their break time during the course of a shift to participate in research which was of no direct benefit to themselves.

Once settled in a seat, each nurse was given a copy of the consent form and asked to read it through carefully. The investigator gave each nurse an opportunity to ask questions about the consent form or raise specific concerns. All nurses who came to the conference room voluntarily chose to sign the form and proceed with the study. This degree of participation may have been facilitated by the posting of a sample copy of the consent form in the nursery one week prior the commencement of the study. The staff were thus provided with an opportunity to acquaint themselves with the content of the form in advance.

When all consent forms were signed and returned to the investigator, data collection forms were handed to each participant. The investigator requested that they all read the instructions at the top of the page and take note of the sample provided. An opportunity was then provided for participants to ask questions about the data collection form.

Prior to beginning the videotape, the investigator re-iterated that they would be shown a total of 10 babies. Each baby would be shown for a total of 30 seconds, and then the video monitor would go black for 45 seconds. During this time they were to read the vignette, place a stroke on the line of the visual analogue scale, and write down the cues that led them to that judgement. The demographic information sheet was to be completed when the vignette/videotape portion of the study was over. The demographic information sheet collected information such as age, years of

experience, level of education, and ethnicity (see Appendix H). The nurses were told that the entire process would take a total of 20 minutes. A large clock with a second hand was on the wall for those who were concerned about the time.

When the participating nurses were ready the videotape began. The vignettes/videotapes were presented in the three different randomly ordered formats on a rotating basis (version I, version II, version III). This was done to control for contamination, response set bias, and any effects that could be present due to order of presentation of individual vignettes (order effects).

The investigator remained in the room throughout each data collection period. When all participants finished responding to the 10 vignette/video segments and the demographic information sheets were complete all forms were collected by the investigator. The participants were thanked for their time, and reminded not to discuss the study with anyone until all their colleagues had an opportunity to participate and data collection was complete.

Prior to leaving the room many of the nurses commented to me that they found the study interesting, thought provoking, and would be anxious to hear the results when analysis was complete. When the two week data collection period was complete, the investigator sent a note to the unit thanking all participants for their cooperation, and indicating that a summary of the findings would be posted in the unit when analysis was complete.

Methods of Data Analysis

Both quantitative and qualitative methods of data analysis were utilized in this study. Nurses' ratings of pain intensity from zero to ten on the visual analogue scales provided data that could be quantified.

Qualitative data were included in this study in order to provide a richer, deeper understanding of the research problem. Content analysis was done on the data about the pain cues collected from the open ended questions following each vignette/video. Content analysis is a method for quantifying the content of communications in a systematic and objective way (Polit & Hungler, 1987). The investigator meticulously reviewed the data collection forms to discover, record, and enumerate the occurrence of each of the cues identified by the respondents as those used to judge pain in neonates. A number of categories of cues based upon the literature and the investigator's personal experience as an N.I.C.U. nurse were used to help sort the data (see Appendix I). The seven categories of cues with examples are:

1. Vocalizations - crying; screaming; sobbing; whimpering.
2. Facial expression - grimacing; quivering of the lip or chin.
3. Body movement/posture - extremities - kicking; flailing.

4. State system - reference to behavioral state eg. quiet/alert; unsettled; asleep; sucking or rooting.
5. Physiological signs - reference to skin colour; changes in respiration rate or pattern; muscle tension.
6. Contextual variables - reference to information from the vignette about state of health, age, gestation.
7. Other attributes - hunger; emotional attributes - frustration; distress; anger; discomfort.

Summary

This chapter has outlined the methods used to carry out a descriptive study aimed at exploring nurses' judgements of pain intensity in both term and preterm newborns, and neonatal pain cues. The ethical concerns, population, setting, instruments, and data collection procedures, have been described. The next chapter will describe the results of this study.

CHAPTER IV:

RESULTS

Data Analysis

The purpose of this study was to:

1. examine nurses' judgements of pain intensity in term and preterm infants.
2. describe the cues that neonatal nurses use to assess the possible presence of pain in newborns.

The specific hypotheses tested were:

1. There is no difference in nurses' pain intensity ratings between term and preterm infants undergoing the same procedure.
2. There is no difference in the cues identified by N.I.C.U. nurses as indicating pain in term versus preterm infants.

Data for this study were collected over a two week period in February 1990. Data collected from each of the 45 participants included VAS ratings and descriptions of pain cues for each of the 10 videotaped infants, as well as a demographic questionnaire for each nurse. The data were hand scored by the investigator, coded, and transferred into a computer file. The computer package SAS was utilized to analyze the results.

Under the direction of a statistical consultant, the data were plotted to assess normalcy, compare mean values of pain intensity for each of the ten video/vignettes

and to detect the presence of outliers (variability). Demographic information was summarized using descriptive statistics.

Statistical significance for this study was set at the .05 level. This level of significance was selected because " The minimum acceptable level for significance level in scientific research is .05 " (Polit & Hungler, 1987, p.400). A stricter level of significance for rejecting a null hypothesis (i.e. .01) would increase the probability that a false null hypotheses would be accepted (a Type II error).

To determine if there was a statistically significant difference in pain intensity scores assigned to term versus preterm infants, a two-tailed t-test was used. The t-test is the basic parametric procedure for testing group means (Polit & Hungler, 1987). There are two forms of the t-test for comparing group means - one for independent samples and one for dependent, related, or correlated samples. In this study the correlated samples t-test was used.

One basic assumption involved in t-testing is that the results follow a normal distribution. In addition, use of the t-test assumes that the variability of the two groups is reasonably similar. However, the t-test is robust to violation of its assumptions, and " the results of analysis can still be relied upon to be accurate when one of the assumptions has been violated " (Burns & Grove, 1987, p.503).

An alternative approach to the analysis of the data in this study included utilizing non-parametric or distribution-free techniques. Visual inspection of the data in this study revealed that not all of the results conformed to a normal distribution. Non-parametric methods of analysis involve less restrictive assumptions concerning

the distribution of the critical variables than do parametric tests, and provide another means of interpreting the results. The Friedman two-way analysis of variance by ranks was therefore also utilized to interpret the data.

Content analysis was carried out on the data about pain cues collected from the open ended questions following each vignette/video.

Content analysis is a method for quantifying the content of communications in a systematic and objective way (Polit & Hungler, 1987).

This chapter describes the results of data analysis. Following a discussion of the sample characteristics, each of the hypotheses will be addressed.

Sample Characteristics

During the two week period of data collection, a total of forty-five (45) out of the fifty-five eligible nurses (target population) voluntarily chose to participate in the study (82% response rate). In actual fact the response rate was even higher, as several staff nurses were away on vacation or ill during this two week period, and therefore not accessible. Given the high response rate, the risk of serious response bias is therefore negligible. The sample can be considered to be representative of the target population of nurses in this particular unit.

Demographic Data

All participants in this study were female, with the majority being Caucasian (one Asian). They ranged in age from 20 to 52 years, with a mean age of 31.2 years. The majority of participants were married (68.9%). Forty percent of the subjects were parents (n=18). Three quarters of the group (75.6%) responded that either they or a member of their family had undergone a "severely painful experience" at some point. What constituted a "severely painful experience" was left up to each individual to define. Some examples cited included giving birth, and migraine headaches.

The group's level of nursing experience (or total years practising as an R.N.) ranged from 0.5 years to 29 years ($x = 9.1$ & S.D.= 7.4). Four staff members had one year or less of nursing experience. Thirteen had between 1-5 years of experience. An additional nine nurses had 5-10 years of experience, and nineteen of the participants had been nursing for more than 10 years.

When nursing experience was compared to the total years experience specifically gained in the N.I.C.U. this profile changed. The number of years working in the N.I.C.U. environment ranged from 0.25 to 18 years ($x = 6.4$ & S.D.= 5.5). Roughly one quarter (24.4% n=11/45) of the staff had one year or less experience! A further quarter had between one and five years experience. Ten of the participating staff had between 5-10 years of N.I.C.U. experience, and the remaining thirteen had worked more than ten years in an N.I.C.U.

TABLE 1

Demographic Data

Demographic variables	Range	Mean	S.D.
Age (yrs)	20 - 52	31.2	7.4
Nursing Experience (yrs)	0.5 - 29	9.1	7.4
N.I.C.U. Experience (yrs)	.25 - 18	6.4	5.5

The majority of the subjects (n=38) were diploma prepared nurses with no higher level of educational preparation. Only seven of the subjects had a baccalaureate degree in nursing, and there were no masters level prepared nurses in the group. Eleven of the nurses (24.4%) had completed a post-basic critical care nursing course - either adult (N=3) or pediatric/neonatal (N= 8).

Other demographic data collected revealed that the group was ethnically diverse, with the vast majority being Canadian born but of Anglo Saxon or Eastern European origins. Of those who identified a religious preference, the majority were Protestant (n=19), followed by Catholic (n= 10), and other religions (n=7). The remainder of this chapter will examine the relationships between the empirical findings and the two hypotheses.

Hypothesis #1:

There is no difference in nurses' pain intensity ratings between term and preterm infants undergoing the same procedure.

Descriptive Findings

The data collected from the visual analogue scales indicate that the N.I.C.U. nurses gave significantly higher pain intensity rankings to the fullterm babies than the preterm babies (see Tables 2 & 3). The mean pain intensity score for all five fullterm infants including the control group infant J was 3.73. The mean pain intensity score for the subgroup of four fullterm babies (excluding control baby J) was 3.69.

The mean pain intensity score for the five preterm infants including the control group baby F was 2.55. The mean score for the subgroup of four preterm infants (excluding control baby F) was 2.23.

The range of pain intensity scores for both groups of neonates was wide (see Table 2). All ten of the infants received at least one score of zero. This corresponded to a rating of 'no pain' on the visual analogue scale.

One fullterm (baby H) and one preterm (baby F/control) each rated one score of ten. A rating of ten was indicative of 'pain as bad as it could possibly be ' on the visual analogue scale.

TABLE 2

Pain Intensity Scores

Fullterm				
Baby I.D.	Range	Mean	Median	S.E.
A	0 - 8.2	2.43	2.2	0.28
C	0 - 9.4	3.74	3.9	0.31
D	0 - 8.8	3.74	3.6	0.32
H	0 - 10	4.87	5.0	0.39
J (Control)	0 - 8.2	3.91	4.2	0.36
Preterm				
B	0 - 4.8	1.22	0.7	0.19
E	0 - 5.9	1.26	1.0	0.19
F (Control)	0 - 10	3.84	3.3	0.37
G	0 - 7.7	3.27	3.2	0.33
I	0 - 7.6	3.2	3.2	0.32

TABLE 3

Group Mean Pain Intensity Scores

Group status	Mean score
Fullterm group (A, C, D, H, J)	3.73 *
Fullterm subgroup (excluding control group baby J)	3.69
Premie group (B, E, F, G, I)	2.55 *
Premie subgroup (excluding control group baby F)	2.23

*t = 8.37, d.f. = 8, p < .001

Parametric analyses

When the mean pain intensity scores of all five fullterm babies were compared to the scores of all five preterm babies, the following results were obtained:

$$t = 8.37, df = 8, p < .001$$

When the mean pain intensity scores for the subgroup of four fullterm infants were compared with the scores of the subgroup of four preterm infants, the following results were obtained:

$$t = 1.90 , df = 6, p < 0.1 , n.s.$$

The nurses did not distinguish the control group infants from the other infants of similar gestation. In fact, both the control group infants (who were crying, but had not yet been subjected to the heel lance) received higher mean pain intensity scores

than most of the other babies, although these differences were not statistically significant. When the mean pain intensity scores of the fullterm subgroup of four intervention babies were compared to the mean score of the fullterm control group baby, the following results were obtained:

$$t = 0.44, df = 3, n.s.$$

Similarly, when the mean scores of the subgroup of four preterm intervention babies were compared to the mean score of the premie control group baby, the following results were obtained:

$$t = 2.8, df = 3, n.s.$$

These findings indicate that the pain intensity scores for the two control group infants were similar to the scores obtained for the other four infants in their respective gestational groups. Such being the case, when a comparison is drawn seeking differences in pain intensity scores between the two groups of infants - fullterm and preterm - the control group infants scores can be included in the analysis.

When the mean pain intensity scores for the control babies (n=2) were compared to the scores of the intervention babies (n=8) no appreciable difference existed:

$$t = 1.35, df = 8, n.s.$$

In an attempt to discover if the pain intensity scores correlated with nurses' age, years of experience, level of nursing education, parental status, ethnicity, or religion, Pearson correlation coefficients were derived. Categorical variables were recorded using dummy variables.

A correlation coefficient expresses in numerical terms the direction and magnitude of a linear relationship between variables. The values of a correlation coefficient can range from -1.00 for a perfect negative correlation, through zero for no relationship, to + 1.00 for a perfect positive correlation. " For most variables of a social or psychological nature, however, an r of .70 is quite high" (Polit and Hungler, 1987, p.387). Shelley (1984) states " A correlation must reach .70 before it accounts for almost half of the variance. The popular rule of thumb is that it is a strong correlation when it accounts for half of the variance. Correlations of 0.50, which may seem high actually account for only 25 percent of the shared variance and are considered moderate" (p.182).

The results of this study indicated that neither age, years of experience, level of education, parental status, ethnicity, nor religion were correlated with pain intensity scores. The r values for all of these categories generally fell between 0 and 0.2 . The only variables found to correlate in this study were age with years of NICU experience (0.84), and age with total years of nursing experience (0.92).

In summary, the N.I.C.U. nurses in this study assigned higher pain intensity scores to a group of five fullterm babies in comparison to a group of five premie babies. These results were found to be statistically significant by t-test giving a p

value of < 0.001. Correlations between the pain intensity scores and the variables of age, years of experience, level of nursing education, parental status, ethnicity, and religion were essentially nonexistent to extremely weak, with an r value set at 0.07. Therefore, hypothesis number one was not supported when parametric analysis procedures were employed.

Nonparametric analyses

The Friedman two-way analysis of variance by ranks can be used for three or more dependent groups, with ordinal data. This test considers magnitude rather than absolute scores, and allows for nurse to nurse variability in the rating of pain intensity. For example, some nurses had a tendency to score all ten infants on the lower end of the VAS while others scored the infants on the higher end.

The pain intensity scores were ranked from one (for the infant with the lowest score) to ten (for the infant with the highest score). In the event of tied pain intensity scores, the infants were assigned midranks. " Midrank assignments are preferred, since they tend to produce a conservative test of hypothesis" (Marascuilo & McSweeny, 1977, p. 357). If the observed value of $Xr^2 \geq$ the value in the table for the selected level of significance (p .05 = 16.92; p .01 = 21.67) with 9 degrees of freedom, then the ranks in the 10 columns differ significantly and the babies have different median pain intensity scores.

Since the observed $Xr^2 = 23.36$, df = 9, p = < .01 , significant differences were found.

In this study, 39/45 nurses (86.6%) ranked the group of fullterm babies higher than the group of preterm infants. The sign test is a nonparametric test which can be applied to paired ordinal data to establish that two conditions are different. When there are only two groups (i.e. fullterm and preterm), the Friedman test is equivalent to the sign test (Marascuilo & McSweeney, 1977).

For this data set, the X^2 observed = 22.2 The critical value of X^2, with one degree freedom and p = .05 is 3.84 . Therefore, a significant difference was found between the ranking of the fullterm and preterm groups.

In conclusion, both parametric and nonparametric analyses indicated that differences in nurses' pain intensity determinations between a group of preterm infants and a group of fullterm infants occurred. These nurses assigned higher pain intensity scores or rankings to the fullterm group than the preterm group.

Hypothesis #2

There are no differences in the cues identified as indicating pain in term versus preterm infants.

The content of each of the 45 respondents' answers to the open ended questions for each of the 10 infants was reviewed by the investigator. These responses were then placed into one of seven categories for scoring by frequency counts (see

Table 4). These categories were based upon the literature and the investigator's personal experience as an N.I.C.U. nurse.

Chi-square was used to determine any differences present in fullterm versus preterm for the frequency of cues identified in each of the seven categories. " The chi-square statistic is used when we have categories of data and hypotheses concerning the proportions of cases that fall into the various categories" (Polit and Hungler, 1987, p.412).

Three cues, body movement, context, and other attributes (such as hunger) were found to show statistically significant differences in the frequency of cues identified by the nurses as indicating pain in term versus preterm infants (see Table 4).

The category of vocalizations was most frequently identified as indicative of pain in the newborns. References were made to a number of different aspects of crying including pitch, intensity, quality, and pattern. Examples include: "high pitched cry", "weak cry", "loud cry", "shrill cry" and "intermittent cry". Other kinds of vocalizations described by the nurses as indicative of pain included screaming, sobbing, whimpering, groaning, and screeching.

TABLE 4

Frequency of Cues Used to Identify Pain by Gestation

Cue	Fullterm		Preterm		Total	
	n	%	n	%	n	%
1. vocalizations	160	(35.48%)	166	(36.81%)	326	(72.4%)
2. facial expression	62	(13.75%)	65	(14.41%)	127	(28.2%)
3. body movement*	126	(27.94%)	93	(20.62%)	219	(48.6%)
4. state system	44	(9.76%)	62	(13.75%)	106	(23.5%)
5. physiological	21	(4.66%)	17	(3.77%)	38	(8.4%)
6. context *	50	(11.09%)	30	(6.65%)	80	(17.7%)
7. other attributes *	72	(15.96%)	41	(9.09%)	113	(25.1%)

0.05 critical value of X^2 with 1 df = 3.84

* denotes statistically significant difference $p < 0.05$

Body movement was mentioned in approximately 48% of the responses of the 45 nurses to the 10 babies. This category included references to limb movement, movement of hands and fingers, movement of the torso and head, as well as body posture and position. Examples in this category include: "waving arms", " kicking", "fists clenched", "fingers splayed", and "thrashing around".

Facial expression was noted approximately one quarter of the time (28.2%). This category included reference to facial grimacing, quivering of the lip, chin, or tongue, clenching of the eyes, and facial expressions such as frowning, scowling, and the presence of a furrowed brow.

The assignment of other emotional attributes was also mentioned 25% of the time. Most commonly, hunger was mentioned by the nursing staff as a possible explanation as to why the infant was crying. A total of 23 references to hunger were made for fullterm babies, and 17 for babies in the preterm group. At least one reference to hunger was made for all of the infants with the exception of one premature baby (E). Other emotional attributes assigned to the infants by this group of nurses included frustration, distress, anger, agitation, and sadness.

References to state system often included comments about self calming behaviours such as sucking and rooting. " Baby unresponsive to soother" , " Trying to suck on hand" ,and "Baby appears to be rooting" are some examples. The nurses also commented about baby's behaviour or changes in activity level or state such as " Baby appears to be falling asleep" , is "fussy", "unsettled", or "active".

Context and physiological variables were recorded least frequently. Contextual cues noted included reference to the infant's health status, a noxious stimulus, and gestational age. Sometimes this information came directly from the written vignette which accompanied each video segment. Examples of the nurses' use of context are:

" History doesn't indicate painful treatments", " No obvious sources of pain (IV, OR, etc) ", "I.V. in place", " Dressed in isolette, doesn't appear sick ", and " Healthy premie with no apparent noxious stimulus" .

Physiological variables addressed by the nurses in this study included references to skin colour such as " looks dusky" , "turned red in the face", and "face looks flushed". Some nurses noted changes in respiration rate or pattern, including breath holding and hyperventilation.

Following completion of the study, a few of the respondents commented that 30 seconds of videotape viewing did not allow them sufficient time to make a fair judgement of the infants' status. However, the majority remarked that they had seen and heard enough in that time period to make a response. Thus, individual respondent variability in decision making played a role with regards to this aspect of the study.

Respondents also commented that they were better able to express themselves once they 'got into it'. Each nurse seemed to develop her own assessment style and pattern which was followed with each succeeding question. Nurses tended to comment upon the same aspects such as facial expression or type of cry for all ten of the babies viewed. In order to take into account the possibility of response set bias in this study, the investigator utilized three different formats of presentation. Response set bias can be defined as " The measurement error introduced by the tendency of some individuals to respond to items in characteristic ways, independently of each item's content." (Polit & Hungler, 1987, p.536).

When the babies in the three different presentation formats were rank ordered by mean pain intensity scores, the ranking did not appear to differ greatly between the three versions (see Table 5). Babies B and E always were ranked as having the lowest mean pain intensity scores, falling into either positions one or two. Babies A and G were always ranked in either third of forth position. Babies I and D were ranked twice in the same position, with a shift of only one position in the third version. Babies C and F fell into the same ranked position in versions one and two, and shifted over two ranks in version number three. Baby J was ranked in ninth position in versions one and two, but held the fifth position in the third version. Baby H was ranked in position ten (indicating the highest mean score) for all three versions.

TABLE 5

Ranking of infants by Mean Pain Intensity Scores

lowest mean score ..... highest mean score										
Version I:	B	E	A	G	I	C	F	D	J	H
Version II:	E	B	G	A	I	C	F	D	J	H
Version III:	E	B	A	G	J	I	D	C	F	H

In conclusion, these results indicate that vocalizations, body movement and facial expression were the most frequently identified cues reported by neonatal nurses as indicative of pain in newborns.

Some differences were found in the frequency of cues noted between term and preterm infants. These differences were found in the categories of body movement, frequency of use of context, and the frequency of nurses assigning other attributes to the infants. In all three of these situations, these particular cues were mentioned more often for the fullterm than the preterm infants (see Table 4).

Hypothesis number two, which stated that there were no differences in the cues identified as indicating pain in term versus preterm infants was therefore rejected. The next chapter will discuss the implications of the findings drawn from the data analysis.

CHAPTER V:

DISCUSSION

Summary

This study was designed to explore and describe nurses' judgements of pain intensity in fullterm and preterm newborns, and neonatal pain cues. The conceptual framework which guided this study was derived from the work of Davitz & Davitz (1981) that examined nurses' inferences of patients' pain and psychological distress. This model is comprised of three major components: observation of cues; interpretation of cues; and judgement of another person's suffering.

The nurses in this investigator's study were presented with 10 videotaped segments of neonates. Each of the ten videotaped segments presented was accompanied by a written vignette and a visual analogue scale with extreme end points representative of no pain and pain as severe as possible. All 10 video/vignette combinations were followed by an open ended question about the cues that lead the nurse to her decision or judgement about pain intensity. As well, every subject completed a demographic information form at the conclusion of the test period.

This investigation combined both a quantitative and qualitative approach to the study of the research questions. Frequency distributions, T-tests, correlation co-efficients, chi-square, and the Freidman two-way analysis of variance by ranks were used to analyze the quantitative data. Content analysis was used to examine the qualitative findings.

The research sample was comprised of 45 N.I.C.U. staff nurses employed in a large, university affiliated tertiary care hospital. All staff nurses in the unit were invited to participate. A response rate of 82% was achieved.

The results of this study, obtained through both parametric and non-parametric methods of analysis, indicated that the N.I.C.U. nurses attributed a higher level of pain intensity to fullterm than to preterm newborns. Neither nurses' age, experience, level of education, nor parental status was found to relate to the pain intensity scores.

Content analysis confirmed that in general, the cues identified by this group of nurses were similar to those reported in the literature. Crying, body movement, and facial expression were most frequently identified as being important in making judgements about a newborn's pain experience. Some differences in the cues identified by the nurses in assessing pain in term versus preterm neonates were found. These results raise a number of possible interpretations, conclusions, implications for nursing practice, and future nursing research.

Discussion

In this study, the first null hypothesis which stated " there is no difference in nurses' pain intensity ratings between term and preterm infants undergoing the same procedure" was rejected. A statistically significant difference was found in nurse rated pain intensity scores between the fullterm and preterm infants. Higher mean pain

intensity ratings were attributed to the fullterm babies in this series than to those who were premature. When ranking procedures were carried out on the data, it was found that the fullterm group of babies was consistently ranked higher than the preterm group with regards to pain intensity.

The most logical explanation of the findings is that in general, the fullterm infants were more vigorous and vocal. They cried louder and harder, and were much more active than their premature counterparts. From this data, it appears that pain intensity judgements by nurses are influenced by the vigour and richness of the infant's behavioral response.

These findings confirm those previously reported by von Baeyer, Johnson, and McMillan (1984) in their study of consequences of nonverbal expression of pain and observer concern. Von Baeyer and colleagues utilized two videotapes portraying low and high nonverbal pain expressiveness. Visual analogue scales measured the observer's judgement of the patient's pain and distress. These researchers found that high nonverbal expressiveness yielded significantly higher ratings of patient pain.

This phenomenon potentially has important clinical implications, as it suggests that the 'squeaky wheel gets the grease'. The prematures are deemed to be suffering less when such may not be the case. The nursing care of these infants (or other groups of quiet or frail children such as those with a debilitating illness) may be subsequently influenced such that they do not receive adequate analgesia because

they are not able to communicate their suffering to their caretakers. Lack of recognition of pain in premature neonates may result in other consequences aside from infant suffering.

Acute pain episodes with associated physiological changes are not without potential risk. Fluctuations in blood pressure resulting in hypertension, or swings in blood sugar and osmolarity brought about by metabolic shifts, may result in detrimental consequences to a premature infant such as increased incidence of intraventricular hemorrhage. Nurses must be able to accurately assess pain in this group of infants so that appropriate pain control measures can be instituted. This may serve to decrease the morbidity in this population.

Aside from the physiological and biochemical effects, pain in the short term can affect an infant's activities of daily living. The presence of pain in a bottle or breastfeeding infant can adversely affect nutritional status, as a result of anorexia, vomiting, or lack of energy for sucking. Pain can disrupt sleep-wake cycles, affecting both the quality and quantity of the newborn's sleep. This may impact upon recovery from illness and also hamper thriving. Finally, pain may affect an infant's activity and movement, as well as his ability to interact in a positive engaging way with parents or caretakers. Control of pain in neonates can have a positive effect on infants' general well-being, and facilitate a healthy bond with the parents.

The longterm effects of the pain experience on a developing premature infant are not yet well known. However, animal research indicates that there may be harmful effects from inappropriate sensory stimulation during critical periods of

neurodevelopment. Furthermore, research into the new field of psychoneuro-immunology suggests that the presence of ongoing stress and pain can have an effect on the immune system. This could result in these infants being even more susceptible to infection and illness. A great deal of future research and long-term studies are needed to address these questions.

One might surmise that the longer a nurse has worked and the greater her level of clinical experience, the more adept she would be at recognizing pain in her patients and differentiating pain behaviour from other infant behaviour. Benner (1984) has described a progression from novice to expert clinical nurse which involves a change from reliance on abstract principles to concrete experiences.

Differences in how novice versus expert nurses diagnose why an infant is crying have recently been reported (Holden & Klingner, 1988). They identified a number of differences in the problem-solving approaches of the groups studied. In their study, experts differed from novices by using less information, and selecting different information units to solve the computer-presented simulations. In addition, nursing students who were also parents were the most accurate in solving the simulated computer-problem of why an infant was crying.

In contrast to the findings of Holden & Klingner, this investigator found no correlation between pain intensity score and nurses' age, years of experience, level of education, or parental status. This study, however, did not look at the process of decision making but rather focused on the final result. Perhaps the processes of

arriving at the pain intensity scores differed among nurses of different ages or levels of experience, but made no difference to the ultimate findings.

Another possible explanation of the lack of association between the variables of experience, education, and parental status and pain intensity scores on the visual analogue scales might be that the acceptance of the notion that newborns actually experience pain is a relatively recent one. As a result, education for nurses related to pain assessment in newborns is a very recent endeavour. It is only within the past two years that the topic of pain assessment and management in neonates has been taught in the post-graduate neonatal critical care specialty course in this city, or included in hospital orientation programs for newly hired N.I.C.U. nurses at the hospital in which this research was carried out. In a recent survey of continuing education needs for nurses at the Children's Hospital in Winnipeg, neonatal pain assessment and management were deemed to be of high priority.

Therefore, nurses in this study, despite their various levels of nursing education and experience may have had similar scores because very few of them have had any formal education in this particular area. Only one of the 45 nurses participating in this study indicated that she had received any additional education or attended any programs on the concept of pain. This finding identifies a need for continuing education for nurses in practice, as well as for the inclusion of this topic in basic nursing education programs.

The results of the test of the second hypothesis which stated " There are no differences in the cues identified as indicating pain in term versus preterm infants "

indicated that the frequency of body movement and posture, context, and other attributes (ie. such as hunger) were more often identified by the nurses as cues of pain in the fullterm than the preterm group of infants. The nurses' greater frequency of documentation of body movement can be readily explained by the fact that the fullterm babies exhibited more movement than the premature infants. The prematures may not have had the energy or neuromuscular development necessary to express themselves as blatantly in this dimension as their fullterm counterparts. This is congruent with Als synactive model of neonatal behavioral organization (Als, 1986) which highlights the differences in neurodevelopmental capabilities between premature and fullterm neonates.

Context appeared to be more important to the nurses looking at fullterm babies than the prematures (see Table 4). Contextual cues included: reference to the infants health status (eg. a healthy baby), medical conditions such as hyperbilirubinemia; the presence of an intravenous line; reference to a noxious procedure, stimulus, or possible source of pain; and reference to other factors such as the baby being handled, noise in the environment, bundling, and gestational age. The importance of context as related to nurses' judgements of pain in newborns is an issue that needs to be investigated further in future studies.

The frequency with which other attributes were mentioned by the respondents also resulted in a statistically significant difference between the fullterm and preterm groups. Other attributes were noted by the respondents 72 times for fullterm infants, and 41 times for preterm infants (see Table 4).

The category of other attributes was comprised of the nurses attributing emotional attributes to the infants such as frustration, distress, anger, irritability, fussiness, and hunger. Discrete emotional expressions can be recognized in the fullterm newborn infant. Perhaps they are not present or just more subtle in premature infants. The fullterm babies may have exhibited a greater number of emotional expressions and behaviour patterns than the premature infants purely as a result of more advanced neurological development.

More often it was suggested that the fullterm babies might be crying because they were hungry. The nurses made a total of 23 references to hunger for fullterm babies, and 17 for babies in the preterm group. At least one reference to hunger was made for all of the infants with the exception of one premature baby (E).

The difference in frequency of nurses reporting hunger as a pain cue might be explained by their knowledge that the prematures are generally fed on a regular schedule in hospital. Fullterm babies are often fed on demand, and therefore not fed until they indicate that they are ready to eat, (which is generally communicated by crying).

A more likely explanation might be the presence of bias in the written vignettes. The written vignette for fullterm baby A made reference to " some minor feeding problems - a weak suck, and G.I. reflux following feeds ". This was the only vignette that made specific reference to feeding. This contextual information probably led the nurses to attribute hunger to fullterm group member baby A more often than to other infants, including those in the preterm group.

Vocalizations (crying behaviours) were ranked as the most frequently noted cue indicating pain in both groups of infants. This was followed by body movement and facial expressions. These findings support those reported by Jones (1986) in her study identifying signs and symptoms that nurses interpret as indicating pain in newborns.

Physiological variables were utilized the least as pain cues by the nurses in this study. Changes in pulse, blood pressure, the presence of dilated pupils or perspiration could not be readily assessed by viewing the videotape. This factor could therefore account for the decreased frequency of cues noted by participants in this study versus actual clinical conduct.

Another possible explanation accounting for the low frequency of physiological cues might be that N.I.C.U. nurses are accustomed to utilizing a variety of monitors to provide them with continuous information about an infant's vital signs. Although some of the infants in this study were attached to heart monitors, for the sake of continuity this information was not included. Perhaps the N.I.C.U. nurses are so dependent on monitors that they neglect to observe the more discrete physiological signs of pain such as skin colour (eg. duskiness, flushing, or mottling), changes in respiration rate or pattern of breathing (including breathe holding and hyperventilation), sweating, or increased muscle tension.

Of some interest are the sociodemographic descriptive findings of the nurses in this study. The demographic data profile of this investigator's study is similar to the group of nurses described by Jones in her 1986 study entitled 'Identification of

Signs that Nurses Perceive and Interpret as Indicating the Possibility of Pain in the Newborn' (see Table 6). Jones utilized a convenience sample of eight-one registered nurses who cared for newborns in a large, tertiary care, university affiliated hospital in the midwest of the U.S.A. The strong similarities between the two groups of nurses sampled provides some justification as to the representativeness of the sample of N.I.C.U. nurses in this study. These similarities, may therefore allow for a limited degree of generalizability to other groups of neonatal nurses in central North American teaching hospitals.

The main difference between the nurses in Jones group and this investigator's study lies in the area of nursing education. Jones' group had a higher percentage of nurses educated at the baccalaureate level (43.3%) in comparison to the local group (15.5%) (see Table 6). This finding is not surprising, and congruent with the pattern of development of nursing education programs throughout North America. Since level of nursing education was not found to be related to pain intensity scores in this investigator's study, the differences in educational preparation between Jones' group and the local group may not be important.

TABLE 6

Comparison of Sample Characteristics

	Jones (1986)	Shapiro (1990)
Sex:	female = 98%	female = 100%
Race:	caucasian = 100%	caucasian = 99%
Age:	mean years = 29	mean years = 31
Parent:	with children = 44%	with children = 40%
Nsg. Educ.:	RN = 56.7%	RN = 84.5%
	BSN = 43.3%	BN = 15.5%
Total years nursing experience:		
	range = .08 - 33 years	range = .5 - 29 yrs.
Neonatal nursing experience:		
	range = .08 - 11 years	range = .25 - 18 yr.

Limitations of the Study

The investigator has identified a number of limitations of this study that need to be addressed. The generalizability of this study is limited by the fact that all data were collected in one hospital from a small group of nurses. Any conclusions reached may be applicable only to this particular population, although there may be a limited degree of generalizability to other groups of neonatal nurses in central North America.

The use of random sampling in the selection of the 10 videotaped segments utilized (rather than a convenience sample selected by the investigator) would have served to eliminate the possibility of selection bias. This could have been achieved by videotaping more than five fullterm and five preterm infants (i.e.ten and ten) and then randomly selecting five members from each group. As well, random sampling should have been utilized in the selection of control group (pre heel lance) members to eliminate further potential bias.

All of the premature infants in this study were relatively healthy babies of $\geq$ 34 weeks gestation and < 37 weeks gestation. No infants of less than 34 weeks gestation were included. This condition arose as a result of an absence of infants <34 weeks gestation in the nurseries during the instrument development phase who also met ethical eligibility requirements. The findings of this study are therefore limited to neonates within a gestational range of 34-40 weeks.

A larger panel of babies (ie.10 term and 10 preterm infants) might have provided a more diverse group of newborns and possibly different findings. The inclusion of premature infants of < 34 weeks gestation would have also broadened the scope of the instrument. However, the study of premature infants of less than 34 weeks gestation could be another entire study as these infants are even less mature from a neurodevelopmental standpoint, and tend to require more technological support in order to survive.

Another possible limitation was the lack of consistency in the presentation of the infants. For example, some were clothed and others were naked or in diapers. Some

were in isolettes while others were in cribs. These factors provided subtle contextual cues to the nurse respondents, as they gave some indication of the infants' state of wellbeing. On the other hand, the clothing or blankets sometimes interfered with the nurses' ability to observe total body motion, posturing, colour, etc.

Ideally, all infants should have been left in diapers (to eliminate the introduction of the sex variable which might influence nurses' judgements) and placed on open Ohio beds. This would have allowed for greater observation of infant behaviour. However, the investigator wanted the infants to be as natural and true to the clinical situation as possible. By videotaping them as they were, the investigator was less intrusive and the study was more closely true to real life conditions in the nursery. Nurses often make judgements about babies who are dressed/undressed or inside/outside isolettes.

N.I.C.U. nurses are not used to working with the relatively healthy babies as viewed in this study. The inclusion of more contextual information such as heart rate, blood pressure or transcutaneous oxygenation readings may have been helpful in making this methodology more meaningful for this group of respondents.

Part of a nurses's decision making in the clinical situation is based upon the ability to handle and interact with the infant and note response. This component was not available to the nurses in this study.

Implications for Practice

This study has implications for the nursing care of hospitalized premature newborns. Nurses have much of the responsibility for the assessment of pain and the provision of subsequent comfort measures. There was a great deal of nurse to nurse variability in the judgements of pain intensity on the visual analogue scale. This is probably due in part to nurses' difficulty in recognizing the behavioral cues of pain in infants. If nurses have a difficult time reading the cues of preterm infants and do not recognize that an infant is experiencing pain, babies will suffer unnecessarily. Furthermore, this may result in an increase in morbidity and mortality.

Neonatal nurses should be provided with continuing education that focuses on preterm infant neurobehavioural development and cues for care. Als (1986) synactive model of development and the Assessment of Preterm Infant Behaviour (A.P.I.B.) tool can be utilized to help nurses better understand the immature infant's individual behavioral cues.

Use of Als' synactive framework for the assessment of preterm infant behaviour would allow the nurse to determine an infant's threshold for stress such as pain. Behaviours such as gaze aversion, yawning, or hiccoughing may be subtle cues from a premature infant that he or she is being stressed. Recognition and correct interpretation of these cues and others is essential in order that subsequent nursing care can be provided to help the infant cope with the pain. For example, the

infant may cope better if he or she is bundled during the insertion of an intravenous line.

Following completion of the testing sessions, some nurses commented to me that this study had forced them to think about how they arrived at their decisions. One nurse stated " I never really thought about how I assessed pain before." Others commented that it would be helpful to have some specific guidelines to follow so that everyone would be assessing the babies' pain in a consistent way. A need for standards of pain assessment exists to ensure consistent, quality nursing care. This study therefore has implications both for nursing practice and education.

Recommendations for Future Research

A number of recommendations for future nursing research arise from this study. One important recommendation would be to replicate this study with nurses from other Neonatal Intensive Care Units both in Canada, the U.S.A., and overseas. This would serve to enhance the sample size and determine if the findings can be generalized to the broader population of neonatal nurses. Larger collaborative studies with nurses in foreign countries and with nurses of various ethnic and religious affiliations could provide some important findings regarding the influence of these variables on determinations of infant pain and suffering.

In a further attempt to broader the applicability of this study's findings, it would be interesting to replicate the study on a number of other groups of

individuals: neonatal nurses employed in intermediate care and normal nursery environments; nursing students; pediatric residents, neonatal fellows and neonatologists; and lay persons, both parents and non-parents.

Nurses working in an intermediate care or normal nursery may be more accustomed to listening to crying babies than N.I.C.U. nurses. Infants in a neonatal intensive care unit are often intubated, and therefore can't produce an audible cry. Other infants in the N.I.C.U. are simply too frail and may produce only a brief, weak cry when distressed. Perhaps this difference in working environment plays a role in pain intensity judgements. Intermediate care and normal nursery nurses may view crying as a normal phenomenon rather than one indicative of pain, or perhaps they become habituated to the crying and no longer respond to it in the same way.

Results of this study lead this investigator to speculate that other groups of quiet, frail, or behaviourally non-demonstrative children (i.e. those from verbally non-expressive cultural groups or those with chronic pain) may also be misread or ignored by nursing staff. Further research must be done in this area to determine if such in fact is the case.

In this study, years of experience, level of education, and parental status did not correlate with pain intensity scores. It has been suggested that this is indicative of a lack of formal education in this area, and that nurses in practice do not follow any particular method of assessing pain in newborns. If such is the case, then scores of student nurses, new nursing graduates, or lay people should be similar to the scores of the nurses sampled in this study.

While it is the responsibility of the nurse to assess her patient's pain, and administer analgesics as ordered, it is the responsibility of physicians to order the medications. As the patient's advocate, nurses are frequently placed in a position where they must convince the physician that the administration of a pharmacologic agent is indeed warranted. Such being the case, it is important to compare the pain intensity scores of the nurses to those of physicians working in the area of neonatology in future studies.

Other ideas for further research include utilizing videos of sick infants (e.g. those requiring ventilatory support), premies of gestation < 34 weeks, and videos of infants undergoing a variety of different types of painful procedures (e.g. veinpuncture, I.V. insertion, lumbar puncture, etc).

Since nurses in the clinical setting are aware when an infant is undergoing a painful procedure this might make a difference to their inferences of pain. Another study could, therefore, compare nurses' pain intensity scores when they are told the infants in the videotape have undergone a painful procedure, versus when they are not informed that a noxious event occurred.

This study considered only one aspect of nurses' judgements concerning neonatal pain - the determination of pain intensity. Another study of relevance would be to examine nursing behaviour in response to neonatal pain. Do more expressive babies actually receive more attention, medication, or different nursing care than the quieter, less expressive infants? Is there a correlation between the pain intensity rating scores and the amount of time a nurse devotes to her patient? Finally, long-

term studies are needed to assess the effects that pain in the neonatal period may have upon future child development, personality, and pain perception.

Conclusion

This study utilized a new method for assessing nurses judgements of pain intensity in newborns - videotapes of infants accompanied by written vignettes and visual analogue scales. This methodology was used to increase the validity of the data derived from this study in comparison to other previously utilized methodologies such as questionnaires.

It was found that NICU nurses attributed a greater intensity of pain to a group of fullterm neonates than to a group of preterm neonates. The participants were not aware of the fact that eight of the infants had just undergone a heel lance to obtain a blood sample. Two of the infants, one fullterm and one preterm were shown prior to undergoing this procedure, and thus served as a control group.

Despite the fact that all eight of the intervention group babies (four term and four preterm) underwent the same procedure, there was variability in the individual infants' response to the painful stimulus. Some infants were very vigorous and expressive, while others were less active or expressive. Nurses based their inferential judgements about the infants' pain experience upon the behavioral and contextual cues they picked up from each infant. The findings confirm those previously reported

by von Baeyer, Johnson, and McMillan (1984) who reported that situations of high expressiveness yielded significantly higher ratings of patient pain.

Surprisingly, neither age, experience, level of education, or parental status appeared to be related to the pain intensity scores. These results are in contrast to other studies that indicate that 'expert' nurses who have greater experience are more astute decision makers.

The cues that the nurses reported as indicating the possible presence of pain in neonates confirmed those previously cited in the literature. Three variables, body movement, context, and other attributes were found to show significant differences in the frequency with which they were identified as indicating pain in term versus preterm infants.

Findings have provided some tentative support for the concept that nurses attribute a greater intensity of pain to fullterm versus preterm infants. They have also contributed important baseline data in an area of research that is relatively new and unexplored.

Several implications for nursing practice, education, and research have been identified. The use of this new methodology as a research tool for deriving clinically pertinent data appears promising. Further refinement and use will be of benefit in providing answers to future questions about infant pain assessment and management.

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APPENDICES

APPENDIX A

CONSENT TO VIDEOTAPE NEWBORN

I (please print name in full)_____, parent of baby _____, give my permission to Carla Shapiro, RN, BN, Masters in nursing candidate, to make a videotape recording of my infant.

It has been explained to me that the videotapes are being made by Ms Shapiro to be used in her research. The purpose of this research is to learn more about how nurses judge baby behaviour, and how nurses respond to these signals. Upon completion of this study, the tape may be used by Ms Shapiro for educational purposes to teach other nurses, and/ or further research.

I understand that the videotaping process will in no way interfere with the usual care that my infant receives, and that nothing special or extra will be done to my baby for the sake of the video. I have been told that code numbers will be assigned to all infants to maintain confidentiality, and my infant will not be referred to by name in the video. All videotapes will be securely stored by Ms Shapiro in a locked filing cabinet.

I have been told that participation in this project is completely voluntary, and there is no direct benefit of participation to myself or my infant. Choosing not to participate will in no way affect or alter the care that myself or my infant will receive in hospital. If for any reason I choose to withdraw from the study, I may do so by notifying Ms. Shapiro. The video of my baby will then be destroyed.

I give Carla Shapiro RN, BN, permission to make a videotape recording of my infant, which will be used for nursing research and educational purposes.

Date:_____

Signature of parent: _____

Investigator's signature:_____

Investigator's phone no.: (work)

(home)

APPENDIX B

WRITTEN EXPLANATION OF VIDEOTAPING FOR PARENTS

A registered nurse, who is currently a student in the Master's in Nursing program at the University of Manitoba, will be doing a study of nurses who care for newborns in hospital. The investigator hopes to learn more about how nurses recognize and interpret baby behaviours.

In order to do this, the nurse researcher needs to make some videotapes of newborn infants. You are being asked to participate in this preparatory phase of the study by allowing this nurse to make a videotape recording of your baby while he/she receives the usual hospital care. Nothing special or extra will be done to your baby for the sake of videotaping, as the idea is to make a video of a newborn infant receiving normal care.

Your participation in this project is completely voluntary. There is no obligation to participate. If you do not wish to allow your baby to be videotaped, this will in no way interfere or affect the care that you or your baby receive in hospital.

However, your permission to allow a videotape to be made of your baby may help nurses learn more about behavioral signals in infants, and provide better care for newborns in the future.

If you have any questions about this project and how the videos will be used in the study, feel free to contact the nurse researcher. Her name is Carla Shapiro, and she can be contacted by telephone at: work = or at home =

APPENDIX C

APPROACH OF PARENTS TO SEEK CONSENT FOR VIDEOTAPING

" Good morning (afternoon). My name is Carla Shapiro, and I'm a registered nurse working on my Master's in Nursing at the University of Manitoba. Would it be alright if I spend a few minutes with you now to talk to you about my project? " [If the mother is in agreement I will proceed. If she indicates that this is not a good time, I will ask for her permission to return later. If she indicates that she is not interested in talking to me, I will respect her choice and leave].

" I understand from the nurses in the nursery that your baby will be having a heelstick done today to collect blood for (P.K.U./ sugar). I'm going to be making a number of videotapes of babies having this procedure done, and I've come to ask if you would consider allowing me to do this.

Its completely voluntary, so if you'd rather not, it's perfectly o.k., and this will in no way affect the care that you or your baby receive here in the hospital." [allow time for parent to respond or ask questions].

If parent responds negatively, then investigator will respond:

" O.K. That's just fine. Thanks for your time."

If parent hesitates or is ambivalent, investigator will respond:

" I have a written explanation of the project with me. Would you like to have a chance to look it over before making up your mind one way or the other? "

If parent agrees or expresses an interest in the project, the investigator will respond:

" I have a written information sheet that gives more information about the project. Would you like to take a few minutes now to read it over? "

If parent remains in agreement following this, than the investigator will bring out the consent form and say

" Before I can go ahead, I'll need your written permission to videotape your baby. Here's a copy of the consent form that you'll need to sign. Would you please read it through? If you have any questions as you go along, just stop and ask me. "

If parent agrees and signs the consent form, investigator will respond: " Thanks for your cooperation. I really appreciate it."

If parent reads consent form and hesitates, or indicates she would prefer not to sign anything, investigator will respond:

" That's perfectly O.K. Thanks for your time anyway."

APPENDIX D

CONSENT FROM LAB FOR VIDEOTAPING

I, (please print name in full)_____ give my permission to Carla Shapiro, RN, BN, Masters in Nursing candidate, to make a videotape recording of the participating infant under my care while a routine blood test is being performed by myself.

It has been explained to me that the videotapes are being made by Ms. Shapiro to be used in her research. The purpose of this research is to learn more about how nurses judge baby behaviour, and how nurses respond to these signals.

I understand that the investigator is interested in recording only the infant's behaviour throughout the procedure, and that both the infant and myself are to remain anonymous. I will not be referred to by name during the videotaping, and my face will not be filmed. I have also been told that I am in no way being evaluated or judged on my technique or performance in carrying out the procedure.

My participation in this project is completely voluntary, and there is no direct benefit of participation to myself. Choosing not to participate will in not way affect my job, and I may withdraw from this project at any time by informing Ms. Shapiro.

I have been told that the videos will be stored in a locked cabinet by Ms. Shapiro. Following completion of the study, the tapes will not be destroyed, as they may be of use in future nursing research or for educational purposes. However, confidentiality will be maintained at all times.

I give Carla Shapiro, RN, BN, permission to make a videotape recording while

I carry out a routine procedure on a participating infant.

Date: _____

Signature: _____

Investigator's Signature: ----------

Investigator's phone no.: (work)

(home)

APPENDIX E

NURSES' CONSENT TO PARTICIPATE

This consent form is to certify that I _____(please print full name), agree to participate in the research study being conducted by Carla Shapiro, RN, BN, who is a Masters in Nursing student at the University of Manitoba. I understand that the purpose of this study is to examine nurses' judgements of pain intensity in newborns, and to identify the signals or cues that nurses use to assess pain in neonates.

I have been informed that the format of the study will be composed of 1O videos of neonates , each accompanied by a short written description. I will be asked to answer a number of questions based upon the information provided, as well as provide some general demographic information (such as age, years of experience, etc). The entire study will take approximately 30-45 minutes and will be conducted at the hospital.

I understand that numerical codes will be used in place of names in order to maintain confidentiality, and that only group or aggregate data will be reported. All information collected from me will be treated with strict confidence. Only the investigator, thesis committee members, and statistical consultant will have access to the data collected. All data collection forms will be securely stored by the investigator in a locked filing cabinet. Following completion of the data analysis and

publication of the findings, a summary of the findings will be posted in the unit for my information.

My participation in this study is completely voluntary, will have no effect on my job, and I have the option to withdraw at any time. I am aware that I will not directly benefit from participating in this study.

Should I have any questions or concerns about this study, I know that I may contact the investigator (Carla Shapiro) at any time.

My signature below indicates that I have been informed about the proposed study and agree to participate as a volunteer.

Date:_____

Signature of participant: _____

Carla Shapiro RN, BN

Phone: (home)

(work)

APPENDIX F

VIGNETTES - DATA COLLECTION FORM

INSTRUCTIONS:

You will now view a video composed of 10 brief segments of newborns. A short written description is provided about each baby. Following each baby's video segment, you will have 60 seconds to read the description and complete the questions. Please rate how much pain you believe that each infant is experiencing, by placing a stroke somewhere through the line.

SAMPLE:

NO PAIN_____ PAIN AS BAD AS IT COULD POSSIBLY BE

1. Baby A. is a fullterm infant delivered by C. section 5 days ago for C.P.D. This infant has some minor feeding problems - a week suck, and G.I. reflux following feeds.

NO PAIN_____ PAIN AS BAD AS IT COULD POSSIBLY BE

What are the cues that lead you to that judgement? (Please include any visual, auditory, and written clues).

2. Baby B. is a healthy 5 day old premature infant, delivered at 34 weeks gestation by C. section.

NO PAIN_____ PAIN AS BAD AS IT COULD POSSIBLY BE

What are the cues that lead you to that judgement? (Please include any visual, auditory, and written clues).

3. Baby C. is a fullterm infant 4 weeks of age with B.P.D. The infant requires continuous oxygen by nasal prongs.

NO PAIN_____ PAIN AS BAD AS IT COULD POSSIBLY BE

What are the cues that lead you to that judgement? (Please include any visual, auditory and written clues).

4. Baby D. is a fullterm infant 2 days of age, receiving prophylactic I.V. antibiotics in view of maternal pyrexia.

NO PAIN_____ PAIN AS BAD AS IT COULD POSSIBLY BE

What are the cues that lead you to that judgement? (Please include any visual, auditory and written clues).

5. Baby E. is a healthy premature infant one day of age, delivered at 34 weeks gestation.

NO PAIN_____ PAIN AS BAD AS IT COULD POSSIBLY BE

What are the cues that lead you to that judgement? (Please include any visual, auditory and written clues).

6. Baby F. is a healthy 5 day old premature infant delivered at 35 weeks gestation.

NO PAIN_____ PAIN AS BAD AS IT COULD POSSIBLY BE

What are the cues that lead you to that judgement? (Please include any visual, auditory and written clues).

7. Baby G. is a healthy 5 day old preterm infant delivered at 35 weeks gestation with hyperbilirubinemia.

NO PAIN_____ PAIN AS BAD AS IT COULD POSSIBLY BE

What are the cues that lead you to that judgement? (Please include any visual, auditory and written clues).

8. Baby H. is a healthy fullterm newborn 3 days of age with hyperbilirubinemia.

NO PAIN_____ PAIN AS BAD AS IT COULD POSSIBLY BE

What are the cues that lead you to that judgement? (Please include any visual, auditory and written clues).

9. Baby I. is a healthy premature infant with polycythemia and resolving jaundice.

NO PAIN_____ PAIN AS BAD AS IT COULD POSSIBLY BE

What are the cues that lead you to that judgement? (Please include any visual, auditory and written clues).

10. Baby J. is a healthy fullterm newborn 3 days of age with jaundice.

NO PAIN_____ PAIN AS BAD AS IT COULD POSSIBLY BE

What are the cues that lead you to that judgement? (Please include any visual, auditory and written clues).

NOW PLEASE TURN THE PAGE TO COMPLETE THE DEMOGRAPHIC INFORMATION SECTION.

APPENDIX G

FORMAT OF VERSIONS

	I	II	III
1.	A	F	B
2.	B	E	J
3.	C	I	E
4.	D	D	F
5.	E	A	A
6.	F	H	A
7.	G	B	D
8.	H	G	G
9.	I	C	C
10.	J	J	I

APPENDIX H

DEMOGRAPHIC DATA

1. Age: __ years

2. Marital status : (please check one)

__ married

-- single

-- divorced

-- widowed

-- common law

3. Are you a parent? (circle one) YES or NO

4. Have you or a member of your family ever undergone a severely painful experience? (circle one) YES or NO If yes, please explain..

_____

5. Total years nursing experience = _____

6. Years and type of neonatal nursing experience = _____

7. Level of nursing education achieved to date: (check as many as correct).

__ RN.

__ BN.

__ MN.

__ Critical care nursing course (please specify - adult, pediatric, or neonatal ?)

_____

__ Other specialty nursing course ? (please specify)_____

__ Currently enrolled in a nursing education program ? (please specify)_____

8. Race:

-- Caucasian

-- Asian

-- Black

__ Other (please specify)

9. To what ethnic group(s) do you belong?_____

10. Religious Preference: (check one)

-- Protestant

-- Catholic

-- Jewish

-- Other (specify)_____

-- None

Thank you for participating in this study.

APPENDIX I

CATEGORIES FOR CONTENT ANALYSIS

I. BEHAVIORAL VARIABLES

1. Vocalizations

   a. crying

   b. other eg. grunting; moaning; screaming; shrieking; whimpering.

2. Facial expressions

   a. grimacing; furrowing of the brow;

   b. quivering of the chin.

3. Bodily movements and posture

   a. limb movement, withdrawal, swiping, or thrashing;

   b. torso activity;

   c. rigidity;

   d. flaccidity;

   e. clenching of fists.

4. State system

   a. irritability;

   b. agitation;

   c. fussiness;

   d. restlessness;

   e. changes in sleep/wake cycles or level of arousal;

   f. changes in activity level.

5. Physiological variables:

   a. changes in skin colour - pallor, flushing, duskiness.

   b. increase in heart rate, blood pressure, respiratory rate, and muscle tension.

   c. diaphoresis; sweating

   d. dilated pupils

   e. bowel movement; voiding; emesis

6. Contextual variables:

   a. gestational age

   b. general health status

   c. nature of the noxious stimulus

7. Other attributes

   a. emotional attributes - frustration, upset/distress/agitated/unconsolable, anger/mad/frantic, irritable

   b. hunger

   c. discomfort/unconfortable