EPIDURAL ANALGESIA DURING LABOUR AND DELIVERY: EFFECTS ON THE INITIATION AND CONTINUATION OF EFFECTIVE BREASTFEEDING

BY

ZORINA MARZAN CHANG

A Thesis
Submitted to the Faculty of Graduate Studies
In Partial Fulfillment of the Requirement for the Degree of

MASTER OF NURSING

Faculty of Nursing
University of Manitoba
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THE UNIVERSITY OF MANITOBA

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ABSTRACT

Epidural analgesia, is the most effective pain relief for women during labour and delivery. However, it is associated with risks affecting normal labour and delivery process, and the well being of the mother, fetus and the newborn. Breastfeeding is the preferred and recommended method of infant feeding due to the health benefits. However, breastfeeding initiation and duration rates in Canada and United States are below national goals. Studies examining the relationship between epidural analgesia and breastfeeding are limited and results are inconclusive. Guided by the Mutual Regulation Model and the Skill Theory, a prospective, ex post facto research design was carried out to examine relationship between epidural analgesia during labour and delivery and the initiation and continuation of effective breastfeeding. Healthy, term infants delivered vaginally to mothers who received only epidural (n=52) or no-analgesia (n=63) during labour and delivery were assessed at 8-12 hours of age, using the LATCH-R Breastfeeding Assessment Tool and the Neurologic and Adaptive Capacity Scoring System (NACS). A telephone interview with a breastfeeding questionnaire was carried out at 4 weeks postpartum. Comparisons of the two study groups showed that: (a) The difference in the proportion of infants achieving effective breastfeeding (LAC=6) was not statistically significant (χ^2=1.33, df=1, p=.248); (b) the difference in proportion of infants still breastfeeding at 4 weeks of age was not statistically significant (χ^2= .575, df = 1, p = .448); (c) the difference in NACS scores was not statistically significant (t= -1.21, df=95.95, p=.115); (d) correlation between neonatal neurobehavioral status and effectiveness of breastfeeding at 8-12 hours of age was statistically significant (r=.475,

$p < .05$), and (e) the difference in mean NACS score at 8-12 hours of age between infants who were having and not having breastfeeding difficulty at 4 weeks of age was statistically significant ($t=2.55$. $df=93$, $p=.006$). Therefore, the conclusions are: (a) Epidural use during labour and delivery is not related to the initiation and continuation of effective breastfeeding; (b) Epidural use during labour and delivery is not related to infant neurobehavioral status; and (c) Infant neurobehavioral status and effectiveness of breastfeeding are positively correlated.

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This work is **DEDICATED** to my **FAMILY**.

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CHAPTER I

Introduction

Statement of the Problem

Research shows that human milk and breastfeeding of infants offer health, nutritional, psychosocial, environmental, and economic benefits. Breastfeeding is recommended for at least the first 2 years of life (American Academy of Pediatrics, 1998; Breastfeeding Committee for Canada, 1996; World Health Organization (WHO)/United Nations Children's Fund (UNICEF), 1981,1989, & 1990). The national initiation rate of breastfeeding for Canada in 1996-1997 is 76.7% (Health Canada, 2000a). The United States Nationwide Mother's Survey data indicates 64% initiation rate in 1998, compared to 61.9% in 1982 (Hill, 2000). In Manitoba hospitals, about 65% of mothers initiate breastfeeding exclusively (Manitoba Health, 1999).

Although the American Academy of Pediatrics (1997), Canadian Paediatric Society, Dietitians of Canada, and Health Canada (1998) and WHO/UNICEF (1990) recommend breastfeeding exclusively to at least six months, Barber, Abernathy, Steinmetz, and Charlebois (1997) found a rapid decline in breastfeeding rates even in the first 4-8 weeks postpartum. The Canadian Perinatal Surveillance System (1998) report about 40% of women who initiated breastfeeding stopped by three months and fewer than 35% mothers are still exclusively breastfeeding at 4 months (Barber et al., 1997). For the United States, only 29% of those who initiated breastfeeding continue any form of breastfeeding until 6 months postpartum (U.S. Department of Health and Human Services, 2000).

The belief that breastfeeding is more beneficial than formula feeding is the primary reason cited by 90% of women in the National Population Health Survey (NPHS) who chose breastfeeding for their infants (Canadian Perinatal Surveillance System, 1998). Despite maternal choice and intentions, literature indentifies multiple factors affecting the initiation and continuation of effective breastfeeding. Among these are childbirth experience, hospital practices, and social support (Caplan, 1999; Kennedy & Visness, 1997; Livingstone, 1996; Scott & Binns, 1999)

The WHO and UNICEF launched the Baby Friendly Hospital Initiative (BFHI) in 1989 to promote, protect, and support breastfeeding worldwide. One of the steps in the BFHI is significant to the particular research of interest. The step emphasizes health care provider responsibility to inform pregnant women about the benefits and management of breastfeeding. This includes: (a) informing women prenatally about practices which will promote or prevent successful breastfeeding; (b) educational material, and information preparing women for birth should incorporate any known advantages or disadvantages arising from specific birth management procedures open to the woman's choice which may influence successful breastfeeding; and (c) caution regarding the effects of medications during labour and delivery on infant responsivity (Chalmers, 1998). The American Academy of Pediatrics Work Group on breastfeeding (1998) recommends that breastfeeding should begin as soon as possible after birth, usually within the first hour, except under special circumstances. Further recommendations are made about the avoidance and limitation of procedures that may interfere with breastfeeding.

Epidural analgesia offers the most effective pain relief for women during labour and has become increasingly popular in recent years. More women are planning and

demanding an epidural to avoid any labour pain (Simkin, 1991). A National Survey conducted in 1992 reported between 40-45% of women giving birth received epidural analgesia during childbirth and that this reflects a 100% increase since 1981 (Hawkins, Gibbs, Orleans, Martin-Salvaj, & Beaty, 1997). A report of the 1993 Survey of Routine Maternity Care and Practices in Canadian Hospitals shows that the proportion of women who use epidural analgesia varied among provinces ranging from 5% to 33% (Levitt, Hanvey, Avard, Chance, & Kaczorowski, 1995). Rates for analgesia/anesthesia for deliveries have risen from 35% in 1989 to 44% in 1996 in Manitoba, with the highest rates of epidurals in the province's largest hospitals (Manitoba Health, 1999). There is an overall agreement in survey results reporting an increase in the use of epidural analgesia during labour and delivery.

Although epidural analgesia provides superior pain relief for most women, the Guide to Effective Care in Pregnancy and Childbirth categorizes the use of epidural as a form of care with a trade-off between beneficial and adverse effects (Enkin et al., 2000). Epidural analgesia has been associated with risks affecting normal labour and delivery process, and the well being of the mother, fetus, and neonate (Leighton & Halpern, 2002, Lieberman & O'Donoghue, 2002; King, 1997; Mayberry, Clemmens, & De, 2002; Thorp & Breedlove, 1996; Thorp, McNitt, & Leppert, 1990). Conflicting evidence exists on the effect of epidural used during labour and delivery on neonatal neurobehavioral outcome. Some of the findings show that epidural analgesia probably affect infant sucking and rooting abilities.

Although a structured survey was not undertaken, informal discussion with nursing staff in a Winnipeg hospital indicated an observed breastfeeding difficulty

among some babies born to mothers who received epidural analgesia during labour and delivery. These difficulties may be related to a sleepy baby or poor sucking. It is also important to note that some of these women may have had other forms of analgesia, most commonly systemic medications such as Meperidine or inhaled anesthetics such as Nitrous Oxide prior to or after receiving their epidural. Therefore, it is reasonable to be cautious in interpreting newborn behaviors to be due to epidural alone. There is a gap in knowledge about the relationship between epidural analgesia and breastfeeding. A literature search resulted in 4 research studies that looked at the relationship, with two using a breastfeeding assessment tool.

Little is known about the effect of epidural analgesia on breastfeeding. As more and more women demonstrate their need for information surrounding childbirth and infant care, and exert their right to make decisions about their experience, health care providers must keep abreast of old and new knowledge. Health care providers who work with childbearing women are in a strong position to provide the information necessary to make informed decisions. However, more evidence is needed to be able to answer women's questions about the effect of epidural analgesia used during labour and delivery on breastfeeding. Therefore, the purpose of this study is to examine the relationship between epidural analgesia during labour and delivery and the initiation and continuation of effective breastfeeding.

Theoretical Framework

The theoretical framework for this study is based on the Mutual Regulation Model (Tronick, 1989) and the Skill Theory (Fischer & Hogan, 1989). According to the Mutual Regulation Model, normal development is dependent on both the infant's capacities to

self-regulate homeostatic, affective, and behavioural states, and the caregiver's capacity to promote the infant's ability to self-regulate. Self-regulatory capacities include physiologic regulatory mechanisms, coping behaviours, attention mechanisms, and cognitive and communicative capacities. The infant's ability to engage actively and thoroughly with the social environment depends on how well the self-regulatory mechanisms are working. Active and repeated interactions are fundamental to the process of normal development. Additional regulatory input from the caregiver is required for the infant to maintain a stable and positive state of engagement. A sensitive, responsive, and supportive caregiver is able to help the infant overcome his inadequacies. Caregiver's behavioural adjustments occur in response to changes displayed by the infant. The communicative process involving the exchange of information between the infant and the caregiver is critical to the infant's regulatory system. This makes the relationship a dyadic system and it is the quality of the functioning of this dyadic system that determines the infant's developmental course. According to the Mutual Regulation Model, there are environmental regulators that may influence the dyadic system in a positive or negative way. A positive environmental regulator such as prenatal care or social support enhances the regulatory functioning of both the mother and infant. When negative environmental regulators are present such as maternal illness or drug use, the mother's or infant's ability to self-regulate may fail (Beeghly & Tronick, 1994). The Mutual Regulation Model postulates that the critical event determining the functioning of the dyadic system is the manner in which the system resolves regulatory failure.

The second theory used to guide this study is the Skill Theory. This theory integrates developmental and short-term variations in infant behavioural development.

The Skill Theory is based on the concept of skill, which suggest an ability to carry out a set of actions in a particular type of task. The skill level of a particular behavior depends on the characteristics of an infant but also the context that supports the infant's actions. The organization of skills and abilities is influenced by the nature of the task (e.g. breastfeeding), environmental conditions such as immediate skin to skin contact, degree of environmental support (i.e. physical and social), arousal state (e.g. readiness to feed), and body structure (i.e. reflexes, tone, positioning). The Skill Theory focuses on parameters that may affect the ability of the infant to perform motor skills for a specific task.

A visual representation of The Mutual Regulation Model, The Skill Theory and their components are presented in Figure 1.

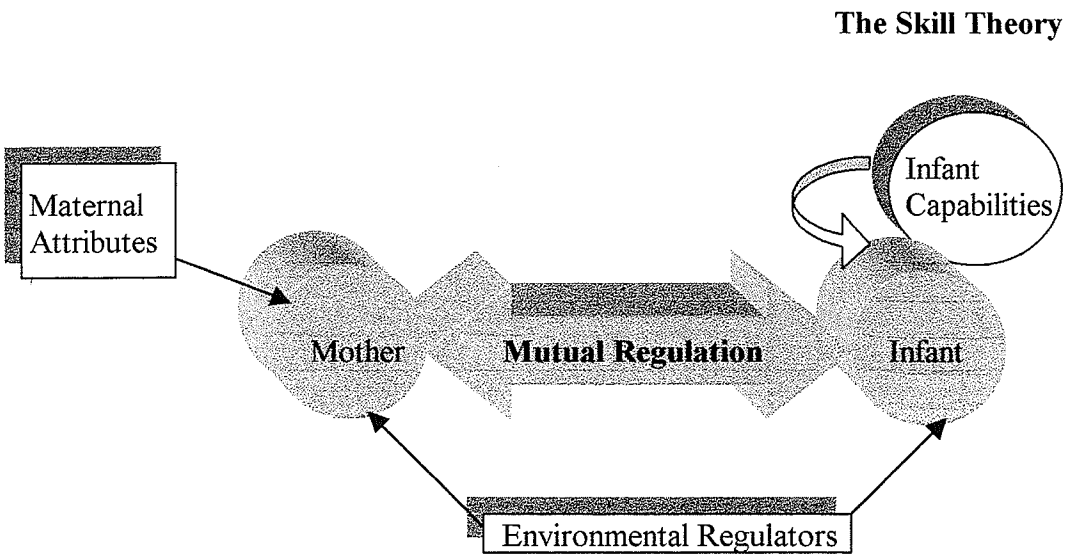

Figure I. Theoretical Framework based on the Mutual Regulation Model (Tronick, 1989) and the Skill Theory (Fischer & Hogan, 1989).

The relationship between the two theories and the proposed study are presented in Figures 2 and 3. The Mutual Regulation Model is first applied on the mother-fetal relationship (see Figure 2), at which time placental transfer of medication used during labour is considered to effect the dyadic system. In examining the effect of maternal use of epidural analgesia during labour on the initiation and establishment of effective breastfeeding, both the Mutual Regulation Model and the Skill Theory are applied. This is illustrated in Figure 3 which outlines the connection between variables considered in the study based on the two theories.

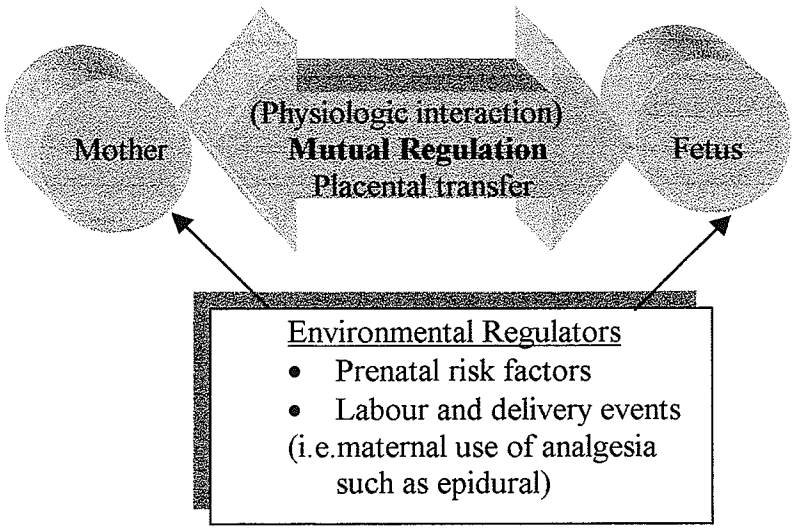

Figure 2. Application of the Mutual Regulation Model to Maternal-Fetal relationship.

According to Driscoll (1992), breastfeeding is more than just a feeding method but process of connection involving the mother and her infant, thus, the Mutual Regulation. In addition to the relationship, breastfeeding is also a technical process that facilitates the transfer of milk from mother to her infant. The method of breastfeeding

combines maternal and infant contributions, including the abilities or skills needed for effective breastfeeding (Jensen, Wallace, & Kelsay, 1993; Matthew, 1988; Mulford, 1992; Shrago & Bocar, 1989). The Skill Theory fits in examining the infant contribution to the breastfeeding process. According to this theory, the acquisition of skill is affected by infant capacities. These capacities are dependent on multiple factors including infant health and environmental support (Fischer & Hogan, 1989).

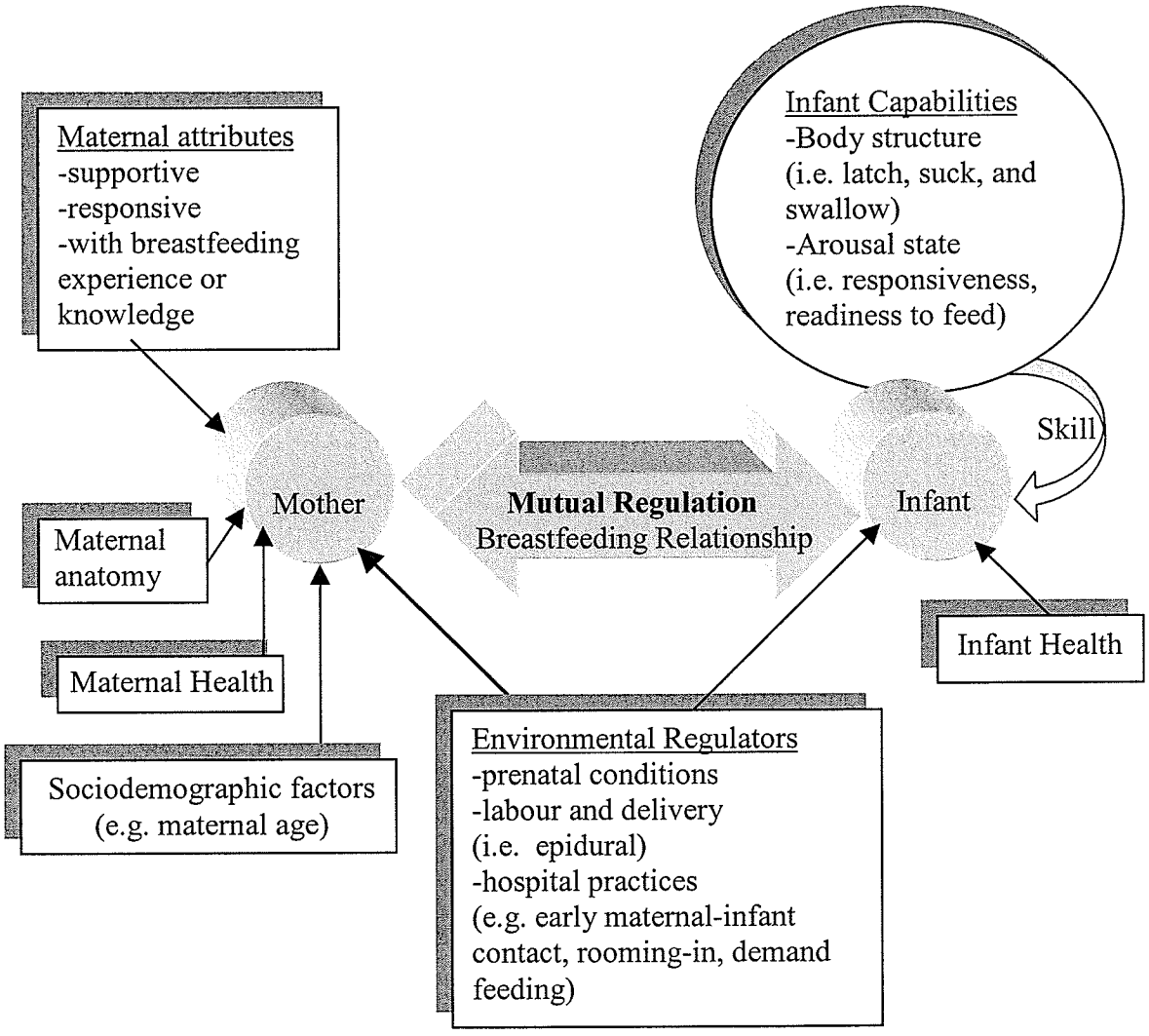

Figure 3. The Mutual Regulation Model applied in the breastfeeding relationship. The Skill Theory applied in examining infant capabilities to breastfeed.

The combination of The Mutual Regulation Model and the Skill Theory will guide the study in examining the relationship between epidural analgesia during labour and delivery and the initiation and continuation of effective breastfeeding. Based on the Mutual Regulation Model, the infant's ability to breastfeed depends on how well his self-regulatory mechanisms are working. It is hypothesized that these self-regulatory mechanisms will be affected by epidural analgesia used by the mother during labour and delivery via placental transfer, thus, influencing the initiation and continuation of effective breastfeeding. The Skill Theory focuses on parameters (e.g. maternal use of epidural analgesia) that may affect the ability of the infant to perform motor skills (e.g. latch, suck, and swallow) for a specific task (e.g. breastfeeding). Based on this theory, it is hypothesized that the ability of the infant to carry out the task of breastfeeding and perform the necessary skills to breastfeed will be affected by maternal use of epidural analgesia during labour.

Summary

There is a gap in current knowledge about the relationship between epidural analgesia and breastfeeding. Therefore, the purpose of this study is to examine the relationship between epidural analgesia during labour and delivery and the initiation and continuation of effective breastfeeding. The Mutual Regulation Model and The Skill Theory will be applied in this study.

CHAPTER II

Review of the Literature

Pregnancy is a time of physical and psychological preparations for birth and parenthood. Many women actively prepare for childbirth considering the many options available to them. Psychological preparation may involve examination of choices during labour and delivery such as where to deliver, labour support and pain management. During pregnancy, most women also make choices about infant care such as infant feeding. The core concepts of the thesis are epidural analgesia as the pain management of choice during labour and delivery, and breastfeeding as the infant feeding of choice. The literature review will focus on these two concepts. The aim is to provide basis of information that demonstrates the significance of epidural analgesia and breastfeeding, and to clarify the proposed relationship between the two.

Labour Pain

Each woman has unique expectations about birth including pain and her ability to manage it. Pain is a universal experience and is influenced by a variety of factors. These factors include culture, anxiety, and fear, previous birth experience, preparation and support (Bachman, 1999). Pain involves both physiological and psychological components. It is subjective and personal. Labour pain, however, is different from other pain in that it is a normal process, self-limiting, and it ends with the birth of a baby (Gorrie, McKinney, & Murray, 1998). Psychological management of pain involves alleviation of fear and anxiety such as prenatal preparation, and providing emotional and social support. The physiological component may be achieved by non-pharmacological

or pharmacological interventions. Epidural analgesia is one technique used for pharmacological management of labour pain.

During the first stage of labour, women experience visceral pain associated with uterine contraction, cervical dilation, progressive ischemia within the uterine muscle and compression of surrounding structures (Cheek, Gutsche, & Gaiser, 1994; Brown, 1994). The pain sensation is mediated via afferent nerve fibers that enter the spinal cord from the lumbar segment (L1) to thoracic segment (T10) (King, 1997; Vincent & Chestnut, 1998). The pain is commonly felt over the lower abdomen and to lower back and sacrum. According to Cheek et al. (1994), visceral pain can be completely alleviated by: (a) bilateral paracervical blocks; (b) bilateral lumber sympathetic blocks at L2; (c) bilateral paravertebral somatic blocks at T10, T11, T12, and L1; and (d) segmental lumbar epidural block of signal segments T10 to L1. However, they state that none of these blocks will be effective in relieving the pelvic, vaginal and perineal pain associated with the descent of infant through the birth canal.

Somatic pain is associated with the second and third stage of labour. The pain experienced is the result of pelvic floor, vaginal, and perineal distention caused by the presenting part (Fehder & Gennaro, 1993). The pain is transmitted through pudendal nerve derived from the anterior primary divisions of sacral nerve (S2, S3, and S4) (Brown, 1994; Cheek et al., 1994; King, 1997; Vincent & Chestnut, 1998). The somatic pain is superimposed on the uterine contraction pain. Bilateral pudendal nerve blocks, saddle block from S1-S4 will alleviate the pain (Cheek et al., 1994).

Pain experienced during the third stage of labour is due to uterine contraction similar to that experienced on first stage of labour (Lowe, 1996). Effective analgesia

during labour can be achieved by combining any of the suggested methods for both visceral and somatic pain. All labour pain can also be managed by modified saddle block with upper sensory level to T10 or higher, lumbar epidural from T10 to S4, or caudal epidural block from T10 to S4 (Cheek et al., 1994).

Both labour pain and pharmacological management affect maternal physiology. Pain affects maternal respiration by causing hyperventilation and increased oxygen consumption. There is a left-shift of maternal oxyhemoglobin dissociation curve which may compromise transplacental transfer of oxygen to the fetus. Uteroplacental and fetoplacental vasoconstriction can ultimately lead to fetal hypoxemia and acidosis (Cheek et al., 1994; King, 1997; Vincent & Chestnut, 1998). Paracervical block or epidural analgesia used to relieve pain may result in decreased maternal oxygen consumption and improved uteroplacental and fetoplacental oxygenation (Cheek et al., 1994).

The cardiovascular system is also affected during labour. There is progressive increase in maternal cardiac output. According to Cheek et al. (1994), increase in the uterine contraction increase cardiac output by 10-25% and is associated with 5-20% increase in blood pressure. Maternal cardiac output is further increased following delivery due to the rise in venous return secondary to relief of vena cava compression and auto-transfusion from the involution of uterus. King (1997) and Thorp & Breedlove (1996) note that epidural analgesia can cause decrease in blood pressure by decreasing vascular resistance.

Maternal plasma concentration of beta-endorphins is increased in pregnancy. There is further increase during labour that is proportional to the frequency and duration

of uterine contraction (Cheek et al., 1994; Gorrie et al., 1998). Both suggest that epidural analgesia may be associated with decreased beta-endorphin concentration.

During labour, there is an increase in catecholamine in maternal plasma concentration caused by pain, stress, anxiety, and fear (Cheek et al., 1994; Gorrie et al., 1998). This increase can lead to decreased uterine blood flow, decreased uterine activity, prolonged labour, and increased incidence of abnormal fetal heart rate (FHR) (Cheek et al., 1994; Lowe, 1996). High concentration of catecholamine affects both the mother and the fetus. The use of epidural analgesia has been shown to cause 55% decrease in maternal plasma concentration of epinephrine and 25% decrease in norepinephrine (Shnider et al., 1983).

The psychological effects of labour pain are anxiety and fear (Gorrie et al., 1998). Mild anxiety is considered normal for a woman during labour and birth. However, extreme anxiety and fear magnify sensitivity to pain and impair a woman's ability to cope with it. Anxiety and fear cause increase in muscle tension and decreased effectiveness of uterine contraction. With this physiological response, a cycle of increased fear and anxiety begins (Bachman, 1999). This prolonged tension can lead to general fatigue.

Although labour pain is part of a normal process, it can have negative effects to the mother and the fetus. Labour pain experience varies with several physiological and psychological effects. However, it has been found that women who are able to effectively cope and manage pain with or without medication are more likely to view their childbirth experience positively (Simkin, 1991).

Pain Management

The physiologic and psychologic effects of labour pain are important considerations in the care of women during labour. Because pain is subjective and personal, its management is determined by personal choice. Whether the woman chooses to deal with labour pain using non-pharmacological or pharmacological interventions, or both, nurses play an important role in supporting them.

Non-pharmacologic Pain Management

Non-pharmacologic strategies to encourage relaxation and relieve pain include cutaneous stimulation, sensory stimulation and cognitive strategies (Bachman, 1999). Counterpressure, effleurage, therapeutic touch, walking, rocking, changing positions, heat and cold application, transcutaneous electrical nerve stimulation (TENS), accupressure, and shower or baths are part of cutaneous stimulation strategies. Sensory stimulation techniques may include aromatherapy, breathing techniques, music, imagery, and use of focal points. Finally, hypnosis and childbirth education are examples of cognitive strategies that can be used for non-pharmacologic labour pain management.

Pharmacologic Pain Management

Even with the tremendous therapeutic benefit of non-pharmacologic pain relief during labour, pharmacologic management is often needed. Pharmacologic pain management includes sedatives, narcotics and anesthetics (Bachman, 1999; Faucher & Brucker, 2000). These medications may be used systemically or to produce regional analgesia. Systemic drugs are those that " have effects on multiple systems because they are distributed through the body" (Gorrie et al., 1998, p. 374). Other drugs are given to

produce regional analgesia (some pain relief and some motor block), and anesthesia (pain relief and motor block) (Bachman, 1999).

There are specific considerations when medicating a pregnant woman. These are: (a) Any medication taken by the woman may affect her fetus, (b) drugs may have different effects on pregnant women, (c) drugs can affect the progression of labour, (d) complications may limit the choice of pharmacologic management, and (e) some women may have limitations in safe choice due to history of substance abuse or use of other therapeutic drugs (Gorrie et al., 1998).

Sedatives and hypnotic agents. These agents are used to relieve anxiety and induce sleep during early labour. They act by reducing the awareness of pain (Faucher & Brucker, 2000). Included in this category are barbiturates, benzodiazipines and histamine antagonists. Undesirable side effects include respiratory depression affecting both the mother and the newborn (Bachman, 1999). Barbiturates are now rarely used.

Opioids or narcotics. Medications under this group attain their pharmacotherapeutic effects from receptor mediated binding (Faucher & Brucker, 2000). Binding to receptors in the dorsal horn of spinal cord, the thalamus, hypothalamus, spinal cord pain transmission neurons, and the primary afferent pathways that relay the pain message, perception of pain is reduced (Faucher & Brucker, 2000; Gorrie et al., 1998). The pharmacologic properties and associated side effects maybe related to their receptor binding.

Opioids can provide mild-to-moderate analgesia but cannot be used to completely eliminate pain. Common side effects are sedation and respiratory depression. Other side effects include orthostatic hypotension, nausea and vomiting.

Opioids rapidly cross the placenta (Hale, 1999), therefore, affecting the fetus and neonate. During labour, the FHR pattern may show loss of variability. In the neonate, respiratory depression is the most serious side effect. Subtle effects on neonatal neurobehavior also occur. With most opioids, the maximum neonatal depression of Apgar scores occurs in newborns delivered 2-3 hours after maternal intramuscular (IM) administration and with a shorter interval after intravascular (IV) administration. Some medications in this group are:

1. Morphine, which produces analgesia with sedation, raises the pain threshold and modifies the pain perception. Morphine is most effective for pain arising from visceral as well as from skeletal muscles, joints and integumental structures. This narcotic may be given systemically or for regional analgesia. According to Hale (1999), when given systemically (IM or IV), Morphine has been found to produce significant depression. Therefore, it is no longer popular for labour pain management via these routes. Maternal side effects are nausea, feeling of heaviness, dryness of mouth, diaphoresis, and pruritus (Faucher & Brucker, 2000; Stoelting, 1987). Subarachnoid space administration causes profound and long lasting effect with pruritus and nausea. Morphine injected via epidural technique causes slow pain relief with sporadic effect. The effects are highly dose dependent and often accompanied by nausea and vomiting and dizziness. Therefore, it is considered a poor choice for obstetric analgesia (Hale, 1999).

2. Nalbuphine (Nubain), which is equivalent to Morphine as a potent analgesic, causes respiratory depression effect similar to the effects of Morphine. However, analgesia and respiratory depression reaches a ceiling-effect at 30 mg (Stoelting, 1987).

Sedation is the most common side effect. Less than 10% of recipients develops nausea and vomiting, dizziness, and dry mouth. There is also transient effect on FHR (Faucher & Brucker, 2000; Stoelting, 1987).

3. Meperidine (Pethidine, Demerol), is a systemic analgesic agent most frequently used in labouring women (Bachman, 1999; Faucher & Brucker, 2000; Hale, 1999). Given systemically, maternal side effects include sedation, respiratory depression, hypotension, diaphoresis, nausea and vomiting (Faucher & Brucker, 2000). Meperidine readily crosses the placenta. Fetal plasma level is equivalent to maternal plasma level within 6 minutes of IV administration and 40-50 minutes of IM administration, which coincides with the peak analgesic effect (Douglas & Levinson, 2002). The duration of action is 3 to 4 hours. The fetal effects include altered electroencephalogram (Rosen, Schibetta, & Hochberg, 1970), decreased respiratory movement or apnea (Boddy & Dawes, 1975), decreased fetal movement (Zimmer, Divon & Vadasz, 1988), and decreased FHR variability (Yeh, Frosythe, & Hon, 1973; Zimmer et al., 1988). Maternal and umbilical cord blood levels are similar at delivery, (Beckett & Taylor, 1967; Moore, McNabb, & Glynn , 1973). According to Stoelting (1987), umbilical cord blood level may exceed plasma concentration. Meperidine has been found to produce neonatal respiratory depression, decreased Apgar scores, lower oxygen saturation, respiratory acidosis, and abnormal neurobehavioral scores (Faucher & Brucker, 2000; Hale, 1999; Hodgkinson, Bhatt, & Wang, 1978). The elimination half-life of Meperidine in the newborn is reported to be between 13 and 23 hours, and the neonate will excrete Meperidine for 3-6 days (Douglas & Levinson, 2002). Neonatal outcome is dependent

on timing of dose and duration of fetal exposure (Crowell, Hill, & Humenick, 1994; Hale, 1999; Stoelting, 1987).

Meperidine use is associated with subtle effects on neonatal behavior (Belsey et al., 1981; Brackbill, Rosenblatt, Kane, Manniello, & Abramson, 1974; Hodgkinson et al, 1978; Hodgkinson & Husain, 1982). Observational studies found that Meperidine affected infant sucking ability (Nissen, Lilja, Matthiesen, Ransjo-Arvidsson, Uvnas-Moberg, & Widstrom, 1995; Righard & Alade, 1990). Crowell et al. (1994) and Rajan (1994) found that Meperidine produces greater negative impact on the initiation of breastfeeding compared to other systemic analgesic agents and local anesthetic effects.

4. Fentanyl, which is a very popular and widely used potent opioid is primarily given via epidural, but may be given intravenously (Hale, 1999). According to Faucher & Brucker (2000), and Stoelting (1987), Fentanyl has greater analgesic potency than Morphine and Meperidine. Fentanyl is about 100 times more potent than Morphine (Hale, 1999). Side effects are similar to that of Morphine but Fentanyl may also cause maternal hypotension, bradycardia, and skeletal muscle rigidity (Stoelting, 1987). Due to its high potency and high lipid solubility, it penetrates the epidural and arachnoid membranes readily, providing rapid and potent analgesia (Faucher & Brucker, 2000; Hale, 1999). Fentanyl rapidly penetrates the placenta, but high protein binding ability may reduce overall transfer to the fetus (Hale, 1999).

Anesthetics. Anesthetic agents are used to produce either local or general anesthesia. Anesthesia can affect sensory and motor function. Inhaled anesthetics such as Nitrous Oxide are still commonly used today. Nitrous Oxide is most often administered in combination with opioids or other anesthetics. Inhaled anesthetics are

small, lipid-soluble molecules, and therefore, cross the placenta easily. Maternal alveolar concentration and duration of exposure influence placental transfer. "After 15 minutes of maternal administration of nitrous oxide, the fetal/maternal ratio is 0.8 to 0.9" (Baker, 1991, p.76). Analgesia effect is prominent but skeletal muscle relaxation is minimal (Stoelting, 1987).

The drugs used to induce general anesthesia are different from those that provide local anesthesia (deJong, 1994). They differ in their sites and modes of actions. For the purpose of this review, the focus will be on anesthetics used to produce local anesthesia. Local anesthetics block nerve impulses which stops "to-and-fro flow of electrical signals, including those that convey the sensation of pain to the central nervous system and delivery coded signals to the body's musculature" (deJong, 1994, p. 1). Local anesthetics selectively anesthetize only chosen body parts without loss of consciousness. They may be used for local infiltration, pudendal and paracervial blocks, and epidural blocks (Faucher & Brucker, 2000). They are directly administered into the area that needs to be blocked and act by reversibly blocking the sodium channels of nerve axons and neuronal cells which serve as the conduction pathways (Miller, 1998). According to Faucher and Brucker (2000), local anesthetics agents are potent vasodilators and absorption in the maternal circulation occurs within 10-15 minutes regardless of site of injection. The concentration of the drug used is proportional to the density of the block desired. Local anesthetic absorption is related to the vascularity of the area (Stoelting, 1987). The effects are dependent on the specific characteristics of the anesthetic used. For example, the greater the lipid solubility, the greater the potency, and the greater the protein binding, the longer the duration of action (Miller, 1998).

Local anesthetics commonly used today are Bupivacaine, Lidocaine, and Ropivacaine. The mechanism and effects of these drugs are especially significant because of the changes that occur during pregnancy as well as the effects imposed on both the woman and the fetus. According to Santos, Pederson, and Finster (1994), pregnancy enhances spread of anesthetics due to epidural venous engorgement. There are also increased neuronal sensitivity, increased susceptibility to neural blockade due to hormonal and biochemical changes, and increased diffusion of drugs across nerve membranes due to higher pH in cerebrospinal fluid (CSF). Pregnancy may also enhance uterine vascular reactivity to local anesthetic agents. Fetal well being depends on the adequacy of maternal and fetal perfusion of the placenta. According to Santos et al. (1994), local anesthetics exert direct effects on the uterine smooth muscles. Therefore, changes in uterine tone and contractility may affect uteroplacental perfusion.

Most drugs including anesthetics readily cross the placenta. Factors that influence placental transfer are: (a) the concentration of free drugs in maternal blood; (b) physicochemical characteristics of local anesthetics itself; (c) the permeability of the placenta; and (d) hemodynamic events occurring within the fetal-maternal unit (Briggs, 2002; Santos et al., 1994; Santos & Finster, 2002).

Maternal blood concentration of drugs is determined by the dose, the site of administration, metabolism and excretion, and effects of adjuvants such as Epinephrine. According to Santos et al. (1994), for a given local anesthetic, the maternal blood concentration determines fetal drug exposure. Therefore, the higher the dose, the higher the maternal and fetal blood concentration. The elimination half-life of some local

anesthetics is relatively long. When repeated injections or continuous infusion of drug is maintained, it may lead to accumulation in the maternal plasma (deJong, 1994; Santos et al., 1994). Lumbar epidural is less vascular than caudal region; therefore, there is slower rate of maternal plasma uptake of medication. Finally the use of additional drugs, mainly Epinephrine, enhance analgesia and delay the uptake of drug from the site of administration (deJong, 1994; Santos et al., 1994; Stoelting, 1987).

According to Santos & Finster (2002), drug delivery to the placental exchange site depends on the fraction of total uterine blood flow that perfuses the intervillous space. There is little information available on how changes in maternal hemodynamics alter delivery of a drug to the placenta. The supine position which may cause maternal vena caval and/or aortic compression, maternal hypotension or hypertension may affect delivery of drug to the placenta to an unknown extent (Santos & Finster, 2002).

Once a given drug has reached the intervillous space, it undergoes passive diffusion which is determined by drug physicochemical properties (Santos & Finster, 2002). Characteristics of local anesthetics that are significant are molecular weight, ionization and lipid solubility, and protein binding. Molecular weight less than 500 daltons easily cross placenta (Santos et al., 1994). The lower the molecular weight, the more readily it passes through the placenta. Lidocaine has the lowest weight molecular weight of 234 daltons, followed by Ropivacaine (274 daltons), and Bupivacaine (288 daltons). Most local anesthetics are weak bases and these combine readily with acids. Drug in the non-ionized form can readily cross the placenta. Acidosis in the fetus can result in accumulation of local anesthetics in the fetus (Santos et al., 1994;

Stoelting, 1987). Lipid solubility provides an approximation of local anesthetic's affinity to nerves (deJong, 1994). The long-acting local anesthetics such as Bupivacaine are more lipid soluble than short-acting Lidocaine. In the same manner, the more lipid soluble the anesthetic, the less amount crosses the placenta. According to Santos et al. (1994), protein binding of local anesthetic in fetal plasma is approximately 50% of the mother's. This is determined by calculating the fetal/maternal blood concentration ratio (F/M). Highly protein bound drugs have more restricted placental transfer with lower F/M blood concentration ratio. The F/M ratio of the three anesthetics are Ropivacaine (0.2), Bupivacaine (0.2-0. 4), and Lidocaine (0.5-0. 7). According to Santos & Finster (2002), high molecular weight, poor lipid solubility, and a high degree of ionization will impede but not totally prevent the transfer of a drug across the placenta.

Placental transfer of drugs may also be affected by changes in placental permeability. As part of the normal maturational process, the placenta undergoes considerable changes throughout gestation. In the normal course of events, there is increasing placental surface area and placental thinning with the growth of the fetus. Placental transfer of drugs diminishes under conditions that either decrease the surface area such as placental abruption or increase the thickness of the placenta such as infection and hydrops, (Garland, 1998).

Once local anesthetic crosses the placenta, the distribution in the fetus depends on: (a) fetal plasma protein binding, (b) lipid solubility, (c) the degree of ionization of drugs, and (d) hemodynamic factors that affect the distribution of fetal cardiac output (Santos et al., 1994). The fetal plasma protein-binding capacity for local anesthetics is approximately half of the mother's. Anesthetics that are highly lipid soluble such as

Lidocaine have higher levels in the fetal liver because of the high lipid content. When there is fetal acidosis and hypoxemia, there is an increased blood flow to vital organs with increased concentration of anesthetic in the fetal circulation. Any drug that reaches the fetus will undergo metabolism and excretion which is bound to be slower than the mother (deJong, 1994). According to Stoelting (1987), clearance values and elimination half-life represents mainly hepatic metabolism because renal excretion of unchanged drugs is minimal. The elimination half-life for Bupivacaine maybe as long as 14 hours for the neonate (Santos et al., 1994). The mechanism of drug transfer and elimination is presented in Figure 4.

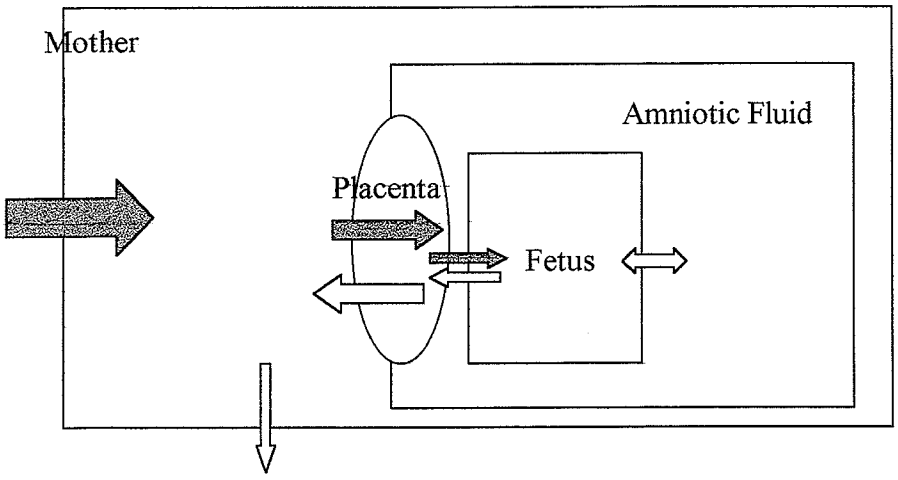

Figure IV. Maternal drug transfer from mother through the placenta to the fetus. (Solid arrows indicate drug and white arrows indicate metabolite movements).

The medications used in the management of pain are many. The exact mechanism, in which they work and affect the mother and fetus, are complex. Because

intrapartum pain management is a major focus of care for women in labour, nurses need to be familiar with non-pharmacologic techniques as well as the pharmacology of labour pain drugs and their effects.

Epidural Analgesia

Epidural analgesia is the most commonly used and the most effective labour pain relief method available to date (Glosten, 1994; Gorrie et al., 1998; King, 1997; Vincent & Chestnut, 1998). This section will describe epidural block, pharmacologic aspects of epidural medications commonly used during labour, and the benefits and complications associated with epidural analgesia.

Lumbar Epidural Block

Lumbar epidural block "can provide analgesia without loss of consciousness and minimal motor block to allow patient cooperation, making it an ideal form of analgesia for labour and vaginal delivery" (Gutsche, 1994, p. 211). The epidural space is outside the dura mater, between the dura and the spinal canal. It is filled with fat, connective tissue, and epidural veins that are dilated during pregnancy (Gorrie et al., 1998). The epidural block is achieved by injecting local anesthetic into the epidural space entered at about L3-L4 interspace. The catheter allows continuous infusion or intermittent injections of medication to maintain pain relief. Just as any invasive technique, the safe administration of epidural analgesia must follow certain requirements. These are: (a) Pre-anesthetic consultation and evaluation of the patient, (b) continuous anesthesia and nursing care available, (c) reliable intravenous site, (d) uterine displacement throughout labour and delivery, (e) adequate and continuous maternal and fetal

monitoring, and (f) intravenous prehydration before initiation of the block (Gutsche, 1994).

Before injecting any significant amount of local anesthetic in the epidural space, a test dose must be performed to determine that the injection is not in the subarachnoid space or intravascular (Gorrie et al., 1994; Gutsche, 1994). The test dose may use Epinephrine or small concentration of Lidocaine, depending on the institution or anesthetist. Subarachnoid placement will produce intense sensory block, and intravascular injection results in lightheadedness, dizziness, tennitus, rapid hypotension, and numbness of the tongue, and lips when tested by Lidocaine. Epinephrine will cause tachycardia. Proper placement is critical to maximize intended effect and avoid any preventable complications. Contraindications to epidural analgesia are: (a) patient refusal, (b) active maternal hemorrhage, (c) maternal septicemia or untreated febrile illness, (d) infection at or near the needle insertion site, and (e) maternal inherited or acquired coagulopathy (Vincent & Chestnut, 1998).

Epidural Medications

There is a broad range of epidural medication available for pain relief during labour. The choice depends on intended result. The goals are to achieve effective and controllable analgesia, safety for the mother and fetus and unaffected labour process (Bromage, 1992; Drasner & Bromage, 2002).

The drugs injected into the epidural space are preservative free. For the past several years, the dose and concentration of drugs in epidurals during labour have decreased. Epidural analgesia is often a combination of local anesthetic and narcotic to

maximize the sensory block while minimizing motor block (Gorrie et al., 1998; Gutsche, 1994; King, 1997).

Lidocaine (Xylocaine). For many years, Lidocaine was the standard local anesthetic agent for epidural analgesia in labour (Bromage, 1992). Lidocaine has a rapid onset (19 minutes), and provides dependable analgesia with duration of about 60 minutes (Bromage, 1992; deJong, 1994; Fusi, Steer, Maresh, & Beard, 1989; Stoelting, 1987). When mixed with Epinephrine, the duration can last up to 75 minutes. Motor block effect start within 25 minutes of administration and lasts for 1½ - 2 hours. The active metabolites crosses the placenta more readily than of other local anesthetic agents. The decrease in use has been due to research findings of negative effects on neurobehavioral studies on newborns (Bromage, 1992). Tronick et al. (1976) found negligible amount of Lidocaine in newborn plasma level at 24 hours of age, but maternal dosage was not indicated. Another study found a gradual decrease in neonatal plasma levels of Lidocaine, reduced by 50% at 8 hours of age (Scanlon, Brown, Weiss, & Alper, 1974).

Bupivacaine (Marcaine, Sensorcaine). Bupivacaine is the most commonly used local anesthetic today. It has two advantages in obstetric practice: (a) the quality of analgesia in relation to motor block, and (b) the duration is long especially when Epinephrine is added (Bromage, 1992). The onset of analgesia is 8-10 minutes with peak effect in 20 minutes and lasts for 4 to 7½ hours while motor block starts in 20 minutes and lasts for 4 to 5 hours (deJong, 1994). Bupivacaine is highly protein bound which limits placental transfer (Glosten, 1994). However, metabolites have been found in the neonate for as long as 48-72 hours (King, 1997; Lieberman et al., 1979; Loftus, Hill, & Cohen, 1995; Ortega et al., 1999).

Ropivacaine. The use of Ropivacaine is relatively new in obstetrics. Information regarding efficiency, safety, and fetal effects is limited. Ropivacaine is structurally similar and clinically similar in effects as Bupivacaine. Stienstra et al. (1995) found Ropivacaine 0.25% and Bupivacaine 0.25% are equally effective in onset and in intensity of pain relief, and overall quality of analgesia. However, Ropivacaine has only 60% of Bupivacaine's potency as a local anesthetic (Drasner & Bromage, 2002). Motor blockade is less intense and shorter in duration than Bupivacaine (Kerkkamp, Gielen, & Edstrom, 1990). Ropivacaine when compared to Bupivacaine is less cardiotoxic (deJong, 1994; King, 1999). Comparison between the two medications also found higher maternal and fetal plasma concentration of Ropivacaine but shorter half-life (Datta, Camann, Bader, & VanderBurgh, 1995). This short-half life has an advantage over Bupivacaine regarding neurobehavioral outcome (Stienstra et al., 1995).

Epinephrine. Epinephrine has long been used as an adjuvant for subarachnoid and epidural anesthesia (Bromage, 1992). It is sometimes added to local anesthetic solution to slow vascular uptake of anesthetic and opioids from the spinal canal. Epinephrine promotes the uptake into the lipids of the cord and canal, which increases the intensity, and duration of the blockade (Bromage, 1992; deJong, 1994; Stoelting, 1987). Because it is a vasoconstricting agent, there is a risk of uterine artery vasoconstriction, which leads to uteroplacental insufficiency.

Fentanyl. A potent opioid analgesic, Fentanyl is commonly combined with local anesthetics. The drug combination provides quicker and long-lasting pain relief for labour with lower total dose of local anesthetic and less motor block (Bromage, 1992; Gorrie et al., 1998; Hale, 1999). According to Hale (1999), Fentanyl has been found to

rapidly penetrate placenta and is detectable in fetal blood within 1 minute after maternal epidural administration. However, because Fentanyl is highly protein bound, overall transfer to the fetus may be reduced. Fetal uptake of Fentanyl is redistributed from plasma compartment to fetal brain and other tissues (Hale, 1999). The half-life in neonates range from 3-13 hours possibly due to reduced fat content and immature liver function. Hale (1995) warns that although there might be negligible neonatal plasma concentration found at delivery, it does not reflect the levels that may be contained in vital organs such as the brain.

Empirical search is ongoing for optimal mixtures of anesthetic and narcotic agents to provide the best maternal analgesia with the least effect on the fetus or the musculature powers of parturition (Bromage, 1992; Drasner & Bromage, 2002).

Benefits and Complications

The benefit of labour pain management has made epidural analgesia increasingly popular among childbearing women. However, like many medical interventions, it comes with many possible complications.

Benefits. Epidural analgesia provides superior pain relief during all stages of labour (Gorrie et al., 1998; King, 1997; Vincent & Chestnut, 1998). It facilitates patient cooperation during labour and delivery (Bachman, 1999; Bromage, 1992; Gorrie, 1998). According to King (1997), local anesthetics used in epidural space provide 90% pain relief to 85% of women who undergo the procedure. Relief from pain during labour can facilitate rest and prevent maternal exhaustion. Epidural analgesia may be conveniently used for cesarean delivery if operative delivery becomes necessary (Vincent & Chestnut, 1998). Youngstrom, Baker, and Miller (1996) state that by targeting pain and modulating

catecholamine release, epidural analgesia can improve maternal and fetal oxygenation and acid-base balance. Reduced catecholamine levels can promote more effective uterine function and in certain cases, increase uterine blood blow (Cheek et al., 1994; Lowe, 1996; Shnider et al., 1983; Youngstrom et al., 1996).

Complications. Inspite of the widespread acceptance of epidural among physicians and patients, controversy remains regarding the subsequent effects of intrapartum epidural analgesia on the mother, fetus, labour and delivery, and the neonate.

Maternal complications can begin with the procedure of epidural insertion. Unintentional puncture of the dura can result in substantial leakage of the CSF, which may or may not be obvious. This can lead to subsequent spinal headache. There is always the risk of epidural catheter migration outside the dural space and inadvertent vascular injection (Gutsche, 1994; Vincent & Chestnut, 1998). Subarachnoid infiltration results in more potent anesthetic effects while intravascular infiltration causes more rapid systemic side effects.

The blockade of sympathetic nerves due to epidural block may result in vasodilation and hypotension (Gorrie et al., 1998; Gutsche, 1994; and Vincent & Chestnut, 1998). Hypotension resulting in systolic blood pressure of less then 100 millimeters mercury (mmHg.) or decrease of 25% below pre-block average (King, 1997), can compromises the oxygen supply to the mother's and the fetus's vital organs (King, 1997; Thorp & Breedlove, 1996).

Blockade of sacral spinal-segment leads to interrupted pelvic autonomic transmission and subsequently interferes with normal bladder function (Glosten, 1994;

Gorrie et al., 1998; Ross, 1994; Youngstrom et al., 1996). Inability to spontaneously empty the bladder may necessitate urinary catheterization, another invasive procedure.

Studies found that epidural analgesia is associated with increased maternal temperature without evidence of infection or adverse consequence (Fusi, 1989; Lieberman et al., 1997, Lieberman et al., 2000; Macaulay, Bond, & Steer, 1992). However, the etiology of hyperthermia is unclear. These studies speculate that the increase in temperature maybe due to the reduction in perspiration produced by sympathetic block.

Post-delivery backache has been associated with the use of epidural. MacArthur, Lewis, Knox, and Crawford (1990) proposed that a combination of epidural anesthesia and prolonged second stage labour result in muscular relaxation and postural problems the mother is unaware of, resulting in a potentially damaging position. The search for a causal relationship between epidural anesthesia and new-onset back pain after birth resulted in conflicting findings (Breen, Ransil, Groves, & Oriol, 1994; Macarthur, Macarthur, & Weeks, 1995; Russell, Dundas, & Reynolds, 1996). The increased risk for back pain may be due to use of large needle, hematoma, difficulty finding epidural space during initiation, and prolonged assumption of unnatural position during labour and delivery (Glosten, 1994).

Epidural has been associated with increased cesarean section rate (Lieberman et al., 1995; Morton, Williams, Keeler, Gambone, & Kahn, 1994; Peaceman, Lopez-Zeno, Minogue, & Socol, 1993; Ramin et al., 1995; Thorp, 1997; Thorp et al., 1991). However, other researchers found no association between epidural and cesarean section rate (Ploeckinger, Ulm, Chalubinski, & Gruber ,1995; Sharma et al., 1997). After

completing a systemic review of the literature, Lieberman and O'Donoghue (2002) reported that current evidence available does not clearly indicate whether there is an association between epidural and cesarean delivery

A negative effect of epidural analgesia on the progress of labour has been found in several studies (Halpern et al., 1998; King, 1997; Newton, Schroeder, Knape, & Benett, 1995; Thorp & Breedlove, 1996; Thorp et al., 1990). The proposed mechanism are: (a) Sympathetic effect on the uterus impairs uterine contractility, (b) epidural decreases endogenous oxytocin release causing inadequate contractions, and (c) pelvic floor relaxation and increased blockade predisposes to malpositions which can cause longer labour (Newton et al., 1995). Motor blockade prevents ambulation and the potential advantages to progress in labour and parturient comfort related to upright posture (Thorp et al., 1991). Thorp et al. (1991) also suggest that both voluntary bearing down which is adjunct to uterine activity during expulsion and the involuntary bearing down reflex arc may be affected by epidural analgesia. Bates, Helm, Duncan, and Edmonds (1985), and Thorp et al. (1990) found decreased uterine activity following initiation of epidural analgesia. Although existing data suggest there may be a longer first stage of labour with epidural, current evidence is insufficient to determine definitively whether that is the case (Lieberman and O'Donoghue, 2002).

Increased instrumental vaginal delivery has been associated with the use of epidural analgesia. The retrospective studies and randomized controlled trials reviewed by Thorp and Breedlove (1996) demonstrate an association between epidural analgesia and use of forceps and vacuum for vaginal delivery. The Jouppila, Jouppila, Karinen, & Hollmen's study in 1979, and the Poore and Foster's study in 1985 were the only two

studies that failed to show a significant association between epidural analgesia and instrumental delivery out of twenty-four retrospective studies cited by Thorp and Breedlove (1996).

The effects of epidural analgesia on the fetus and neonate are as inconclusive as those suggested effects on the mother. Effects on the fetus may be directly related to the drugs given to the mother as a result of placental transfer (Gorrie et al., 1998). The effects on the fetus include transient bradycardia and decreased fetal heart rate variability (Viscomi, Hood, Melone, & Eisenach, 1990). The effects on FHR were transient and did not result in any negative fetal outcome (King, 1997).

Secondary effects on the fetus include hypoxia from maternal hypotension (Gorrie et al., 1998). Neonates born to women who developed fever during epidural use had lower Apgars, required oxygen therapy, and developed fever without any associated infection (Lieberman et al., 2000; Thorp & Breedlove, 1996). According to Thorp and Breedlove (1996), fever during labour which is a major clinical marker for infection could precipitate diagnostic and therapeutic interventions to the newborn.

The issue of whether epidural analgesia adversely affects newborn behavior is complex. To evaluate the more subtle effects of maternally administered drugs, neurobehavioral assessment tools were developed. The main components of these assessment tools are the evaluation of: (a) the neonate's muscle tone, (b) the ability to alter his state of arousal, (c) the ability to suppress repetitive or intrusive stimuli, (d) the ability to respond appropriately to external events, (e) the ability to initiate complex motor acts, and (f) the appropriateness of reflex motor responses (Kuhnert, Linn, & Kuhnert, 1985). According to Cohen, Levinson, and Shnider (1992), neonatal

behavioral tests have proved sensitive in demonstrating depression of the neonate after perinatal asphyxia, illness, maternal medication, and other influences.

The Brazelton Neonatal Behavioral Assessment Scale (BNBAS) is the most comprehensive neurobehavioral test. The BNBAS consists of 49 individual items. It includes 27 behavioral items, 20 elicited responses and 2 predominant states. The assessment was developed for evaluating full-term Caucasian infants whose mothers had been medicated with barbiturates and other sedatives during delivery. The test must be performed following delivery and repeated several days after. Although originally designed as a clinical tool, it is now widely used as a research measure of newborn behavior (Kuhnert et al., 1985).

The Scanlon Early Neonatal Neurobehavioral Scale (ENNS) uses a different analytic approach than the BNBAS. This test was designed to evaluate neurobehavioral changes associated with epidural anesthesia (Cohen et al., 1992). It was initially designed to assess infants during the first 8 to 12 hours of life, a time that corresponds with the presence of significant levels of analgesic or anesthetic agents in neonatal tissues. The ENNS must be performed when the infant is awake. It consists of 15 individual observations of primary reflexes, muscle tone, and decrement responses to stimulation, and 11 observations on states of consciousness, and one general assessment of the infant's neurobehavioral status. The reliability to assess the recovery of the infants from the stress and medication from labour beyond the 12 hours is not established (Kuhnert et al., 1985).

The Neurologic and Adaptive Capacity Scoring System (NACS) was specifically designed as a screening test to detect CNS depression caused by drugs and to distinguish

it from that caused by asphyxia or birth trauma (Cohen et al., 1992). This tool uses 20 criteria to evaluate 5 general areas, which are adaptive capacity, passive tone, active tone, primary reflexes, and general neurologic status.

Debate continues regarding the effects of epidural analgesia on the neonate's neurobehavioral responses. Researchers evaluating the association between neurobehavioral outcome and epidural analgesia have reported inconsistent findings.

Several studies have found negative effects of epidural analgesia during labour on neurobehavioral outcome (Brazelton, 1961; Corke, 1977; Hodgkinson et al., 1978; Lieberman et al., 1979; Loftus et al., 1995; Murray, Dolby, Nation, & Thomas, 1981; Rosenblatt et al., 1981; Scanlon et al., 1974; Sepkoski, Lester, Ostheimer, Brazelton, 1992; Standley, Soule, Copans, & Duchowny, 1974; Tronick et al., 1976). Among these, Murray et al. (1981), and Sepkoski et al. (1992) are the only studies which included unmedicated control groups. Further details are provided only on research that has been used as reference of comparison for subsequent studies.

Scanlon et al. (1974) performed the ENNS on 41 newborn infants, including 28 infants whose mothers received continuous epidural blocks with either Lidocaine (n=9) or Mepivacaine (n=19). The study illustrated that Lidocaine compromises neonatal neurobehavioral function when used for epidural analgesia. Scanlon et al. (1974) reported that infants of mothers who received epidural anesthesia with Lidocaine had significantly lower scores than "nonepidural" infants on tests of muscle strength and tone. This study was instrumental in the loss of popularity of Lidocaine for epidural anesthesia in obstetrics. (Kuhnert et al, 1985). However, these researchers pooled their subjects into groups with variable medications. In addition to pooling Lidocaine patients with the 19

Mepivacaine, 11 patients received barbiturates 6 or more hours prior to delivery. The non-epidural group consisted of 7 infants whose mothers received either low spinal or local anesthesia with or without barbiturate, and 6 infants born to unmedicated mothers. Failure to make distinct separation of subjects receiving different medications affects the validity of the results. In a subsequent study, using the same control patients from this original study, Scanlon et al. (1976) found epidural anesthesia using Bupivacaine to be free from the motor depression seen with Lidocaine.

Murray et al (1981) compared the neurobehavioral status of 20 infants whose mothers received Bupivacaine (0.25% with Epinephrine), 20 infants whose mothers received epidural Bupivacaine and Oxytocin, and 15 control infants whose mothers received no medication for vaginal delivery. The study used the BNBAS at days 1, 5, and 30, combined with diaries of infants crying and feeding patterns, feeding observations, and maternal questionnaires. The most significant effect was seen at one day of age. Compared with the unmedicated group, infants in both epidural groups scored poorly on the motor, state control, and physiologic response clusters. Although there was evidence of improvement by day 5, the medicated babies continued to exhibit poor state organization. There was more maternal-infant separation for the medicated groups and more mothers reported having difficulty caring for these infants. The positive aspect of this study was the isolation of study groups differing only in the administration of a single drug.

Sepkoski et al. (1992), tested the neurobehavioral outcomes of 60 infants, 38 were born to mothers who received 0.5% epidural Bupivacaine, and 22 who were born to unmedicated mothers (control group). Using the BNBAS at 3 hours after birth, and days

3, 7, and 28, the epidural group showed poor performance on the orientation and motor clusters over the first month of life. Findings also showed decreased mother-infant interaction in mothers who received Bupivacaine. The epidural group had longer labour, received significantly more oxytocin and more forceps delivery than the non-epidural group. Sepkoski et al., (1992) used multiple statistical analyses to control for confounding factors and demonstrate the differences between their study groups. The subjects were matched according to maternal and infant variables. The investigators were blinded to the study groups. Repeated measures were performed using analysis of variance, hierarchical multiple regression on the BNBAS scores, Pearson product moment correlation on drug variables, and multiple regression to see the effect of Bupivacaine levels to BNBAS scores. Results support the findings of Murray et al., (1981) that Bupivacaine used during labour has a significant and consistent negative effect on neonatal neurobehavioral performance.

Contradictory results were reported by Abboud, Khoo, Miller, Doan, and Henriksen (1982), Abboud et al. (1983), Abboud, David, et al. (1984), Abboud, Afrasiabi, et al. (1984), Bader et al. (1995), Celleno and Capogna (1988), Kangas-Saarela et al. (1987), Kileff, James, Dewan, and Floyd (1984), Lieberman et al. (1979), and Scanlon et al. (1976).

Abboud et al. (1982), compared the neurobehavioral status of 170 infants, 50 were born to mothers who received 0.5% epidural Bupivacaine, 50 with 2% epidural 2-Chloroprocaine, 50 with 1.5% epidural Lidocaine, and 20 in an unmedicated control group. Using the ENNS, neonatal neurobehavior was evaluated at 2 and 24 hours of life. This research used random allocation of local anesthetics to the epidural study groups.

Using analysis of variance, the result showed no differences between groups in the ENNS scores. Abboud et al. (1982) concluded that giving a small volume and low concentration of local anesthetics do not adversely affect the neurobehavioral performance of the neonates. However, these researchers failed to provide information on the actual dosage received by the epidural groups. In a subsequent study, Abboud, Afrasaibi, et al. (1984) had similar findings using similar medications with continuous infusions, and the NACS neurobehavioral testing. These studies provided limited information about the sample characteristics and did not control for confounding factors such as length of labour, which could affect outcome. No data on recovery were provided on the neurobehavioral tests.

Kileff et al. (1984) compared neonatal neurobehavioral outcomes for 2% epidural Lidocaine (n=10), and 0.5% epidural Bupivacaine (n=21) for cesarean section. Using the ENNS and nonparametric statistics, results showed no difference between the two groups of infants except for depressed sucking response at 24 hours of age for the Bupivacaine group. The 2% Lidocaine did not compromise the newborn outcome, which is contrary to the findings of Scanlon et al. (1974). Using a control group of unmedicated mothers could have demonstrated whether epidural analgesia has an effect on neonatal neurobehavioral outcome.

Lieberman et al. (1979) used selected items from the BNBAS to compare the neurobehavioral outcome of 145 infants at delivery, 1, 3, 7, 21, 42 days of age. Fifty-one mothers received IM Pethidine (100-150 mg with 10 mg Metaclopromide, 59 used .375% epidural Bupivacaine (10-14 ml injected over 10 minutes), and 35 did not use any medication (control group). Although the infants in the Bupivacaine group were less responsive to the human voice when compared to the other groups, there were no

significant differences in the levels of social responsiveness, motor organization and state control in the three groups. These researchers employed multiple regression with the behavioral measures as the dependent variable and to control for confounding factors.

Research on the effects of epidural analgesia on the mother and fetus is increasing. Although certain outcomes seem to be more conclusive than others, inconsistencies in research findings continue to be reported. Comparison of studies is difficult because of differing operational definitions of their study variables, methodologies, samples, and medication regimes. Further controversy exists in examining the effect of epidural analgesia on neonatal behavior. The studies discussed in this section introduce the clinical relevance of newborn behavior on the establishment of breastfeeding.

Breastfeeding

Breastfeeding is the biologically natural way for a mother to nourish and nurture her newborn. The superiority of human milk for human babies is supported by a volume of scientific documentation. However, women who desire to breastfeed may have problems that impede them from the successful initiation and maintenance of breastfeeding. To enhance understanding about the significance of promoting, supporting, and protecting breastfeeding, this section will address the benefits of breastfeeding, and factors affecting its initiation and duration.

Benefits of Breastfeeding

The health, nutritional, psychological, economical and environmental benefits of breastfeeding are widely acknowledged (American Academy of Pediatric Work Groups

on Breastfeeding, 1997; Canadian Pediatric Society, Dieticians of Canada, and Health Canada, 1998; La Leche League, 1995; Janke, 1993; Sullivan, 1992).

Health benefits. Breastfeeding, which is a process of interaction between the mother and her infant, offers multiple health benefits to both. Research is abundant suggesting a causal relationship between breastfeeding and healthy infants. Wright, Bauer, Naylor, Sutcliffe, and Clark (1998) found that increasing exclusive breastfeeding reduced infant illness. This finding was supported by the results of Wang & Wu (1996), that four months of exclusive breastfeeding offered protection against infection.

Substantial evidence highlights the immunologic benefits of breastfeeding. The Secretory IgA (SIgA) is the major immunoglobulin present in the breastmilk. SIgA antibodies are directed against all the microbes the mother has met previously (Hanson, 1998). Pabst & Spady (1990), and Hanson (1998) found that breastfed infants have more vigorous immunologic response to standard immunizations compared to formula fed babies. SIgA also protects the newborn's digestive tract by acting at the intestinal mucosal surface and blocking adhesions of potential pathogens. Thus, breastmilk provides major protection against the development of diarrheal disease (Caplan, 1999; Hanson, 1998; Riordan & Auerbach, 1993). The incidence of diarrheal illness among breastfeeding infants is half of that of formula feeding infants (Dewey & Nommsen-Rivers, 1995). A literature review by Bick (1999) found research results on the protective benefit of breastmilk against gastrointestinal infection are conclusive.

Breastmilk offers protection against neonatal necrotising enterocolitis (NEC) (Bick, 1999). A prospective multi-centre randomized control trial (RCT) of 926 infants compared the outcome of pre-term infants receiving breastmilk or formula (Lucas &

Cole, 1990). The results showed that children who only received formula were 10 times more likely to develop NEC than those exclusively breastfeeding. Infants who received combination feedings of breastmilk and formula had lower incidence of NEC than exclusively formula fed babies. The immunoprotective factors including IgA antibody, plasma cells, phagocytic cells, and enzymes contributed to the protective effect of breastmilk against NEC (Caplan & Mackendrick, 1993).

A literature review by Bick (1999) found conclusive evidence of the protective value of breastmilk against otitis media. The exact mechanism of this protection is unclear but a combination of the immunologic factors, the feeding position, and lack of irritation from formula may provide some explanation to this phenomenon (Duncan et al., 1993; Dewey & Nommsen-Rivers, 1995; Riordan & Auerbach, 1993). Duncan et al. (1993) found that increased duration and exclusivity of breastfeeding significantly reduced the total number of acute otitis media episodes in the first year and was associated with decreasing the risk of recurrent otitis media, independent of other factors.

Studies have investigated breastfeeding protection against respiratory infection. After reviewing these studies, Bick (1999) found that the current evidence suggest that breastfeeding protects against some lower respiratory tract infections but further evidence is required to confirm this.

Non-antibody factors of human milk also protect infants against bacterial infection. These factors include lactoferrin, bifidus factor, lactoperoxidase, and oligosaccharides (Riordan & Auerbach, 1993; Slusser & Powers, 1997).

The bioactive components of breastmilk promote growth and development of the newborn, and work together to protect the newborn from illness. These bioactive

components include enzymes, growth factor hormones, and taurine (Janke, 1993; Riordan & Auerbach, 1993). The enzymes vary in their functions, which include protecting against bacteria and inflammation, helping in the digestion of fat and starch and cholesterol metabolism, strengthening mucousal barrier to antigens, and are associated with the synthesis and cellular proliferation (Riordan & Auerbach, 1993).

Several studies report that breastfeeding may protect against Crohn's disease and ulcerative colitis in children (Riordan & Auerbach, 1993). These are the most common inflammatory bowel diseases in this age group. Rigas et al. (1993) found that breastfeeding was negatively associated with Crohn's disease and ulcerative colitis. The protective effect of breastfeeding against inflammatory bowel disease increases with the duration of breastfeeding. The anti-inflammatory properties of breastmilk may be associated with the protection against Jouvenile Rheumatoid Arthritis (JRA). Although results are inconclusive, Mason et al. (1995), and Hanson (1998) found that children who have JRA are less likely to have been breastfed.

Breastmilk may protect against early development of Insulin Dependent Diabetes Mellitus (IDDM). Gimeno and deSouza (1997) found a causal link between early introduction to cows milk and IDDM as well as possible protective role of exclusive breastfeeding against the development of IDDM. Research findings suggest possible protective effect of breastmilk against childhood diabetes, however, these findings are inconclusive (Bick, 1999).

Hormones in breastmilk include: (a) insulin-like growth factors; (b) thyroxine which may stimulate the maturation of the infant's intestine; (c) cortisol which is associated with the control of fluids and salt transport in the infant's intestinal tract; and

(d) prostaglandin which affect many physiologic functions such as circulation, gastric and mucous secretion, electrolyte balance, zinc absorption (Caplan, 1999; Riordan & Auerbach, 1993).

Taurine is the second most abundant amino acid in breastmilk. It plays an important role in brain maturation and absorption of dietary fats (Riordan & Auerbach, 1993). A literature review by Bick (1999) cites several studies with evidence suggesting that breastfed infants have an intellectual advantage over the formula fed infants.

Breastfeeding has been associated with the reduction of risk for developing allergies such as asthma, eczema, or hay fever especially in the first year of life (Bick, 1999). Breastmilk has its greatest benefit for genetically at risk infants. IgA found in the infant's intestinal tract has been shown to prevent the absorption of potentially allergenic molecules (Janke, 1993; Riordan & Auerbach, 1993). Breastfeeding also delays infant exposure to large amount of foreign proteins from different food sources.

Other health benefits of breastfeeding that have been suggested are superior oral development and protection against Sudden Infant Death Syndrome (SIDS). Labbock and Hendershot (1987), and Palmer (1997) found that breastfeeding promotes proper orofacial muscle and jaw development. Their findings suggest that breastfeeding duration is associated with the reduction of subsequent malocclusion. A meta-analysis and qualitative literature review by McVea, Turner, and Peppler (2000) found that breastfeeding is associated with 50% reduction in SIDS. A causal relationship was not established but findings add to the potential benefits of breastfeeding.

The health benefits of breastfeeding are not limited to the infants. The stimulation of the breasts during feedings increases oxytocin levels in the blood. Oxytocin functions

in contracting the mother's uterus, which helps control postpartum bleeding and enhances uterine involution (Riordan & Auerbach, 1993).

Studies have found that breastfeeding provides maternal protection against breast cancer. La Leche League (1995) cites studies with evidence of breastfeeding protection against the development of breast cancer. The results of research on this topic have been conflicting. A prospective study of breastfeeding and breast cancer on 89,887 women found no significant overall association between a history of having breastfed and subsequent development of breast cancer (Michels et al., 1996). However, the protective association found among their sample relates primarily to premenopausal breast cancer. In some studies, the inverse association between breastfeeding and breast cancer was found to be dependent on the duration of breastfeeding (Layde, Webster, & Baughman, 1989; Kelsey & John, 1994).

The reduction in risk of epithelial ovarian cancer has also been attributed to the benefits of breastfeeding. The relationship between lactation and the development of epithelial ovarian cancer was examined in data from seven countries that contributed to a multinational hospital-based case-control study (Rosenblatt, Thomas, & the WHO Collaborative Study of Neoplasia & Steroid Contraceptives, 1993). This study found that breastfeeding resulted in a slight reduction in risk of developing epithelial ovarian cancer and this reduction is not affected by the duration of breastfeeding.

La Leche League (1995) lists maternal protection against osteoporosis and hip fractures in later life among the benefits of breastfeeding. However, this area of research is limited and inconclusive (Kritz-Silverstein, Barrett-Connor, & Hollenbach, 1992).

Mothers who breastfeed may also experience a delay in the development of subsequent diabetes when they have a history of gestational diabetes (La Leche League, 1995). Kjos, Henry, Lee, Buchanan, and Mishell (1993) found in their study of 809 women, that breastfeeding even for a short period has beneficial effect on glucose and lipid metabolism in women with gestational diabetes.

Breastfeeding delays the return of fertility (Campbell & Gray, 1993; Kennedy & Visness, 1992). Campbell & Gray (1993), found that both breastfeeding frequency per day and average sucking duration per breastfeeding contributed significantly and independently to delay ovulation. Lactation amenorrhea can help prevent pregnancy when combined with barrier or chemical methods of contraception (Riordan & Auerbach, 1993).

Maternal weight loss is also considered one of the benefits of breastfeeding. Dewey, Heinig, & Nommsen, (1993) found weight loss from 1-12 months postpartum was significantly greater ($p < 0.05$) in breastfeeding mothers than in formula feeding mothers, due mainly to the differences in weight loss from 3-6 months postpartum. Study result also showed a positive relationship between breastfeeding frequency and total time of suckling at the breast to the maternal weight loss from 6- 12 months postpartum.

Nutritional benefits. The nutritional composition of breastmilk is optimal for human infants. Human milk is sufficient to sustain the infant for the first six months of life. The following information on the nutritional benefits of breastmilk has been adapted from Riordan & Auerbach (1993).

Breast milk contains abundant amount of taurine and cystine necessary for brain development. Fat provides greater than 50% of calories for breastfeeding infants.

Cholesterol found in breastmilk is necessary in myelination of nerves, and brain tissue development. The high levels of cholesterol in breastmilk are thought to be an important factor in the development of metabolic pathways for handling cholesterol later in life.

Lactose accounts for most of the carbohydrates in human milk. It enhances the absorption of calcium for bone and tooth development. Its metabolites, galactose and glucose, are necessary for central nervous system development. Some olligosaccharides promote the growth of Lactobacillus bifidus in the infant's stomach which increase intestinal acidity inhibiting the growth of pathogenic organism. Lactose intolerance is more common with age and after weaning due to the diminishing activity of intestinal lactase.

Breastmilk contains high quality protein, although in small amount. It is sufficient for the energy needs of both term and pre-term infants. The protein in human milk is for nutritional and immunological purposes.

Most vitamins and minerals are present in adequate amounts and bioavailability to meet the needs of full-term healthy infants. Vitamins in human milk vary markedly from one person to another due to maternal diet and genetic differences. Breastmilk contains fat-soluble vitamins. These are: (a) Vitamin A for visual health, (b) Vitamin D for prevention of rickets, (c) Vitamin K required the synthesis of blood-clotting factors, and (d) Vitamin E for protection of cell membranes in the retina and lungs against oxidant-induced injury. Breastmilk also contains zinc and iron. Calcium appears in small amounts in human milk but babies are able to absorb 67% of the calcium in human milk compared to 25% of the calcium in cow's milk. This contributes to a decreased incidence of neonatal hypocalcemia and tetany in breastfed babies.

Emotional and psychological benefits. The emotional aspect of breastfeeding encourages the development of a relationship or bond between the infant and the mother. The increased quantity and quality of early contact between the breastfeeding mother and infant may also benefit the attachment process. Babies find comfort and security in their mothers' arms. A study examining the impact of breastfeeding for mothers of pre-term infants found five major rewards perceived by these mothers. The emotional and psychological rewards include: (a) Knowing they were providing the healthiest nutrition for the infant, (b) enhancing closeness between the mother and infant, (c) perceiving infant contentment and tranquility during breastfeeding, (d) providing convenience for the mother, and (e) giving the mother tangible claim on the infant (Kavanaugh, Meier, Zimmermann, & Mead, 1997).

There are conveniences associated with breastfeeding. Mother's milk is easily and readily available. There is no mixing and pre-warming required. Breastfeeding ensures that infants receive optimal volumes of milk because it is self-regulating and dependent on infant suckling.

Environmental benefits. Breastfeeding is "environmentally friendly". It is a free, natural and renewable resource. Because it requires no packaging, breastfeeding does not create pollution from the manufacturers and in the disposal of bottles and cans.

Cost benefits. The decrease in infant morbidity among breastfeeding infants affects health care cost. Riordan (1997) provides a powerful illustration related to the health care cost incurred for treatment of four medical conditions in infants who were not breastfed. Health care costs associated with infant diarrhea, respiratory syncytial virus, IDDM, and otitis media is over $1 billion dollars per year. Reduction in illness is also

associated with decreased absenteeism for parents who must care for their ill child. The long-term benefits of breastfeeding reduce health care costs for both the family and government.

Breastmilk has little to no cost to the family when compared to the cost involved with formula feeding. The cost of formula varies depending on type used. Riordan (1997) approximates about $900 per year is spent on formula per infant. There is also the cost of supplies such as bottles, nipples, and sterilizing equipment. Time used in preparation of formula feeding is time lost for the family. Finally, there is also the cost of electricity and water.

The benefits of breastfeeding to the infant, mother, family, and society are many. The nutritional and immunologic properties of breastmilk offer the infant optimal health and growth. The process of breastfeeding offers the mother health benefits, as well as promotes mother-infant relationship. The added benefits of breastfeeding related to reduced waste and costs, make it a desirable form of infant feeding to be promoted, supported, and protected.

Factors Associated with Initiation and Duration

Breastfeeding is multifactorial in nature. The success of breastfeeding is dependent on factors relating to the mother, the infant and the supportive environment. These factors can either be modifiable or non-modifiable. The majorities of variables associated with breastfeeding are attribute variables and as such cannot be modified. These factors include ethnic background, years of education, age, income, and parity. Modifiable factors include support by partner, family and friends, the work place environment, the health care system, antenatal preparation and lactation education. The

discussion of these factors and other contributing variable will be categorized as socio-demographic, biomedical, health services related, psychosocial and cultural factors. The relative importance of an individual factor as a possible promoter of breastfeeding is difficult to evaluate because they confound each other.

Socio-demographic factors. Age, education, marital status, ethnicity, socioeconomic, parity, employment and smoking have been associated with the initiation and continuation of breastfeeding.

Maternal age has consistently been associated with both breastfeeding initiation and duration. In general, after controlling for other potentially confounding factors, research have found that women who are in early 20s to 30s are more likely to choose breastfeeding (Nolan & Goel, 1995; Quarles, Williams, Hoyle, Brimeyr, & Williams, 1994; Rajan, 1994). Breastfeeding initiation increased with the mother's age (Health Canada, 2000a; Kennedy & Visness, 1997; Maclean, 1998; Matthews, Webber, McKim, Banoub-Baddour, & Laryea, 1998; Nolan & Goel, 1995). Older mothers were more likely to breastfeed longer (Coreil & Murphy, 1988; Downie & Juliff, 2000; Health Canada, 2000a; Maclean, 1998; Nolan & Goel, 1995; Pande, Unwin, & Haheim, 1997; Piper & Parks, 1996).

Studies have found a consistent strong association between educational level attained and the initiation and duration of breastfeeding (Kennedy & Visness, 1997; Lawson & Tulloch, 1995; Littman, Vanderbrug Medendorp, & Goldfarb, 1994; Maclean, 1998; Matthews et al, 1998; Nolan & Goel, 1995; Quarles et al, 1994). These research illustrate that women with higher education are more likely to initiate breastfeeding and breastfeed longer.

A literature review on factors associated with initiation and duration of breastfeeding has identified marital status as a determining factor (Scott & Binns, 1999). After controlling for confounding variables, a Canadian study found that single women were only half as likely to initiate breastfeeding (Nolan & Goel, 1995). Other research supporting the association between initiation and marital status are by Bick, MacArthur, and Lancashire (1998), and Maclean (1998). Bick et al (1998) also found that unmarried mothers stopped breastfeeding earlier. A study that looked at breastfeeding practice at 6 months following birth found women who were married were more likely to continue breastfeeding (Kiehl, Anderson, Willson & Fosson, 1996). The positive relationship between marital status and breastfeeding initiation and duration may be associated with the known influence of partner support.

Scott and Binns (1999) found differences in breastfeeding rates amongst various ethnic groups. Their literature review showed a consistently lower rate of breastfeeding among the black and Hispanic women compared to white women who are living in the United States. Dennis (2002), found in her literature review that some researchers have found no difference in breastfeeding rates between low-income ethnic groups, suggesting that socioeconomic status may be more important predictor of breastfeeding behavior than ethnicity. Researchers have also found that breastfeeding initiation was highest among women who were the least acculturated and lowest among women most acculturated (Dennis, 2002). Data from 2 Canadian Research projects, the National Population Health Survey (NPHS) and National Longitudinal Survey of Children and Youth (NLSCY), illustrate that immigrant women were more likely to breastfeed than their non-immigrant counterparts (Kennedy & Visness, 1997). The NPHS and NLSCY

also found breastfeeding initiation rate for Aboriginal women lower than the general Canadian population. Duration of breastfeeding among immigrants and non-immigrants differed in the two surveys with NPHS data showing that immigrants weaned earlier than non-immigrants and NLSCY showing no significant difference.

Social class or socioeconomic status has been documented to have a relationship with breastfeeding success (Scott & Binns, 1999). Middle to upper class women are more likely to choose to breastfeed and more likely to succeed in their breastfeeding efforts than lower class women (Quarles et al., 1994). There is positive relationship between higher income level and initiation and duration of breastfeeding (Downie & Juliff, 2000; Littman et al., 1994, Maclean, 1998; Matthew et al., 1998; Nolan & Goel, 1995; Quarles et al.; Rajan, 1994). Low to low middle socio-economic status was associated with early weaning before 8 weeks (MacLean, 1998). Dennis (2002) found in her literature review that although breastfeeding is positively related to socioeconomic status in most developed countries, there is an inverse relationship in developing countries.

Inconclusive results have been reported on the association of breastfeeding and parity (Scott & Binns, 1999). Bick et al. (1998), Kennedy and Visness (1997), and Rajan (1994) found significant association of multiparity with the initiation of breastfeeding. A US national survey indicates that each increase in parity of one birth resulted in 1.7 times greater in continuing breastfeeding beyond 6 months (Piper & Parks, 1996). It has been suggested that parity may increase duration of breastfeeding in relation to maternal confidence and experience.

Employment has become a strong influence in the initiation and duration of breastfeeding as more women choose to remain in or re-enter the workforce. The association between maternal employment and incidence and duration of breastfeeding is supported by research (Hauck, 2000). A literature review by Scott and Binns (1999) found that in general, intention to return to work has not been shown to affect the initiation of breastfeeding. However, research shows that return to work affected the actual duration of breastfeeding (Bick et al., 1998; Bridges, Frank, & Curtin, 1997; Gielen et al., 1997). Gielen et al. (1991) report positive impact between a supportive workplace environment and the duration of breastfeeding. In addition, they found that the total amount of hours worked (less than 20 hours per week) has a positive relationship in the continuation of breastfeeding following re-entry to the work force. Fein & Roe (1998) had similar findings. A US national survey found the delay in returning to work outside the home has a positive relationship with the duration of breastfeeding (Piper & Parks, 1996). Similar findings are reported by Bick et al. (1998).

There is consistently negative association between maternal smoking and breastfeeding initiation (Nolan & Goel, 1995; Scott & Binns, 1999) and duration (Nolan & Goel, 1995; Piper & Parks, 1996; Scott & Binns, 1999). These researchers found that women who smoke are less likely to initiate breastfeeding than those who are non-smokers. Other research also found a "dose response" effect with smoking mothers in that those smoke the heaviest have the least likelihood of establishing exclusive breastfeeding (Ford et al., 1994).

Biomedical factors. Childbirth, infant health, and maternal health are the biomedical factors that have been associated with the initiation of effective breastfeeding.

Women's childbirth experience has been found to influence the success of breastfeeding (Scott & Binns, 1999). Studies have found that positive childbirth experience may have favourable effect on early feeding attempts. On the other hand, a negative experience might cause women to become discouraged easily.

Labour and delivery management has been shown to have an impact on the initiation and duration of breastfeeding (Scott & Binns, 1999). A literature review by Scott and Binns (1999) indicates that those women who delivered by cesarean section are less likely to initiate breastfeeding. Factors related to cesarean section such as pain, nausea and vomiting, immobility, intravenous therapy, and foley catheter insertion can affect maternal interest to breastfeed and ability to attain a comfortable position for breastfeeding baby (Caplan, 1999). A study by Kearney, Cronenwett, and Reinhardt (1990) showed a delay in the initiation of breastfeeding among mothers who delivered by cesarean section. This research illustrated that cesarean section mothers initiated breastfeeding at a mean time of 11.1 hours following delivery while women who had spontaneous vaginal delivery had an average initiation time of 4.5 hours postpartum. Bick et al. (1998) found general anesthesia was significantly associated with non-initiation of breastfeeding. Rajan (1994) found the incidence of obstetrical instrumentation during labour and delivery negatively affected the initiation of breastfeeding.

Maternal medication during labour and delivery has been shown to affect the sucking ability of the newborn (Crowell et al., 1994; Loftus et al., 1995; Matthews, 1989; Rajan, 1994; Riordan, Gross, Angeron, Krumwiede, & Melin, 2000; Sepkoski, 1992). Righard & Alade (1990) found the majority of infants whose mothers received analgesia

during labour were too drowsy to be able to suck at the breast. A literature review by Walker (1997) indicates that many babies whose mothers have received epidurals have difficulty initiating or sustaining breastfeeding. The relationship between epidural and breastfeeding will be reviewed extensively later in this review.

The provision of continuous labour support is related to exclusive breastfeeding at 4 to 6 weeks postpartum (Langer, Campero, Garcia, & Reynoso, 1998; Scott, Klaus, & Klaus, 1999). Hodnett confirms these findings in a Cochrane review in 2001 as cited by Dennis (2002).

Infant health problems have a negative association with both initiation and duration of breastfeeding (Scott & Binns, 1999; Maclean, 1998). Health problems at birth such as thick meconium or asphyxia often delay the initiation of breastfeeding. "An infant whose nervous system has received an insult such as asphyxia, sepsis, trauma, perinatal maternal drugs, or neonatal narcotic abstinence, has nervous system that has, in essence, been rendered less mature" (Danner, 1992, p.640). Management of health problems may require the separation of the infant from the mother, either for initial observation or prolonged periods in the case of major health concerns. Medoff-Cooper and Ray (1995) found additional stress such as tachypnea, hypoxemia, hypothermia, respiratory or cardiac difficulty significantly affected feeding behavior. The separation may mean physical problems that might limit the ability of infant to feed and also restrict the mother's access to her baby for feeding. According to MacMullen and Dulski (2000), physiologic factors such as prematurity or central nervous system pathology may interfere with suck and swallow coordination necessary for feeding. Prematurity is

related to delayed ability to initiate breastfeeding (Furman, Minich, & Hach, 1998; Martell, Martinez, Gonzalez, & Diaz Rosello, 1993; Medoff-Cooper & Ray, 1995).

Maternal health may delay the initiation and affect the duration of breastfeeding. The initiation of breastfeeding may be affected by critical illness of the mother intending to breastfeed. Management of medical complications resulting from delivery may require the mother to be separated from her infant. According to Coates and Riordan (1992), "breastfeeding may be one of many desirable practices that must be suspended temporarily", (p. 685) when breastfeeding may place the mother's life at risk. Current literature review of factors affecting the initiation and duration of breastfeeding do not include studies that examine the impact of maternal illness on breastfeeding.

Health services related. A variety of hospital practices have been proposed to have a positive impact on the successful establishment and maintenance of breastfeeding. As a result, these practices have become part of the "Ten Steps to Successful Breastfeeding launched by the World Health Organization (WHO)/United Nations Children's Fund (UNICEF) in 1989. In 1991, these two organizations launched the Baby- Friendly Hospital Initiative (BFHI) to ensure a health care environment at birth is conducive and supportive of breastfeeding. DiGirolamo, Grummer-Strawn, & Fein, (2001), found that increased BFHI practices improve the chances of breastfeeding beyond 6 weeks. Rooming-in, early mother-infant contact, demand feeding, and elimination of unnecessary supplementary and complementary feeds have been found to support the initiation of effective breastfeeding.

Rooming-in allows for frequent and unrestricted suckling in the early days of life. A literature review found a consistent positive relationship between the amount of time

the mother spent with her infant and breastfeeding success (Scott & Binns, 1999). When a baby is separated from the mother, the baby may go through rounds of cueing and crying that is unobserved or ignored, which may eventually lead to "shutdown behavior" in which the baby loses energy to get their needs met (Caplan, 1999). This might lead to dysfunctional breastfeeding whereby baby goes for several hours without suckling, leading to lethargy and disinterest, and decreased energy to feed; this scenario negatively affects the initiation of breastfeeding. Research by Buxton et al. (1991), Fahy and Holschier (1988), and Lawson and Tulloch (1995) are among the studies showing a positive relationship between rooming-in and initiation of breastfeeding.

Early mother-infant contact promotes early initiation of breastfeeding. Hospital policies and procedures that separate the mother-baby couple such as nursery based assessments, baths and observation periods affect the initiation of breastfeeding. Separation from the mother during the first hour after birth has a strong effect on the success of the first breast-feed (Righard & Alade, 1990). Early initiation of breastfeeding is significant predictor of breastfeeding duration (Buxton et al., 1991; Coreil & Murphy, 1988; DiGirolamo et al., 2001; Lawson & Tullock, 1995; Matthews, 1991).

Demand feeding means unrestricted breastfeeding through the day and night (Scott & Binns, 1999). Unrestricted suckling in the early days of life has been shown to eliminate potential breastfeeding problems related to latch, sucking and milk production. A literature review by Scott and Binns (1999) found evidence that suggests demand feeding is positively associated with the initiation and duration of breastfeeding. Dennis (2002) cites a Cochrane meta-analysis of three trials involving more than 400 women,

which concluded that demand feeding was associated with a greater continuation at 4-6 weeks postpartum.

Elimination of unnecessary supplementary and complementary feeds is supportive of breastfeeding. Research indicates that the early introduction of supplementation negatively impacts the duration of breastfeeding (Aliperte & MacAvoy, 1996; Blomquist, Jonsbo, Sernius, & Persson, 1994; Breastfeeding Promotion Steering Committee of Manitoba, 1998; Coreil & Murphy, 1988; DiGirolamo et al., 2000; Hill, Humenick, Brennan, & Wolley, 1997; Matthews et al., 1998; Nylander, Lindemann, Helsing, & Bendvold, 1991; Sheehan et al., 1999). Supplementation is the replacement of an entire feed from the breast. Complementation is the addition of other fluids during or after breastfeeding. Supplementation has been shown to affect milk production due to the decreased frequency of suckling at the breast. Complementation may also have the same effect if the duration and frequency of infant suckling at the breast is reduced from what would normally take place if the infant were not given the additional fluid. Supplementation prior to feeding attempt may affect the initiation of breastfeeding. A satiated infant will not feed at the breast. Also, supplementation by bottle may cause the infant to refuse the breast on subsequent feedings. Breastfeeding and bottle-feeding require different skills (Riordan & Auerbach, 1993).

Psychological and cultural factors. This includes social support, prenatal breastfeeding intentions, maternal confidence, maternal self-esteem, and maternal commitment.

Social support can mean: (a) emotional support such as affection, love, acceptance; (b) tangible or instrumental support such as task oriented behavior that

directly help the person; or (c) information support as in the provision of guidance, advice, facts and knowledge (Caplan, 1999). Support from partner, family and friends have been found to influence the maternal choice and duration of breastfeeding (Caplan, 1999; Scott & Binns, 1999). A partner's attitude towards breastfeeding plays an important role in a woman's decision to breastfeed and to wean (Bar-Yam & Darby, 1997; Littman et al., 1994). The infant's father has been found to be an important source of tangible, emotional, and informational support (Bar-Yam & Darby, 1997; Raj & Plichta, 1998).

The relative influence of various social network members varies between cultures (Scott & Binns, 1999). Some cultures may be highly influenced by their partners, other by their mother, their grandmother or their friends (Raj & Plichta, 1998). Access to lactation consultants (Quales et al, 1994) and breastfeeding support groups (Arlotti, Cottrell, Lee, & Curtin, 1998; Matthews et al., 1998; Ryan & Pharm, 1997; Shaw & Kaczorowski, 1999) have been shown to increase the initiation and duration of breastfeeding. Finally, the public sector acceptance and support of breastfeeding may also influence the maintenance of breastfeeding (McIntyre, Turnbull, & Hiller, 1999).

Prenatal breastfeeding intentions have been associated with initiation and continuation of breastfeeding. Studies indicate that women who decide that breastfeeding is their preferred feeding method prior to pregnancy are more likely to initiate breastfeeding than those who make their choice during or after the pregnancy (Buxton et al., 1991; Mackey & Fried, 1981; Scott & Binns, 1999). Research findings show a strong and consistent association between intended duration of breastfeeding and actual duration (Coreil & Murphy, 1988; Lawson & Tullock, 1995; Piper & Parks, 1996).

A positive relationship between maternal breastfeeding confidence and breastfeeding initiation (p=.000) was found by Papinczak and Turner (2000). A literature review by Fahy & Holschier (1988) report maternal factors in the postnatal period which have been identified as reasons for discontinuing breastfeeding. These include flat or inverted nipples, sore nipples, engorgement, difficulties latching and insufficient milk. According to NPHS and NLSCY, weaning before 3 months were due to insufficient milk, difficulties with technique, sore nipples, inconvenience and fatigue (MacLean, 1998). Breastfeeding difficulties result in disappointment, frustration, or early cessation of breastfeeding (Walker, 1989). Fahy and Holschier (1988) found a relationship between mother's difficulties with breastfeeding and a loss of confidence in her ability to breastfeed. Confidence has a positive impact on the decision to continue breastfeeding (Buxton et al., 1991; Coreil & Muphy, 1988; Fahy & Holschier, 1988; Papinczak & Turner, 2000). Problems that cause the mother to experience pain, frustration, and doubt about her ability to provide adequate nourishment for her infant can lead to early cessation of breastfeeding (Chute, 1992). Papinczak and Turner (2000) also found that lower levels of anxiety and depression, and increased self-esteem and coping capacity are positively associated with longer breastfeeding duration. Women who consider themselves to be successful are also positive thinkers, problem solvers, determined to succeed and perceive breastfeeding difficulties as "normal" (McNatt & Freston, 1992). Women who are not successful are also self-doubting, anxious, rigid in their breastfeeding practices, focus on the negative aspects and more likely to discontinue breastfeeding when having difficulties (McNatt & Freston, 1992). Most importantly, it has been found that maternal commitment to breastfeeding can override the negative

impact of delivery events and delayed first breastfeeding (Caplan, 1999; Kearney et al., 1990; Scott & Binns, 1999).

An awareness of the multiple factors associated with both the initiation and duration of breastfeeding are important in the promotion, support, and protection of breastfeeding. Non-modifiable variables such as ethnicity, education, socio-economic status help identify target population for breastfeeding promotion and support programs. The modifiable variables such as early initiation, supplementation, rooming-in, labour and delivery management can be targeted to promote, support and protect maternal choice of breastfeeding.

Breastfeeding Assessment

The early neonatal period is one of the critical periods in the breastfeeding relationship between the mother and the newborn. Breastfeeding is more than a feeding method. Driscoll (1992) defines breastfeeding as a complex relationship and a method of connection involving the mother and her infant. Equally important to this relationship is the technical process that facilitates the milk transfer so that the lactating woman can provide nourishment for her infant and the infant to receive that nourishment. The infant's contribution to the breastfeeding is a combination of readiness to feed, ability to latch, suck, and swallow. By supporting these infant contributions and evaluating the experience, the mother can help establish breastfeeding. Some mothers and infants may experience breastfeeding difficulties that can lead to disappointment, frustration, or early cessation. Optimal breastfeeding assessment allows for objective and subjective evaluation, appropriate management guidelines and anticipatory guidance for expected newborn and maternal needs.

There are several breastfeeding assessment tools available, each having their own specific focus. For the purpose of this literature review, only the tools developed for in hospital use and those including the assessment of infant contribution will be discussed. These tools include the Systematic Assessment of the Infant at the Breast (SAIB), the Mother-Baby Assessment (MBA), The Infant Breastfeeding Assessment Tool (IBFAT), and the LATCH Breastfeeding Charting System. Information regarding the reliability and validity of these tools are increasingly available but are not well established.

The Systematic Assessment of the Infant at the Breast (SAIB). This is a breastfeeding assessment tool that identifies observable criteria to evaluate the infant's contribution to breastfeeding. Developed by Shrago & Bocar (1989), the tool assesses the infant for alignment, areolar grasp, areolar compression and audible swallowing. Alignment focuses on proper infant positioning at the breast and correct body alignment. Specific criteria are outlined for evaluating what is proper positioning and body alignment. Areolar grasp involves: (a) mouth is open widely; (b) lips flanged outward, complete seal and strong vacuum formed by infant's mouth; (d) approximately half of areola is inside the infant's mouth and centered; (e) tongue covers lower areolar ridge; (f) tongue is troughed; and (g) no clicking or smacking or dimpling of the infant's cheek pad during sucking. Areolar compression is evaluated by rhythmic mandibular motion. Finally, audible swallowing indicate milk intake. Shrago & Bocar (1989) state that each component of the SAIB should be evaluated as part of an initial breastfeeding assessment within the first 12 hours of life. The SAIB facilitates specificity in documentation, early recognition of breastfeeding problems and initiation of appropriate interventions. Either

the mother or nurse may use this tool. However, the SAIB evaluates only the infant contribution in the breastfeeding relationship.

The Mother-Baby Assessment (MBA). The MBA is a teaching documentation tool for health providers. The main focus is breastfeeding learning based on the mutual effort of both mother and baby (Mulford, 1992). The MBA divides the process of breastfeeding into 5 sequential steps starting from signaling to positioning, fixing, milk transfer and ending. Each step considers maternal and infant behavior. A score of "+" or 0 is given to each partner of the breastfeeding couple. The "+" is given for each step whenever the mother and baby are doing their best.

For signaling, the mother is observed for signs of readiness to feed such as picking up baby and waking baby. In the same manner, the baby is observed for signs of readiness to feed and response to maternal cues. This step ends when the baby is at the mother's arms and she prepares to offer the breast. The second step is positioning. The mother is observed for posture, how she holds and positions the baby. Rooting is the baby's contribution to this step. This phase is complete when the baby is aligned to the breast, is opening his mouth wide, with tongue in place over the lower gum. The following step is fixing. This is the step in which the baby gets the breast into his mouth and begins to suckle. The mother contributes by supporting the breast with her hand and guiding the baby toward the breast. This step is completed when baby establishes a burst-pause pattern of sucking. The fourth step is milk transfer, which evaluates the milk ejection reflex in response to infant stimulation. Signs may include thirst, uterine cramping, breast sensations and sleepiness. Milk transfer is evident with infant swallowing, slower and steadier sucking and gradual relaxation. This phase ends when

the baby lets go of the breast and gives no further indication for continued interest to feed. The last step is ending. It describes the outcome of the breastfeeding session. Milk transfer is measured by baby's signs of satiation. The mother's breasts are evaluated for softness as indication of milk supply and release, and absence of nipple tenderness as indication of good positioning and fixing technique.

All the "+" are totaled in the end. An even score indicates that both partners have contributed and completed a step. The higher the MBA score, the more effective is the breastfeeding session. This tool has been developed for nurses' use and clearly considers both the mother and baby in the breastfeeding relationship. No evidence of reliability or validity of the MBA has been published to date.

The Infant Breastfeeding Assessment Tool (IBFAT). Matthew (1988) developed the IBFAT to provide an accurate measure of baby's rooting, fixing, and sucking behavior. The IBFAT may be used by the mothers and nurses to evaluate the infant's performance at each feeding. The tool is comprised of 5 items with four major components of infant breastfeeding behavior. These components are (a) readiness to feed (b) rooting, (c) fixing, and (d) suckling. The scores range from 0 to 3 for each component. Therefore, a score of 12 is a sign of vigorous, effective feeding.

Readiness to feed describes the degree to which the baby needs to be stimulated to start to feed. The more readily the baby arouses the higher the score. When the infant is placed beside the breast, the infant who roots effectively at once receives a score of three. Fixing or latching is the ability of the baby to grasp the nipple and flange lips against the areola (Matthews, 1988). This component evaluates infant alertness, and ability to latch. When infant is alert and ready to feed but has problems latching, it may indicate

anatomical difficulties with the mother's breast such as flat or inverted nipples. The degree of ease in latching is scored 0-3. Sucking is identified as the most important newborn feeding activity. A healthy infant should be able to demonstrate coordinated suck and swallow without any distress. This component is scored according to the effectiveness of sucking and swallow. The first item of the IBFAT is an evaluation of the infant state and responsiveness, which are determinants of infant ability. The final item of the tool assesses maternal satisfaction with the feeding. This is an indication of the mother's perception of the breastfeeding session.

The IBFAT addresses both the mother and infant in the breastfeeding relationship. According to Matthews (1993), the assessment focuses on healthy full-term neonates or those who are essentially healthy with transient problems or feeding difficulties. An interrater reliability of 91% was found between mother and researcher assessment (Matthews, 1993). However, in evaluating the reliability and validity of 3 breastfeeding tools, Riordan & Koehn (1997) found a lower interrater reliability (77%) for the IBFAT.

The LATCH Breastfeeding Charting System (LATCH). The LATCH is a documentation tool for breastfeeding assessment. It was developed to facilitate early identification of breastfeeding problems, communication between nurses, and consistent teaching and care to breastfeeding mothers (Jensen, Wallace, & Kelsay, 1993). The LATCH system assigns a numerical score of 0, 1, or 2 to five key components of breastfeeding: (a) "L" for the infant's ability to latch onto the breast, (b) "A" for the presence of audible swallowing of the infant at the breast, (c) "T" for the mother's nipple type, (d) "C" for the mother's sense of breast and nipple comfort, and (e) "H" for the

amount of help the mother needs to hold or position her infant to the breast. A possible score of 10 on the LATCH assessments meets the following criteria:

- "L" = Infant grasp breast, tongue down, lips flanged, rhythmic sucking
- "A" = Spontaneous and intermittent audible swallows if infant is less than 24 hours old or spontaneous and frequent audible swallows if infant is greater than 24 hours old
- "T" = nipple is everted (after stimulation)
- "C" = Breast are soft and nipples are non-tender
- "H" = No assistance from staff required in positioning and mother is able to position and hold infant.

The LATCH Breastfeeding Charting System incorporates the evaluation of both infant and maternal contribution to the breastfeeding process. Either the mother or the nurse may do the scoring. Riordan & Koehn (1997) did not find the tool to have sufficient reliability. On the contrary, Adams & Hewell (1997) found high interrater reliability (85.7-100%) among lactation consultants using the LATCH tool.

The tools described in this section highlight the key criteria in what constitutes effective breastfeeding. The three themes that all tools incorporate are (a) baby behavior, (b) attachment, and (c) effective feeding (Moran, Dinwoodie, Bramwell, & Dykes, 2000). All, but IBFAT include "positioning". An accurate breastfeeding assessment allows for early identification of problems and serves as a foundation for developing interventions to support and protect breastfeeding.

Infant Psychosocial Adaptation

Knowledge about normal infant psychosocial adaptation and feeding behavior during the first few hours and days of life is fundamental in the assessment, and care of the breastfeeding infants and their mothers.

Following delivery, the infant goes through periods of reactivity and sleep. Normal healthy term infants can begin to breastfeed immediately after birth (Hall, Ellerbee, & Newberry, 1997). Beginning at birth, infants are very active and appear wide-awake, alert, and interested in their surroundings. Infants move their arms and legs energetically, root, and appear hungry. If allowed to nurse, many infants latch on the nipple and suck well. Effective breastfeeding at this time provides an optimal level of functioning for both mother and infant for the following reasons: (a) Suckling stimulates uterine contractions, and helps to control maternal bleeding, (b) the infant's suckling reflex is most intense during the first 20-30 minutes of life, (c) the infant immediately begins to receive the immunologic advantages of colostrum, (d) the infant's digestive peristalsis is stimulated, (e) lactation is stimulated, (f) early suckling allows an imprinting to occur as the baby learns to grasp and shape a teat and suckle effectively, and (g) attachment and bonding are enhanced (Livingstone, 1996; Riordan & Auerbach, 1993).

This initial period of reactivity is then followed by deep sleep lasting for 2-8 hours of age. Upon awakening, the infants enter the second period of reactivity. Again, infants are alert and become interested in feeding. The progression of this second period of reactivity varies individually.

In observing 10 healthy full-term infants, Winstrom et al. (1987) found slow spontaneous sucking movements within 15 minutes of delivery. There was a gradual increase to maximal level at 45 minutes following delivery. Rooting activity was also low 15 minutes after birth but increased gradually and reached maximum at 60 minutes of age. Hand to mouth movements was first noticed at a mean time of 34 $\pm$ 2 minutes after birth. When left on their mother's chest, all of the infants found the nipple by themselves and started to suckle vigorously. The mean time of sucking initiation was 55 $\pm$ 4 minutes of age. This observation suggests that an organized feeding behavior develop in a predictable way during the first hour of life.

Righard and Alade (1990) observed similar behavior related to the initiation of breastfeeding. Of seventy-two mother-infant pairs in their study, 38 mother-infant pairs had uninterrupted contact and infants were left at rest on the mother's abdomen until their first feed had been accomplished. Righard and Alade (1990) found spontaneous arm and leg movements after a mean time of 19 minutes in an attempt to reach the breast. Mouthing and sucking movements followed this. After a mean time of 49 minutes, most of infants latched to the breast on their own.

According to Hall et al. (1997), infants demonstrate short periods of nursing at irregular intervals when they are about 8-24 hours of age. At this time, the suck and swallow coordination is developing. Feeding cues are demonstrated by rapid eye movements, small muscle movements, hand to mouth movements, rooting, and crying (late sign). Effective breastfeeding at this time promotes early and frequent removal of milk from milk ducts and accelerates lactation. This is a critical period for the

establishment of breastfeeding (Hall et. al., 1997; Livingstone, 1996; Riordan & Auerbach, 1993).

At 25 - 48 hours of life, appetite increases with frequent nursing. The sleep/wake cycles are more organized. There is increased alertness and longer periods of wakefulness by day 3 to 5 at which time infants typically demand nursing every 2 ½ - 3 hours.

A study aimed to describe breastfeeding behavior during the first 60 hours of life showed that feeding frequency had a marked diurnal pattern (Benson, 2001). The frequency of feeding was lowest between three and nine in the morning gradually increasing through the day to the highest frequency between nine in the evening and three in the morning ($p=.02$). There was no discernible feeding pattern relating to time after birth.

The timeline of typical behavior and physiologic events in the first few hours and days of life provide a framework for identifying actual and potential problems of breastfeeding.

Epidural Analgesia and Breastfeeding

The significance of epidural analgesia for labour pain management is evident from previous discussion. Although it is the primary choice of labour analgesia among childbearing women today, it has been shown to have numerous unintended effects. The significance of breastfeeding is also evident from the discussion of the many benefits it provides. Therefore, when pregnant women plan to breastfeed following childbirth, this choice must be supported and protected. Although research findings on neurobehavioral outcomes following epidural analgesia are inconsistent, results are concerning regarding

the potential effects on the establishment of breastfeeding. It is known that term neonates are born with reflexes that facilitate feeding such as rooting, sucking, and swallowing. Behavioral states are also important in facilitating reciprocal communication and relationship between the mother and infant during feeding. Research examining the effect of epidural analgesia on infants' neurobehavioral responses following birth has also found effects on reflexes that facilitate feeding.

A number of studies have documented that narcotics given systemically during labor decreased neonatal alertness (Belsey et al., 1981), lowered neurobehavioral scores (Hodgkinson et al., 1978; Nissen et al., 1997), affected infant rooting (Nissen et al., 1997), affected infant sucking (Kileff et al., 1984; Nissen et al., 1995; Righard & Alade, 1990), and delayed initiation of effective breastfeeding (Brazelton, 1961; Crowell et al., 1994; Matthews, 1989; Nissen et al., 1997; Righard & Alade, 1990).

The majority of these studies were carried out using different neonatal neurobehavioral tests that do not measure the complex behaviors of feeding at the breast nor include maternal contribution to the breastfeeding process. Matthews (1989), Crowell et al. (1994), and Righard & Alade (1990) were the only researchers who specifically focused on breastfeeding behavior. Studies evaluating the effects of epidural analgesia on breasfeeding are few (see Table 1).

Table I.

Research on Epidural Analgesia and Breastfeeding

Investigators	Design or Measurement	Sample	Medications Groups	Outcomes
Rajan (1994)	-secondary analysis -postal survey (at 6 weeks postpartum)	N=1064	(1) entonox (2) Pethidine (3) Lignocaine (epidural or local) (4) epidural, spinal, caudal, morphine, and other medications	-Epidural and other medications group did not appear to have any impact on feeding behavior. -Women who received general anaesthetic were less likely to be breastfeeding at 6 weeks postpartum. - Among those breastfeeding at 6 weeks, 11% believed that drugs received during labour affected the baby.
Halpern et al. (1999)	-prospective -cohort -telephone interview (at 6-8 weeks postpartum)	N= 189 - middle class, post-secondary education, healthy women, with uncompli-cated pregnancy, term	(1)113 (59%) epidural (a)79 combined epidural; and (b) 34 pure epidural n=91 .08% Bupivacaine with 2 μg/ml Fentanyl n= 11 .08% Bupivacaine n= 11 no continuous infusion (2) 40 opioid n=34 IM n=6 IV	-No association between labour analgesia and early breastfeeding problems (in hospital) -No correlation between breastfeeding success at 6 weeks postpartum and use of parenteral opioid, neuraxial opioid, or local anesthetic for labour analgesia.

Riordan et al. (2000)	-prospective -multisite -IBFAT -follow-up phone call at 6 weeks	N= 129 -Healthy newborn -38-42 weeks gestation -1 to 50 hours of age	(1)no analgesia n=37 (control) (2) only epidural n=27 (3) only IV narcotics n=52 (4) both epidural and IV n=13	-Mean Latch scores 11.1± 0.9 (0 medication) 08.2 ± 3.3 (medicated) (p<.0001) -Comparison of 4 groups 11.1 ± 0.9 (0 medication) 08.5 ± 3.2 (IV only) 08.5 ± 3.4(epidural) 06.4 ± 3.0 (both) -No medication group had significantly higher sucking score -No difference in breastfeeding duration.
Reid & Ly (2001)	-prospective -single blinded observational -IBFAT	N=90	(1) .04% Bupivacaine with 2 μg/ml Fentanyl 2 μg/ml Epinephrine n=51 (2) no analgesia or Entonox (50:50 N20/02 n=39	No difference between the two groups (p=.848)

Scanlon et al. (1974) examined 41 infants born to mothers who used epidural and did not use epidural analgesia. Using the neonatal neurobehavioral test ENNS, research showed that epidural analgesia negatively affected neonatal neurobehavioral outcomes. This study was discussed in detail previously. In relevance to this section, this research also reported less vigorous rooting behavior in epidural block group at 4, 6, and 8 hours of age. However, no significant difference was found on sucking behavior.

As previously discussed, Kileff et al. (1984) also looked at the effect of epidural analgesia on neonatal neurobehavioral outcome. Although this study did not specifically assess for the relationship between epidural analgesia and breastfeeding, it showed that at 24 hours of age, infants whose mother received 0.5% Bupivacaine had depressed sucking responses.

A literature review resulted in 4 studies evaluating the effects of epidural analgesia on breastfeeding. Rajan (1994) assessed the impact of obstetric procedures and analgesia/anesthesia during delivery on breastfeeding at 6 weeks postpartum. Through postal questionnaire, an attempt was made to answer whether drugs used for pain relief during labour have an impact on infant feeding. Limitations of this study include those associated with mail-in surveys such as low response rates and possibly, response biases. Medications identified in the study were Pethidine and Lignocaine with no information on route or dosage. Entonox was found to have no effect on breastfeeding. Epidural was grouped with spinal and caudal route along with other medications (i.e. miscellaneous group). Of 1,060 responses, the study found that women who received general anesthetics were less likely to be breastfeeding at six weeks postpartum. Results also showed that among women breastfeeding at 6 weeks, 11% believed that drugs received during labour affected the baby compared to 86% believed that drugs had no effect. Measurement of medication effect on breastfeeding depended on these maternal perceptions. It lacked operational definitions on epidural analgesia and breastfeeding. The reliability of results is limited due to methodology and measurement tools.

In a prospective, cohort study of 189 mother-infant couples, Halpern et al. (1999) found no association between labour analgesia and early breastfeeding problems

(i.e. in hospital) and at 6 weeks postpartum. Of the 189 mother –infant couples, 113 breastfeeding women (59%) received epidural analgesia. Thirty-four (18%) received IM opioid within 24 hours of delivery (Nalbuphine 20 mg, n=31; Morphine 15 mg, n=2; Meperidine 100 mg, n=1) with a mean time administration at 10 $\pm$ 6 hours. Six women (3%) received parenteral opioids within 5 hours of delivery. Early breastfeeding problems were based on reported difficulty in initiating breastfeeding in hospital. Breastfeeding outcomes at 6 weeks postpartum were described as: (a) Fully (no other caloric support), (b) partial breastfeeding (breastfeeding plus caloric supplements given at least once a day), (c) token breastfeeding (breastfeeding less than 1 per day), and (d) none (no breastfeeding). Breastfeeding success ranged from a score of 0 for no breastfeeding to 3 for fully breastfeeding. Logistic regression analysis was done on 171 participants with complete data sets. Results indicated no correlation between use of parenteral opioid, neuraxial opioid and anesthetics or local anesthetic for labour analgesia on early breastfeeding problem and breastfeeding success at 6 weeks postpartum. The epidural group consisted of combination epidural/spinal and pure epidural of differing combinations of medications. The comparison group consisted of opioid medication given either IM or IV. The limitations of the study include the lack of a control group (no medication), making comparison difficult to determine the actual contribution of labour medication to breastfeeding problems. Definitions used for evaluating breastfeeding were not reflective of any breastfeeding difficulty as it was based on the use of supplementary and complementary feeds. Although participants reported difficulties initiating breastfeeding in hospital related to sore nipples or difficulty latching, the subjective report is not an accurate measure of the infant's contribution to

the problem, nor did the authors measure whether maternal medication affected the infant's breastfeeding abilities. Thus, research could not demonstrate an association between labour analgesia and early breastfeeding problem. With frequent reference to the breastfeeding resources available in the research setting, the discussion section of the report appears biased towards the promotion of lactation support in the postpartum period over the prevention of potential contributing factors for early breastfeeding problems.

A prospective, multi-site study conducted by Riordan et al. (2000) compared the feeding ability of 129 infants ranging from 1-50 hours of age by using the Infant Breastfeeding Assessment Tool (IBFAT). Unable to control for dosage of labour medications given to mothers or duration of drug administration, infants were separated into four groups: (a) no labor pain analgesia, (b) only epidural analgesia, (c) only intravenous narcotics, and (d) both epidural and intravenous analgesia. Epidural analgesia most commonly used in the selected research settings is a combination of 0.125-0.5% Bupivacaine and 50-100 μg Fentanyl. Two per cent Lidocaine and 2% chloroprocaine were used in few instances instead of Bupivacaine. Sufentanil (25-50 μg) was used in one hospital instead of Fentanyl. Four lactation consultants unaware of the group assignment observed a breastfeeding session in the hospital. The study found a significant difference in the mean IBFAT scores between unmedicated and medicated groups. In comparing the groups, the no labour analgesia group had significantly higher total score on readiness to feed, rooting, fixing and suckling (mean = 11.1) compared to the other groups (mean= 8.5) at significance level $p < .0001$. However, no difference was found on breastfeeding duration assessed at 6 weeks postpartum. The inadequacies of using chart review were a limitation of the study. In particular, information related to

medication dosages and intrapartum events. Multi-site differences included variations in medications used that might have affected the results. The study used multiple statistical analyses including ANCOVA to test for group differences and addresses variables (i.e. infant birth weight, gender, and age) that might affect suckling scores. This is the first study examining the effects of labour analgesia on breastfeeding outcome using an assessment tool specific for breastfeeding and included infants of unmedicated mothers as a control group.

Finally, a prospective single blinded observational study assessed breastfeeding during immediate postpartum period and at 4 weeks for 90 study participants. Using the IBFAT to assess breastfeeding newborns, infants whose mothers had received ultra-low dose epidural analgesia (0.04% Bupivacaine with Fentanyl 2 μg/ml and Epinephrine 2 μg/ml; n=51) were compared to infants whose mothers had received no analgesia or Entonox (50:50 N2O/O2; n=39). Using Chi-square test, IBFAT scores were not found to be different between the two groups (p=0.848). Researchers for this study concluded that ultra-low dose epidural analgesia does not influence immediate breastfeeding behavior or success (Reid & Ly, 2001). The abstract used for this information is insufficient to allow a critique of the study. A full research report has not been published nor was made available by the researchers at this time.

The studies of the effects of epidural on neonatal neurobehavioral outcomes are suggestive of potential negative effects on breastfeeding. The use of breastfeeding assessment tools has the potential to demonstrate direct relationship, if any, between epidural analgesia and breastfeeding outcome. However, most studies using these tools have evaluated other labour pain medications and not epidural analgesia. The limited

number of research evaluating the relationship between epidural analgesia and breastfeeding are inconclusive.

Summary

Childbearing women are faced with many choices during their pregnancy. These choices have direct impact on their labour experience or on their infants. The increased availability of epidural analgesia and the favourable experience of women who have had painless labour with epidural block have made it a popular choice for childbearing women. The numerous benefits of breastfeeding have made it the feeding method of choice that is highly promoted. This literature review has presented the benefits and complications related to epidural analgesia, the benefits of breastfeeding, and potential relationship between these two variables that may affect childbearing women's decisions during pregnancy and labour. Little is known about the relationship between epidural analgesia and breastfeeding. Therefore, this lack of knowledge sets direction for further research in order to provide women truly informed choice, and enable health care providers to anticipate mother and baby dyads who may need additional breastfeeding support.

Hypotheses

The main purpose of the study was to look at the relationship between epidural use during labour and delivery and the initiation and continuation of effective breastfeeding. Based on existing knowledge from the literature and the application of the theoretical frameworks, the following hypotheses were formed:

Primary

1. Healthy term infants of mothers who received epidural analgesia will demonstrate less effective breastfeeding at 8-12 hours of age when compared to infants whose mothers received no analgesia.

2. Healthy term infants of mothers who received epidural analgesia will be more likely to stop breastfeeding by 4 weeks of age when compared to infants whose mothers received no analgesia.

3. Healthy term infants of mothers who received epidural analgesia will be less vigorous in the neurobehavioral response at 8-12 hours of age, when compared to infants whose mothers received no analgesia.

4. (a) Neonatal neurobehavioral ability will be positively related to effectiveness of breastfeeding at 8-12 hours of age.

   (b) Neonatal neurobehavioral ability at 8-12 hours of age will be positively related to continuation of breastfeeding and absence of breastfeeding difficulty at 4 weeks of age.

Secondary

Secondary hypotheses were formed to further explore the quality of breastfeeding, maternal evaluation of the breastfeeding and the predictive value of the quality of initial breastfeeding to continuation of breastfeeding.

5. Healthy term infants and their mothers who received epidural analgesia during labour and delivery will be more likely to have breastfeeding difficulties in hospital when compared to infants and their mothers who received no analgesia.
6. Mother and baby dyads in the epidural group will be more likely to have breastfeeding difficulties at 4 weeks of age when compared to mother and baby dyads in the no-analgesia group.
7. Mothers who received epidural analgesia will evaluate the breastfeeding session at 8-12 hours of age less positively than mothers who received no analgesia.
8. Effective breastfeeding at 8-12 hours of age is a positive predictor of continued effective breastfeeding at 4 weeks of age.

CHAPTER III

Methodology

Research Design

This study was a prospective, single-blinded, ex post facto design. Ex post facto research attempts to understand relationships among phenomena "after" the variations in the independent variable have occurred in the natural course of events without researcher intervention (Polit and Hungler, 1999). The independent variables were the use of only epidural analgesia and no analgesia during labour and delivery. The dependent variables were measured at 8-12 hours of age. These were infants' ability to breastfeed based on the LAC score on the LATCH –R Breastfeeding Assessment Tool, the neonatal neurobehavioral score on the Neurologic and Adaptive Capacity Scoring System (NACS), and maternal evaluation of the breastfeeding session. For the Breastfeeding Follow-up Interview at 4 weeks postpartum, the dependent variables were breastfeeding difficulties and cessation of breastfeeding. (See Figure 5)

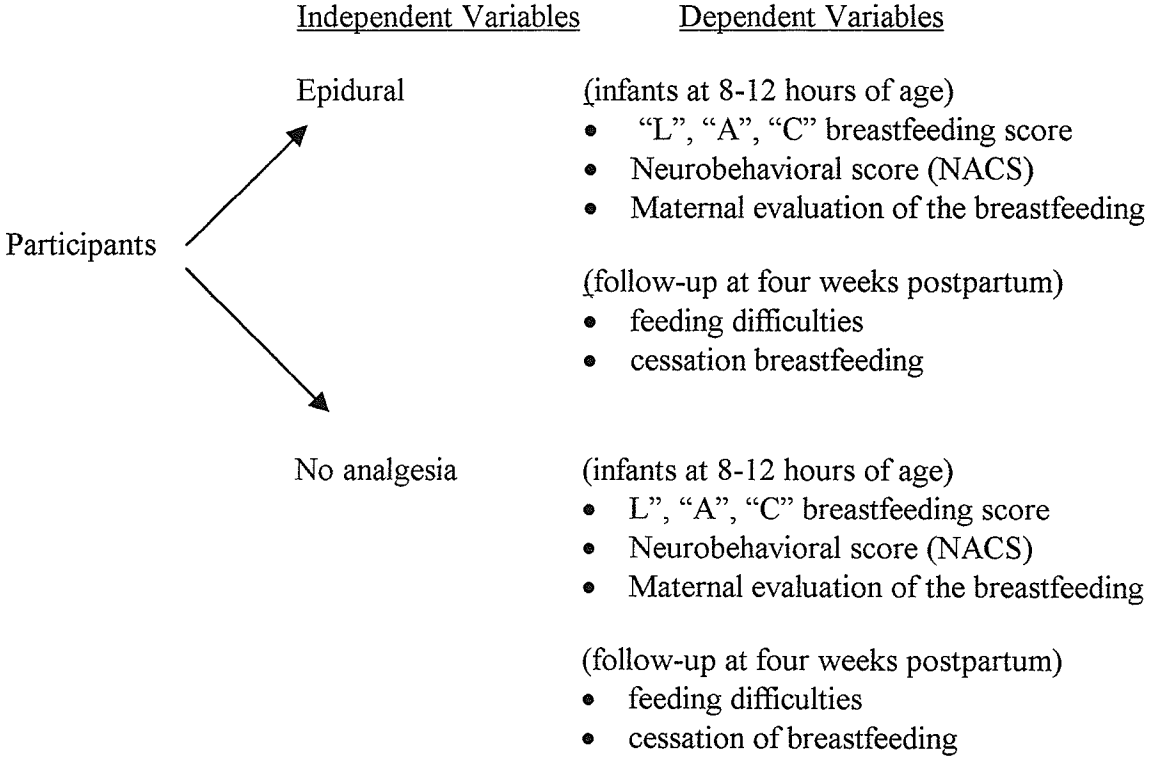

Figure V. Independent and dependent variables

The study design was selected because it was not ethically feasible to randomly assign participants to either epidural or control group. Because labour pain experience is unique to each individual, it would have been unethical to give pain medication to someone who was able to cope with the pain using non-pharmacologic method or deny epidural to those who were unable to relieve labour pain without medication. In this situation, an ex post facto design was practical and feasible. The time frame of 8-12 hours was selected because 8-24 hours following delivery were identified to be critical for the establishment of breastfeeding (Hall et al., 1997). Only 4 hours interval was selected for data collection in order to maintain age differences between infants as small as possible at the time of assessment. The time frame also coincide with the half-life of medications used for epidural (Santos et al., 1994, Stienstra et al., 1995; Hale, 1995).

The 8-12 hour period was also selected in order to increase the number of eligible participants without losing any through early discharge at 24 hours. A prospective research design was utilized to evaluate the relationship of initiation of effective breastfeeding at 8-12 hours of age with continuation of effective breastfeeding at 4 weeks postpartum. The timing of the follow-up was chosen based on: (a) The documented rapid decline in breastfeeding rate in the first 4 to 8 weeks postpartum (Barber et al., 1997), (b) the report of the Canadian National Health Surveys identifying that 35% of infants have been weaned before 8 weeks of age (Maclean, 1998), and (c) feasibility of data collection within the time frame of the study.

Definition of terms

The study defined epidural analgesia as a regional technique employed during childbirth that uses anesthetics, narcotics, or a combination of the two to decrease pain in labour and delivery. It was considered in the context of labour pain management versus anesthesia related to operative delivery. Epidural analgesia for this study was restricted to those administered by continuous infusion only.

Effective breastfeeding at 8-12 hours of age was based on the infant contribution to breastfeeding measured by the criteria "L" (latch), "A" (audible swallow), "C" (maternal comfort).

- Latch was measured by ability to grasp breast with tongue down, lips flanged, and rhythmic sucking which received a score of "2" on LATCH-R Tool. An infant who was too sleepy or reluctant to nurse, did not latch or suck received less than "2". A score of "2" met effective breastfeeding requirement.

- Audible swallow was indicative of milk intake and milk transfer from mother to infant. A score of "2" on LATCH-R Tool met effective breastfeeding requirement. This required spontaneous and intermittent swallows at age less than 24 hours.
- Maternal Comfort was reflective of adequate latch and milk transfer. Characterized by soft breasts and non-tender nipples. Shrago (1992) states that " the observer may believe that areolar grasp is correct, but pain experience by the mother indicates that a problem exists", (p. 585). A score of "2" on LATCH-R Tool met effective breastfeeding criteria.

Therefore, effective breastfeeding measure for the study meant a total score of "6" based on the 3 criteria (i.e. LAC=6).

Effective breastfeeding at 4 weeks of age was defined as the absence of any breastfeeding difficulties at the time of follow-up phone call at 4 weeks postpartum. Continuation of breastfeeding meant that the mother was still breastfeeding, either exclusively or in combination with bottle-feeding, at four weeks postpartum.

Maternal evaluation of the breastfeeding session ranged from not pleased (0) to very pleased (3). There is a positive relationship between effective breastfeeding and positive maternal evaluation of breastfeeding (Fahy & Holschier, 1988). Ineffective breastfeeding was defined by "The state in which a mother, infant, or child experiences dissatisfaction or difficulty with the breastfeeding process" (Henrikson, Wall, McClurg, & Lethbridge, 1993).

The NACS was used to distinguish between neurologically vigorous neonates from less vigorous neonates. The lower NACS score meant less vigorous.

Neurologically vigorous neonates were those neonates who received a total score of 35-40 on the NACS (Amiel-Tison et al., 1982).

Sample

A power analysis conducted by a statistician with the Manitoba Nursing Research Institute identified the number of subjects (N= 102) required to achieve significance criterion, alpha 0.05, and power equal to 0.80, for medium effect size, with n=51 for epidural group and n=51 for no medication (control) group. The recruitment of a convenience sample was ongoing until required number of subjects was achieved after withdrawals and elimination of subjects from the study had been completed.

Sample Selection

Inclusion criteria for the study were: (a) Women who delivered in the LDRP units at Women's Hospital or St. Boniface General Hospital in Winnipeg, Manitoba, Canada, (b) used only epidural analgesia (continuous infusion) or no medications during labour and delivery, (c) breastfeeding, (d) those whose breastfeeding may be observed about 8-12 hours postpartum, (e) those who were able to speak and read English, (f) age 18 years or greater, (g) singleton pregnancy, (h) parity less than or equal to 5, (i) at least 3 prenatal visits documented, (j) infants $\geq$ 37 weeks and $\leq$ 42 weeks gestation, (k) baby was rooming-in since birth, (l) mother and baby anticipated to go home together, and (m) mother has a telephone contact number. Exclusion criteria were: (a) presence of any chronic health condition; (b) associated health concerns during pregnancy such as Pregnancy Induced Hypertension, Insulin Dependent Gestational Diabetes, anemia (90 g/L), and obesity (body mass index greater or equal to 40); (c) alcohol or substance use during pregnancy; (d) baby had congenital anomalies; (e) baby was receiving any

intravenous therapy either for hypogycemia or antibiotics; and (f) mother has undergone any procedure requiring anesthetics prior to breastfeeding session at about 8-12 postpartum.

Setting

Participants were recruited from two tertiary care teaching hospitals in Winnipeg, Manitoba, Canada. Approximately 4,400 babies were delivered in each of the hospitals per fiscal year (April to March). The study was undertaken at The Women's Family Birthplace, Health Sciences Centre, and LDRP Unit, St. Boniface General Hospital from November 1, 2001 to September 6, 2002. Each of the two LDRP units has between 1,250-1,500 deliveries in a fiscal year. Health Sciences Centre is located in a culturally, socially and economically, heterogeneous neighbourhood, while St. Boniface General Hospital is situated in a more homogenous neighbourhood. Both facilities are major obstetrical referral centres for physicians throughout the province. While many of the hospital's clients live within the surrounding area, a substantial number come from outside, not only within Manitoba, but also from Northwestern Ontario and Northwest Territories, and Nunavut. Approximately 30% of the women delivered in each unit receive no pain medication during labour and delivery and about 25-30% receives only epidural analgesia. The two units have a family centered approach to childbirth and postpartum care. The settings were selected to control for environmental factors that might affect the initiation of effective breastfeeding. The LDRP Units are supportive of early initiation of breastfeeding by encouraging early mother-infant contact and provide standard rooming-in environment.

Procedure

- Recruitment and data collection commenced after receiving ethical approval from the Education and Nursing Research Ethics Board at the University of Manitoba, and after receiving approval to access clients at the Health Sciences Centre, and St. Boniface General Hospital (see Appendix A).
- Letters were sent to Physicians, Midwives, Unit Managers, and Nursing Staff to inform them about the research in the Labour, Delivery, Recovery, & Postpartum (LDRP) units (see sample letters in Appendix B).
- Orientation to the units took place with discussion of recruitment, eligibility criteria, and procedure for data collection.
- The primary investigator or research assistant called the units to find out if there were potential research participants only on days when they were available to do data collection.
- Nurses identified prospective participants based on eligibility criteria (see Appendix C) and approached their patients and asked them if they were willing to see the research nurse or assistant who would explain the study and answer questions they may have (see Appendix D-Sample Scripts).
- Primary investigator or research assistant contacted potential participants in the hospital to provide a detailed explanation about the research, answer any questions, and obtained consent if patient was agreeable to participate (see Appendix E-Invitation to Participate, and Appendix F- Consent to Participate). Part I of the Demographic and Childbirth History Information was filled out at this time (see Appendix G).

- If the initial contact with the participant was within the 8-12 hours postpartum period, and the newborn was due to feed, the primary investigator or research assistant conducted the neonatal neurobehavioral test (NACS). The assessment was recorded on Neurobehavioral Assessment Record (see Appendix H). The primary investigator or research assistant also observed a breastfeeding session (for 15 minutes) within this time frame and asked the mother about her perception of the breastfeeding session after observation. Breastfeeding data were recorded on LATCH-R Feeding Record (see Appendix I).
- If consent was obtained prior to the 8-12 hours postpartum period, or the infant was not due to feed, the neonatal neurobehavioral test and breastfeeding observation were postponed until the infant was due to feed at 8-12 hours after birth. The same procedure was followed as above.
- If at anytime, the mother or infant required any help, primary investigator or the research assistant notified the LDRP nurse assigned to the mother and baby couple to assist.
- The research assistant or primary investigator were blinded on which mother and baby couple received epidural analgesia by not having any access to the mothers' charts prior or during the observation period and by not having any discussion with the participants about how their labour and delivery was managed. The staff was also instructed not to disclose the information to the investigators. Any time the researcher became aware of the participant status, attempt was made to arrange for the other researcher to do the neonatal neurobehavioral testing and the breastfeeding observation. If this was not possible, the participant was withdrawn from the study.

- After completion of the newborn assessment and breastfeeding observation, the research assistants or primary investigator informed patients of the completion of their in-hospital participation, thanked them, and reminded them that they will be phoned at 4 weeks postpartum for the follow-up portion of the study.
- The research assistant or primary investigator then completed Part II and Part III of the Demographic and Childbirth History Information (see Appendix G) from patients' charts.
- Participant names, phone numbers, date of birth of infants, and participant identification # were recorded in a folder (see Appendix J). This data was required for the 4 weeks Breastfeeding Follow-up Interview. The investigators kept the folder and all data collection documents until the 4 weeks follow-up portion of the study was completed.
- Primary researcher and assistant kept open communication with each other about unfinished data collection so that each can complete necessary portions when taking over the data collection.
- The primary investigator or research assistant contacted all participants by phone starting at 4 weeks postpartum to conduct the Breastfeeding Follow-up Interview (see Appendix K). Attempt was made to keep the same investigator for both in-hospital and telephone data collection to provide consistency of contact with participants. When a patient was contacted later than 4 weeks, breastfeeding status was discussed retrospectively to 4 weeks (i.e. "At 4 weeks, were you still breastfeeding? ").

- Once Breastfeeding Follow-up Interview has been completed the primary investigator or research assistant informed participants of the completion of their participation and thanked them.

Instruments

LATCH-R Breastfeeding Assessment Tool

Following permission for use by the copyright owners of LATCH and Winnipeg Regional Health Authority, the LATCH-R Breastfeeding Documentation Tool (LATCH-R) was used to assess breastfeeding effectiveness (see Appendix I).

The LATCH system assigns a numerical score of 0,1, 2, to the key components of breastfeeding: (a) "L" for infants ability to latch reflective of infant's behavioral state, readiness to feed, ability to suck; (b) "A" for audible swallowing during feeding reflective of ability of infant to initiate milk transfer; (c) "T" for the mother's nipple type, (d) "C" for the mother's sense of breast and nipple comfort, reflective of proper latch and effective milk transfer; and (e) "H" for the amount of help the mother needs to hold or position her infant to the breast (Jensen et al., 1993). A score of 2 on each criterion meets the description of effective breastfeeding. Adams & Hewell (1997) found high interrater reliability (85.7-100%) among lactation consultants using the LATCH Tool. Riordan, Bibb, Miller, and Rawlins (2001) tested the validity of the LATCH Tool by conducting Spearman correlation between selected variables. Riordan et al. (2001) found significant correlation between mothers' rating of how well she thought breastfeeding went (0=not at all well to 3= very well) and evaluators' LATCH scores ($n=132$, $r= 0.56$, $p=.001$). Findings also showed the mothers' rating of the breastfeeding ($n=127$; $r= 0.22$, $p=.012$)

and total LATCH score were positively correlated with duration of breastfeeding (n=128; r= 0.26, p= .003). Findings supported the construct validity of the LATCH Tool.

The Winnipeg Regional Health Authority (WRHA) has incorporated the "R" component to the LATCH Tool. The "R" measures the mother's responsiveness to infant cues and confidence to breastfeed. The LATCH-R Newborn Feeding Record is utilized in the two study settings. A complete LATCH-R assessment was carried out for data collection. According to Hamelin & McLennan (2000), nurses reported that the LATCH tool provided a system for communicating with each other about their breastfeeding clients and identifying mothers and infants at risk for breastfeeding problems.

The Neurologic and Adaptive Capacity Scoring System (NACS)

The Neurologic and Adaptive Capacity Scoring System (Amiel-Tison et al., 1982) was used for the neonatal neurobehavioral assessment. This tool combines elements from various widely used neurobehavioral tests such as The Early Neonatal Neurobehavioral Scale (ENNS) by Scanlon and Associates, and The Brazelton Neonatal Behavioral Assessment Scale (BNBAS). The NACS was specifically designed as a screening tool to detect central nervous system (CNS) depression caused by drugs and to distinguish it from that caused by perinatal asphyxia or birth trauma (Amiel-Tison et al., 1982). Twenty criteria evaluate five general areas: adaptive capacity, passive tone, active tone, primary reflexes, and general neurologic status (see Appendix H). Each criterion is given a score of 0 (absent or grossly abnormal), 1 (mediocre or slightly abnormal), or 2 (normal), with a maximum possible score of 40. The tool developers have arbitrarily selected the scores 35-40 to indicate neurologically vigorous neonates. The NACS have been tested to show 92.8 per cent inter-observer reliability (Amiel-Tison et al., 1982).

However, validity testing of the instrument has had inconsistent findings (Brockhurst, Littleford, & Halpern, 2000). Among the three widely used neurobehavioral tests that assess the effects of maternal medication on the neonate, NACS requires no complicated equipment, not aversive or noxious to the neonate or the mother, and it is quickly observable and easy to score.

The two instruments (i.e LATCH and NACS) will serve as a check for each other if a positive association is found at the completion of the study. Results will also validate previous research findings on the effects of epidural on breastfeeding using neonatal neurobehavioral tests.

Maternal breastfeeding evaluation ranged from not pleased (0) to very pleased (3). This measure was adapted from the Infant Breastfeeding Assessment Tool (Matthew, 1988). Matthews (1991), found that scores of effective breastfeeding was positively correlated with the maternal satisfaction with their neonates' breastfeeding behavior.

Pilot Test

A pilot test is recommended to discover inadequacies in methodology and instruments. The pilot testing concentrated on establishing interrater reliability between research assistant and primary investigator in using the Neurologic and Adaptive Capacity Scoring System. The pilot test was undertaken following approval for access at one of the study sites. After approval from the unit managers of the postpartum unit and LDRP unit, postpartum mothers were invited to participate in the pilot testing. See Invitation to Participate-A study to compare newborn assessment ratings in Appendix L. On October 24, 2001, ten out of 12 mothers agreed to participate in the pilot study. Following signing of the consent form (see Appendix L) their infants were tested by

either the primary investigator or the research assistant. The investigators alternated in examining each infant. While one of the investigators conducted the neurobehavioral assessment, the other investigator observed the testing. Each investigator recorded their findings separately on the Neurobehavioral Assessment Record (Appendix H).

The results of the pilot testing were analyzed using the Statistical Package for the Social Sciences (SPSS) Version 11 for Windows. Pearson correlation between NACS scores provided by the primary investigator and research assistant tested the interrater reliability. The SPSS analysis resulted in significant correlation between the primary investigator's scores and the research assistant's scores ($n=10$; $r= 0.982$, $p=.01$) (see Appendix L). Both investigators reviewed the recorded scores and discussed ways to improve in areas where they found differences in their assessments.

Both researchers were familiar with and used the LATCH-R Tool in their respective jobs as obstetrical nurses in one of the study sites. Their experience in using the LATCH-R tool for at least one year in their practice was felt to be sufficient for the study without having to do interrater testing.

Limitations

One limitation was the lack of random assignment to study groups. Therefore, bias can stem from differences among participants in groups that were being compared (Polit and Hungler, 1999). As discussed earlier, random assignment was not feasible for this study. Thus, to account for this limitation, a strict criteria has been set for participant selection as well as to control for confounding factors such as maternal and infant health. The risk that the researchers' preconceptions might unconsciously bias the objective collection of data was controlled by blinding the primary investigator and research

assistant to the conditions prior to and during the newborn assessment and breastfeeding observation. The ability to generalize findings of this study was limited because of the use of convenience sample. However, the use of two sites increased the generalizability of research findings. Information on the reliability and validity of LATCH Tool and NACS was limited to what has been provided in the discussion of the intruments.

Ethical Implications

The Canadian Nurses Association's Code of Ethics for Nursing (1997) and The Tri-council Ethical Conduct for Research Involving Humans (1999) guided the conduct of the investigators. Recruitment and data collection commenced following ethical approval from the Education/Nursing Research Ethics Board at the University of Manitoba, and after Health Sciences Centre and St. Boniface General Hospital approvals to access clients.

Informed consent. The proposed study did not involve any forms of deception. A detailed written explanation of the purpose and nature of the research, and dissemination of results was provided to all participants. Potential participants were reassured that their participation was strictly voluntary and that their refusal to take part in the study would not affect the care they receive. Informed consent was obtained from all subjects who voluntarily participated in the study.

Participants were aware of the conditions in which their participation may be withdrawn from that study and were reassured that they may elect to withdraw from the study at any point. They were also informed that they were not obligated to answer all questions on the Demographic History (Part I) and Breastfeeding Follow-up Interview. They were reassured that their refusal to answer any particular question would not affect

their care or treatment during participation. They were reassured that withdrawal of their participation will not affect the care they receive. The research assistant or primary investigator was available for questions during data collection.

Mothers giving consent to their participation also gave consent for their infant, which was stipulated in the Invitation to Participate, and in the Consent to Participate. Information about using confidential records (i.e. patient records), was also included in the Invitation and Consent to Participate.

Anonymity and confidentiality. Participant names were not recorded on any of the data collection records, thereby assuring confidentiality and anonymity. Health records that contain participant identity were treated as confidential in accordance with the Personal Health Information Act of Manitoba and only used for research purposes. Access to the data was restricted to the primary investigator, research assistant, faculty advisor, and statistician, who were directly involved in the research project. The results of the study were presented as a group data, therefore, participant names was not linked with the results of the study, or in any future presentation or publications. List containing participant names, phone numbers, date of birth of infants, and participant identification number, required for the Breastfeeding Follow-up Interview were only available to the primary investigator and research assistant who did the follow-up telephone call at 4 weeks postpartum. Any records will be stored in a locked container and destroyed after ten years.

However, if child abuse was disclosed, the primary investigator or research assistant due to an obligation required by law to report the abuse may breach

confidentiality. This provision was included in the Invitation to Participate and Consent to Participate.

Risks and benefits. There were no known negative consequences to study participants. No experimental conditions were imposed on subjects. The independent variable (epidural use or no-medication) were self-selected by participants prior to contact with investigators. Prior to contact, potential participants have already made the decision to breastfeed. Participants were aware of the data collection involved. Infants were not disturbed or awakened for the purpose of conducting the study. The NACS was not aversive or noxious to the neonate. Investigators were strictly observers during the breastfeeding process and if any need of assistance was identified, the LDRP nurses were notified. If need for assistance was identified during the Breastfeeding Follow-up Interview, the primary investigator or research assistant reinforced resources available in the community and encouraged utilization if desired by participants.

The benefits of the study were anticipated prior to data collection. The aim of the study was to have findings which will: (a) help identify medical intervention that may adversely affect the newborn; (b) help nurses and health care providers better anticipate mother and infant dyad breastfeeding needs; and (c) facilitate informed choice for childbearing women in their decisions regarding labour and delivery pain management.

Summary

This chapter described the research design utilized to explore the relationship between epidural analgesia during labour and delivery and the initiation and continuation of effective breastfeeding. The study procedure was outlined, and he LATCH-R Breastfeeding Assessment Tool, the NACS, and the Breastfeeding Follow-up Interview

were described. Finally, issues concerned with interrater reliability, study limitations, and ethics were addressed.

CHAPTER IV

Results

This study was conducted to explore the relationship between epidural use during labour and delivery and the initiation and continuation of effective breastfeeding. This chapter includes a description of the study sample and results of hypotheses testing. The data were coded, entered, and results of the study were analyzed using the Statistical Package for the Social Sciences (SPSS) Version 11 for Windows. Some data were analyzed using descriptive statistics to produce means (M), range, minimum and maximum, and standard deviations (SD). Other data were crosstabulated to provide comparative data for participants in the epidural group and no-analgesia group. Hypotheses testing using inferential statistics was carried out to demonstrate any differences between groups or relationships between variables. To test for significant difference between groups, $p < .05$, was the significance level selected. A test of normality was done using the Shapiro-Wilks test on NACS score to determine appropriate use of parametric versus non-parametric testing. The NACS score was normally distributed in the two groups. When parametric assumptions were met, independent, one-tailed, t-test was used. When assumptions of parametric approaches were not met, the non-parametric alternative (Mann-Whitney U-test) was used. The Pearson Chi-square test was utilized when data were categorical and hypotheses were concerned with the proportion of cases that fell into the various categories. To test for relationships between two of the dependent variables (effective breastfeeding at 8-12 hours of age and NACS score), the Spearman's rho test of correlation was used. To

address the effects of potential confounding factors such as maternal age and maternal parity, multiple regression and logistic regression were used for statistical analysis.

Study Participants

The participants were inpatients in the Labour, Delivery, Recovery, and Postpartum (LDRP) units of 2 tertiary hospitals in the city of Winnipeg. A total of 141 postpartum women were approached within the first 12 hours after delivery. However, 9 declined to participate prior to study invitation. Six candidates became ineligible because three had just fed upon initial contact and next feeding was past the 8-12 hours time frame for the study, one baby had continuous intravenous infusion, one mother stated she delivered in labour and delivery unit (not on LDRP), and one had poor English comprehension. Five eligible participants declined participation after explanation of the study with invitation to participate. Some reasons included not wanting to be part of the study, feeling tired or "exhausted", and not being comfortable with the statement related to child abuse in the invitation to participate and consent forms. The study had 86% participation rate with a total of 121 mother-baby dyad voluntarily enrolled in the study from November 1, 2001 to September 6, 2002. Six participants were later withdrawn from the study. Reasons participants were withdrawn from the study were their use of Meperidine (2 participants), and use of Nitrous Oxide during labour and delivery, non-eligibility by definition of parity, and epidural bolus only using solutions different from usual epidural continuous infusions.

The final sample consisted of 115 mother-baby dyads. The 115 participants included 52 mothers who received epidural only and 63 mothers who had no analgesia during their labour and delivery.

Demographic Characteristics

The 115 mothers who participated ranged in age from 18- 41 years (M=29.22, SD=5.45). For the 108 women who reported combined family income before taxes, income ranged from < $10,000 to $90,000 and over. Twenty-two percent of the participants were in the $25,000-39,000 range, and 22.2% in the 55,000-69,000 dollars income range. Total years of education of 114 participants who responded to the question ranged from 7 to 21 with mean of 13.89 and SD=2.93. Participants were mostly married or living with a partner (89.6%). Sixty-four per cent (n=73) of 114 participants indicated that they were Caucasian in racial background, 12.3% (n=14) Aboriginal, 9.6% (n=11) Asian, 1.8 % (n=2) Black, and 12.3% (n=14) other which consisted of European, Arabic, or Inuit background.

A good proportion of participants (62.6%) reported having taken some form of prenatal classes, which ranged from 1-10 classes, M=6. One hundred six participants reported themselves as non-smokers. The amount of cigarettes smoked per day by the 9 smoker participants ranged from 2- 25 cigarettes (M=8.89, SD= 7.91). Seventy-nine of all participants had breastfed before, with reported total experience that ranged from 1 to 234 weeks (M=49.20, SD=51.34).

Participants ranged from having had 1 to 6 pregnancies (M=2.57, SD= 1.4), and number of live births not including the current delivery from 0 to 5 (M=1.2, SD=1.1). Review of charts showed that the first stage of labour for study participants was as short as 55 minutes to 2460 minutes long (M=535.5, SD= 426.3). The mean duration of second stage of labour was 46.3 minutes, with SD=55.4, and ranged from 1-272 minutes. None of the vaginal deliveries recorded required vacuum or forceps (one was not

recorded). Nine of the 115 participants received episiotomy and 75 sustained perineal tear during delivery. Only 17 of all participants received oxytocin during labour. Although oxytocin was used only for augmentation of labour, the duration of use from initiation to delivery ranged from 88 minutes to 750 minutes (M=323.1, SD=208.9). Thirty-seven of all participants received antibiotics for perinatal risk factors due to Group Beta Streptococcus, maternal fever, prolonged rupture of membranes, or other reasons. However, only 20 of them received adequate treatment as per hospital protocol before delivery.

Among the 115 infants involved in the study, 53% (n=61) were male and 47% (n=54) were female. The gestational age ranged from 37 to 41 weeks (M=39.9, SD=1.1). The mean birth weight was 3551 grams (range=2435 to 5060 grams, SD=494.1). Ninety-one of these babies were appropriate for their gestational age (AGA), 17 were large for their gestational age (LGA), and 7 were small for their gestational age (SGA). The review of the delivery record showed that 25.9% (n=29) were born with loose nuchal cord, 7.1% (n=8) with tight nuchal cord and 67% (n=75) had none. Of the 115 infants, 84.1% (n=95) were suctioned. Thirteen babies were born with meconium (10 with thin and 3 with thick). Seventeen babies were given oxygen by mask that ranged from 30 to 600 seconds, and 2 babies were given positive pressure ventilation of 45 and 60 seconds long. At one minute of age, Apgar scores ranged from five to ten (M=8.5, SD=0.8). Finally, the five minutes Apgar scores for all babies in the study ranged from 7 to 10 (M=9, SD= 0.4).

As the purpose of the study was to examine the relationship between epidural analgesia during labour and delivery and the initiation and continuation of effective

breastfeeding, two independent groups were formed for the study. The two groups were: (a) Epidural group, composed of women who received only epidural for labour and delivery and their infants; and (b) no-analgesia group, composed of women who had nothing for pain during their labour and delivery and their infants. These two groups were compared according to the information obtained from their Demographic and Obstetrical History (see Table 2 and 3).

When the variables involved were interval or continuous in nature, the independent, 2- tailed, t-test was carried out to test for differences between groups. Results were presented on Table 2. Statistical testing showed no significant difference in total years of education, number of prenatal classes taken, number of cigarettes smoked per day, duration of third stage labour, and time of delivery. However, the two groups were found to be statistically different in age, total weeks of breastfeeding experience, number of pregnancies, number of live births, and duration of first and second stage labour. The group of women who received epidural during labour and delivery tended to be younger, had less breastfeeding experience, and less pregnancies and live births. A closer look at parity (see Table 3) showed that 71% of women experiencing their first delivery used epidural for labour and delivery. The duration of first and second stage of labour for the epidural group was approximately doubled compared to the no-analgesia group.

Table II.

Comparison of Two Groups on Maternal Demographic and Childbirth History (T-Test)

	Group				
	No-analgesia N=63	Epidural N=52			
Variables	M (SD)	M (SD)	t	df	p-value 2-tailed
Age (years)	30.37 (5.00)	27.83 (5.69)	2.54	113	.012*
Total years of education	13.77 (3.16)	14.04 (2.66)	0.48	112	.634*
Number of cigarette smoked per day	N=4 11 (9.70)	N=5 7.20 (6.83)	-0.69	7	.511*
Number of prenatal classes	3.48 (3.27)	4.08 (3.21)	0.99	113	.324*
Total breastfeeding experience (weeks)	45.86 (56.33)	19.19 (30.82)	-3.22	99.26	.002**
Number of pregnancies	2.86 (1.37)	2.23 (1.38)	2.44	113	.016*
Number of live births	1.48 (1.12)	0.77 (0.83)	3.88	111.83	.000**
Duration of first stage labour (minutes)	380.14 (395.15)	723.71 (387.95)	-4.68	113	.000*
Duration of second stage labour (minutes)	23.48 (36.79)	73.98 (61.50)	-5.20	79.85	.000**

Note. * Equal variances assumed; ** Equal variances not assumed.

Using the Chi-square test to compare the epidural group with the no analgesia group, the two groups were not statistically different in marital status, racial background, having attended prenatal classes, smoker status, type of delivery, and having had perineal

tear during their deliveries (see details on Table 3). The proportions of mothers who used epidural between the two settings did not significantly differ. However, differences between the two study groups were found to be statistically significant at $p<.05$ for maternal breastfeeding experience, parity, having episiotomy for delivery, use of oxytocin during labour and delivery, and inadequate antibiotic treatment of Group Beta Streptococcus, maternal temperature, prolonged rupture of membranes or other reasons prior to delivery (see details on Table 3). More women in the no analgesia group (78%) had breastfeeding experience compared to the women in the epidural group (58%). Only 14.3% of women who had no analgesia were nulliparous, compared to 42.3% in the epidural group. Episiotomy for delivery was more common in the epidural group (13.5%) than the no-analgesia group (3.2%). More women in the epidural group received oxytocin (n=15), while only 2 received from the no analgesia group. Finally, greater proportion of mothers in the no analgesia group (63.2%) did not receive adequate antibiotic treatment when needed for perinatal risk factors compared to the women in the epidural group (27.8%).

Table III

Comparison of Two Groups on Maternal Demographic and Childbirth History

(Chi-square Test)

Variable		Group: No-analgesia N=63 n (%)	Group: Epidural N=52 n (%)	χ^2	df	p-value 2-tailed
Facility	Women's Hospital	36 (51.4)	34 (48.6)			
	SBGH	27 (60)	18 (40)	0.81	1	.367
Combined family income		N=59	N=49	4.21	6	.648
	<10,000	7 (11.9)	7 (14.3)			
	10,000-24,999	8 (13.6)	4 (8.2)			
	25,000-39,999	15 (25.4)	9 (18.4)			
	40,000-54,999	5 (8.5)	5 (10.2)			
	55,000-69,999	14 (23.7)	10 (20.4)			
	70,000-89,999	3 (5.1)	7 (14.3)			
	90,000+	7 (11.9)	7 (14.3)			
Marital status				0.93	1	.335
	Single/separated/divorced	5 (7.9)	7 (13.5)			
	Married/living with partner	58 (92.1)	45 (86.5)			
Racial background		N=63	N=51	2.43	3	.488
	White	41(65.1)	32 (62.7)			
	Aboriginal	6 (9.5)	8 (15.7)			
	Asian	8 (12.7)	3 (5.9)			
	Other	8 (12.7)	8 (15.7)			
Had prenatal classes		36 (42.9)	36 (69.2)	1.78	1	.182
Smoker status						
	Non-smoker	59 (93.7)	47 (90.4)	.421	1	.516
	Smoker	4 (6.3)	5 (9.6)			
Mothers with breastfeeding experience		49 (77.8)	30 (57.7)	5.34	1	.021

Parity					
Multiparous	54 (85.7)	30 (57.7)	11.36	1	.001
Nulliparous	9 (14.3)	22 (42.3)			
Episiotomy	2 (3.2)	7 (13.5)	4.18	1	.041
Perineal tear	43 (68.3)	32 (61.5)	0.57	1	.452
Oxytocin during labour	2 (3.2)	15 (28.8)	14.90	1	.000
Required antibiotic (intrapartum)	19 (30.2)	17 (32.7)	.085	1	.771
Received adequate antibiotic treatment prior to delivery	N=19 7 (36.8)	N= 17 13 (76.5)	4.66	1	.031

The epidural group used a variety of epidural solutions. The solutions were: (a) Bupivacaine .05%, Fentanyl 2 μg/ml, Epinephrine 2 μg/ml (n=10), (b) Bupivacaine .1%, Fentanyl 2 μg/ml, Epinephrine 2 μg/ml (n=6), (c) Bupivacaine .08%, Fentanyl 2 μg/ml (n=14), (d) Bupivacaine .05%, Fentanyl 2 μg/ml (n=9), (e) Ropivacaine .08%, Fentanyl 2 μg/ml (n=9), (f) Ropivacaine .2% (n=3), and (g) Ropivacaine .2%, Fentanyl 2 μg/ml (n=1). The two types of anaesthetics received by the epidural group were Bupivacaine (n=39) and Ropivacaine (n=13). The total duration of epidural infusion from initiation to time of delivery ranged from 11 to 1017 minutes (M=295.92, SD=214.42). The total volume of epidural solution infused from initiation to time of delivery ranged from 5.33 to 196.25 ml (M=62.19, SD=44.18). Thirty-three mothers from the epidural group received epidural bolus using different solution from the continuous infusion. The solutions used were Bupivacaine 0.25% (n=16), Ropivacaine 0.2% (n=5), Fentanyl 50 microgram (n=1), other (n=9),

and more than one type (n=2). The total volume of epidural boluses given ranged from 2 – 18 ml (M=8.33, SD=4.16). Seventeen mothers with an epidural experienced short-term complications, which included maternal hypotension, maternal fever, fetal bradycardia, and decreased FHR variabilities.

The 52 infants born to mothers who received epidural only during their labour and delivery were compared with the 63 infants born to mothers who had no analgesia. The results are presented in Table 4. The two groups were not statistically different in gestational age, birth weight, Apgar scores at one and 5 minute of age, duration of oxygen by mask or duration of receiving positive pressure ventilation. To assess for fetal acidosis, cord gases were compared for the two groups of infants. Although all the cord pH results were within normal range, the arterial pH and venous pH of the no-analgesia group were significantly higher than the epidural group. Three infants received supplementary feed of glucose water or formula by supplemental nursing system, finger feeding and bottle prior to the observed breastfeeding session related to low blood sugar, and not feeding. All three infants were born to mothers in the no-analgesia group.

Table IV

Comparison of Two Groups on Infant Characteristics

Variable		Group: No-analgesia N=63 n (%)	Group: Epidural N=52 n (%)	χ^2	df	p-value 2-tailed
Gender	Male	32 (50.8)	29 (55.8)	0.28	1	.595
	Female	31 (49.2)	23 (44.2)			
Gestational age				8.36	4	0.79
	37	4 (6.3)	5 (9.6)			
	38	12 (19.0)	3 (5.8)			
	39	18 (28.6)	16 (30.8)			
	40	25 (39.7)	18 (34.6)			
	41	4 (6.3)	10 (19.2)			
Nuchal cord at delivery		N=61	N=51	0.75	1	.385
	Loose or tight	18 (29.5)	19 (37.3)			
	None	43 (70.5)	32 (62.7)			
Suctioning at or after delivery		N=62	N=51	0.00	1	.949
		52 (83.9)	43 (84.3)			
Oxygen per face mask		10 (15.9)	7 (13.5)	0.13	1	.717
Positive pressure ventilation		1 (1.6)	1 (1.9)	0.02	1	.891
Meconium at delivery		N=61	N=52	1.43	1	.233
	Thin or thick	5 (8.2)	8 (15.4)			
	None	56 (91.8)	44 (84.6)			
Growth percentile						
	10^{th} to 90^{th} (AGA)	47 (74.6)	44 (84.6)	2.09	2	.352
	$>90^{th}$ (LGA)	12 (19.0)	5 (9.6)			
	$<10^{th}$ (SGA)	4 (6.3)	3 (5.8)			

	Group				
	No-analgesia N=63	Epidural N=52			
Variable	M (SD)	M (SD)	t	df	p-value 2-tailed
Gestational age (weeks)	39.21 (1.03)	39.48 (1.16)	1.33	113	.183*
Birth weight (grams)	3533.97 (511.27)	3571.63 (476.519)	0.41	113	.686*
Apgar score at 1 minute	8.49 (0.76)	8.44 (0.94)	-0.31	113	.754*
Apgar score at 5 minutes	8.97 (0.40)	9.04 (0.28)	1.07	113	.287*
O_2 per face mask (duration used in seconds)	N=8 157.50 (189.57)	N=4 172.50 (147.73)	0.14	10	.893*
Positive pressure ventilation (duration in seconds)	N=1 45.00	N=1 60.00	-	-	-
Venous pH	N=36 7.37 (0.06)	N=31 7.35 (0.04)	-2.06	58.50	.044**
Arterial pH	N=50 7.26 (0.07)	N=39 7.24 (0.05)	-2.00	85.29	.048**

Note. * Equal variances assumed; ** Equal variances not assumed; (-Data cannot be calculated).

The Mann-Whitney U Test was used to compare the epidural group with the no analgesia group when variables concerned were ordinal. The difference between the epidural group and no analgesia group in relation to their combined family income before taxes was not statistically significant (p=.347). In examining the rating of the importance of each of their social supports about their breastfeeding decision, both groups rated their partner as most important, their mother next, followed by friends, and others as being

least important. Both groups reported that each of their social supports were mostly very supportive about the breastfeeding decision. However, the no analgesia group (Mean Rank=58.82) tend to rate the support of their partner most important than the epidural group (Mean Rank= 52.56). This difference in rating is statistically significant (p=.049).

In summary, the two groups in the study were generally similar in many demographic and childbirth history. Significant differences between the two groups were found in age, breastfeeding experience, number of pregnancies, number of live births, duration of first and second stage labour, episiotomy, oxytocin use, receiving adequate antibiotic treatment indicated for perinatal risk factors, and cord venous and arterial pH. The similarities and differences in the two groups may help explain the findings from statistical analysis of the study hypotheses.

Neurobehavioral and Breastfeeding Information

The neurobehavioral testing using NACS was done between 7 hours and 58 minutes and 12 hours and 19 minutes of age (M=9.58, SD=1.13). The NACS scores ranged from 24 to 39 (M=32.76, SD=3.09). The breastfeeding observations were carried out between 8 hours and 1 minute and 12 hours and 29 minutes of age (M=9.7,SD=1.20). The LATCH-R total scores ranged from 5 to 12 (M=10, SD=1.86). The total feeding time for the infants ranged from none (n=8) for those who did not latch or suck, to more than 15 minutes (n=50). In assessing the differences between the epidural and no analgesia groups, one-tailed t- tests and Chi-square Tests were used. The difference in age at the time of neurobehavioral testing was not statistically significant (t= 1.35, df= 113, p=.08, equal variances assumed). The time of the breastfeeding assessment did not significantly differ between the two groups (t=1.49, df= 113, p= .07, equal variances

assumed). The results of Chi-square testing on the different components of the LATCH-R Tool are presented in Table 5.

Table V

LATCH-R (Comparison of Epidural and No-analgesia Groups)

		Group				
		No-analgesia N=63	Epidural N=52			
Breastfeeding component		n (%)	n (%)	χ^2	df	p-value
Latch	no latch	5 (7.9)	3 (5.8)	1.72	2	.423
	Hold nipple in mouth	16 (25.4)	19 (36.5)			
	Latch achieved	42 (66.7)	30 (57.7)			
Audible Swallows						
	None	6 (9.5)	9 (17.3)	1.97	2	.374
	Few with stimulation	24 (38.1)	21 (40.4)			
	Spontaneous	33 (52.4)	22 (42.3)			
Nipple type	Flat	1 (1.6)		0.83	2	1*
	Everted	62 (98.4)	52 (100)			
Comfort and Nipple state						
Severe discomfort, cracked		1(1.6)		1.23	2	.540
Mild/moderate discomfort, bruise		3 (4.8)	4 (7.7)			
Non-tender		59 (93.7)	48 (92.3)			
Hold-mother's ability to position						
	Full assist	6 (9.5)	8 (15.4)	4.90	2	.086
	Minimal assist	15 (23.8)	20 (38.5)			
	No assist	42 (66.7)	24 (46.2)			
Responsiveness and confidence						
No response or no confidence			1 (1.9)	1.22	2	.543
Requires prompting/encourage		11 (17.5)	9 (17.3)			
Responsive and confident		52 (82.5)	42 (80.8)			

Note. * Fisher's Exact Test used as an alternative to Pearson's Chi-square when expected frequencies are small (less than 5).

Additional results are discussed in detail in the hypotheses testing section in relation to significant differences in the two study groups related to the neurobehavioral status and breastfeeding ability at 8-12 hours of age.

Breastfeeding in the First Four Weeks

As this study was concerned with the effect of epidural use during labour and delivery on the continuation of effective breastfeeding, a follow-up phone call at 4 weeks postpartum was carried out. The response rate was 99%, thus, the information in this section are based on data collected from 114 women (63 from the no-analgesia group and 51 from the epidural group) enrolled in the study. Information about the first four weeks following delivery was collected. This section presents data collected, which is not part of the hypotheses testing.

Participants were asked how they were feeding their infants during the follow-up portion of the study. Sixty-eight (59.6%) mothers reported breastfeeding exclusively. Nineteen (16.7%) mothers reported having switched to bottle completely, and twenty-seven (23.7%) mothers stated they were both breast and bottle-feeding. Therefore, 83.3% (n=95) of the participants were still breastfeeding at 4 weeks after delivery. Interestingly, one mother who was only bottle-feeding and one mother who was partially breastfeeding at four weeks gave their infants only expressed breast milk.

The breastfeeding frequency in a typical 24-hour day was mainly 9-12 times (50%). Forty-four mothers reported feeding their baby other than breast milk (38.6%). Other feedings were formula (97%), glucose water (15%), plain water (14%), gripe water, and pablum. They were also questioned whether they had any breastfeeding problem(s) in the hospital and/or at home. Forty-five (39.5%) mothers reported having

breastfeeding problem(s) in the hospital and seventy-seven (67.5%) at home. The information reported by the participants in the epidural group and the no-analgesia group were compared.

Details about the breastfeeding status of study participants up to 4 weeks postpartum are presented later in Table 9. Reasons for breastfeeding problems in the hospital and at home are presented in Table 6.

Reported reasons for breastfeeding difficulties in hospital and at home were generally similar. Interestingly, more mothers in the no-analgesia group reported difficulties with latching in hospital than mothers in the epidural group, a difference approaching significant level. More mothers in the no-analgesia group also related their breastfeeding difficulties at home with baby not latching, not sucking and having a sleepy baby. The difference in breastfeeding related problems between the two study groups were not statistically significant. Other breastfeeding related problem(s) reported in hospital were maternal fatigue, aggressive sucking, baby lost weight, cluster feeding and not satisfied, and milk took too long to come in. Breastfeeding related problem(s) encountered at home also included blocked milk ducts, over active letdown, thrush, mastitis, reflux, baby lost weight, and maternal fatigue.

Table VI

Reasons For Breastfeeding Problem in Hospital and at Home

		Group				
		No-analgesia	Epidural			
		n (%)	n (%)	χ^2	df	p-value 2-sided
In Hospital		N=22	N=23			
	Sore Nipples	11 (50)	16 (69.6)	1.79	1	.181
	Not enough milk	5 (22.7)	8 (36.4)	0.98	1	.322
	Not latching	14 (63.6)	8 (34.8)	3.75	1	.053
	Not sucking	1 (4.5)	2 (8.7)	0.31	1	1*
	Fussy baby	4 (18.2)	5 (21.7)	0.09	1	1*
	Sleepy baby	7 (31.8)	7 (30.4)	0.01	1	.920
At home		N= 38	N=39			
	Sore nipples	25 (65.8)	27 (69.2)	0.10	1	.747
	Engorgement	8 (21.1)	11 (28.2)	0.53	1	.467
	Not enough milk	6 (15.8)	6 (15.4)	.00	1	.961
	Not latching	11 (28.9)	7 (17.9)	1.30	1	.254
	Not sucking	4 (10.5)	0	4.33	1	.055*
	Fussy baby	3 (7.9)	6 (15.4)	1.05	1	.481*
	Sleepy baby	9 (23.7)	6 (15.4)	0.85	1	.358
	Sick baby	1 (2.6)	1 (2.6)	.00	1	1*

Note. * Fisher's Exact Test used as an alternative to Pearson's Chi-square when expected frequencies are small (less than 5).

The mothers who reported not having enough milk decided this was a problem because their babies were fussy, breastfed frequently, and did not gain enough weight. The mothers who experienced sore nipples at home were asked to rate the pain from scale of 1 to 5, with 1 being the least pain and 5 being the most severe pain. Using the Mann-Whitney U Test to look at the difference in rating between the epidural and no-analgesia group, the result showed that although the no-analgesia group rated the severity of nipple soreness higher, the difference was not statistically significant (p=.187). Among the 27 mothers in the epidural group who stated having sore nipples at home, 7.4% (n=2) had bruised nipples, 59.3% (n=16) had cracked nipples, and 37% (n=10) had bleeding nipples. Mothers in the no analgesia group who reported having sore nipples at home (n=25), also had bruised nipples (n=5, 20%), cracked nipples (n=16, 64%), and bleeding nipples (n=6, 24%). Differences between the two groups were not statistically significant.

The nineteen mothers (12 from the no analgesia group and 7 from the epidural group) who switched over to bottle-feeding reported stopping breastfeeding in less than one week postpartum (42.1%), 1-2 weeks (26.3%), 21.1% between 2-3 weeks, and 10.5% at third to forth week. Fifty percent of women in the epidural group who stopped breastfeeding did so within the first week postpartum, while only 36.4 % from the no analgesia group. Using the Mann-Whitney U test, the epidural group tended to breastfeed shorter in the 4 weeks postpartum than the no analgesia group. However, this difference was not statistically significant (p=.601). Four mothers reported sore nipples as the single most import reason for stopping breastfeeding, followed by not having enough milk for the baby (n=3), and baby wanting to feed frequently (n=2).

Other reasons that were considered to be most important for these mothers were fussy baby, baby will not suck, baby too sleepy, not convenient, sick baby, feeling ready to stop, baby lost weight, baby did not gain weight, small nipples, mastitis, and hated breastfeeding.

Twenty-eight (29.5%) of mothers who were still breastfeeding planned to continue up to 5-7 months, twenty-six (27.4%) up to 10-12 months, fourteen (14.7%) for both up to 2-4 months, and 8-10 months, ten (10.5%) over 12 months, and three (3.2%) reported not knowing how long they plan to continue breastfeeding. The greatest proportion of mothers from the epidural group reported intending to breastfeed between 5 to 7 months (34.9%), while for mothers from the epidural group stated that they intended to continue breastfeeding up to 10 to 12 months (30.8 %). The difference between the epidural group and no-analgesia group in their intended duration of breastfeeding was not statistically significant (χ^2 =7.63, df=5, p= 1.78).

The two LDRP units generally have an average hospital stay of 24 to 48 hours postpartum. Where the reported range of hospital stay was 12 to 120 hours following delivery for the study participants, extended hospital stay related to breastfeeding problems were reported by 9.8% (n=5) mothers in the epidural group and 6.3% (n=4) mothers in the no-analgesia group. More mothers and infants in the no-analgesia group (n=42, 67.75%) left the hospital within 24-48 hours postpartum compared to those in the epidural group (n=30, 58.8%). Two mothers and their infants from the no-analgesia group and one from the epidural group were discharged prior to 24 hours. Differences between the two groups were not statistically significant (χ^2 =1.38, df= 2, p=.501).

Additional information obtained during the follow-up portion of the study at 4 weeks postpartum included sources of breastfeeding support for the participants and suggestion for health care professionals on how their breastfeeding experience may be improved in the hospital and/or at home. The mothers reported receiving breastfeeding help from physicians (13.3%), community/public health nurse (62.8%), breastfeeding hotline (16.85), breastfeeding clinic (6.2%), La Leche League (2.7%), mother/relative (21.2%), and no one (15.6%). Other sources of breastfeeding help identified by the participants were hospital nurses (39%), friends (5.2%), partner (4.4%), midwives, lactation consultant, pharmacist, and sister-in-law. Approximately 33% of the respondents reported that their previous breastfeeding experience helped them with their current breastfeeding management. Seventy participants offered their suggestions on how their breastfeeding experience could be improved in the hospital. Almost half of the participants emphasized the importance of education in improving their breastfeeding experience. The education they wanted encompassed proper breastfeeding techniques, realistic expectations, involvement of their support person, sensitive to individual needs, and consistent information. The second most recurring suggestion from the participants was the need for nursing staff to be more available to assess breastfeeding management, provide support, education, and encouragement. Four patients attributed lack of nursing availability to help with breastfeeding due to labouring patients and busy unit. Suggestions to health care professional to improve breastfeeding experience after discharge were centred on providing continued support with follow-up, and making breastfeeding resources available and accessible.

In summary, the study findings related to breastfeeding in the first four weeks provided more information related to problems encountered in hospital and at home, breastfeeding practices, and resources. The information is instrumental in recognising continued breastfeeding difficulties for the participants, and their reasons for stopping breastfeeding.

Hypotheses Testing

Four primary hypotheses were formed to examine the relationship between epidural analgesia during labour and delivery and the initiation and continuation of effective breastfeeding. To further explore the quality of breastfeeding and predictive value of breastfeeding assessment at 8-12 hours of age in determining continuation and quality of breastfeeding at 4 weeks postpartum, four secondary hypotheses were also tested. Through statistical analysis, significant or non-significant relationships were determined.

Hypothesis #1

Healthy term infants of mothers who received epidural analgesia will demonstrate less effective breastfeeding at 8-12 hours of age when compared to infants whose mothers received no analgesia. This first hypothesis was analyzed using two methods. According to the definition of terms outlined earlier, effective breastfeeding was defined using the LAC components of the LATCH-R Assessment Tool. Infant contribution to the effectiveness of breastfeeding were determined by, "L" (latch), "A" (audible swallows), and "C" (comfort of the mother). Effective breastfeeding was defined by LAC=6 while ineffective breastfeeding was defined as LAC <6. As the dependent variables were categorical, effective versus not effective breastfeeding, the Chi-square test was utilized.

" The Chi-square test is used when we have categories of data and hypotheses concerning the proportion of cases that fall into the various categories" (Polit & Hungler, 1999, p. 487).

The breastfeeding abilities of the 115 infants enrolled in the study were assessed at 8- 12 hours of age using the LATCH-R Tool. The observations showed that less infants born to women who received epidural analgesia breastfed effectively compared to infants whose mothers received no analgesia during labour and delivery. The difference was not statistically significant (χ^2=1.33, df=1, p=.248). Results are presented in Table 7.

Table VII

Comparison between Epidural and No-analgesia Group

(Breastfeeding and Neurobehavioral Status at 8-12 hours of Age)

	Group				
	No-analgesia N=63	Epidural N=52			
	n (%)	n (%)	χ^2	df	p-value 2-sided
Effective breastfeeding (LAC=6) [a]	31 (49.2)	20 (38.5)	1.33	1	.248
Neurobehavioral status (vigorous) [b]	22 (34.9)	17 (32.7)	0.06	1	.802

Note. [a] Hypothesis #1, [b] Hypothesis #3

The same hypothesis was also tested using the Mann-Whitney U Test. "The Mann-Whitney U Test is a non-parametric procedure for testing the difference between two independent samples when the dependent variable is measured on an ordinal

scale" (Polit & Hungler, 1999, p. 482). The total LAC score ranges from 0 (no latch, no audible swallow, and severe maternal discomfort) to 6 (latch achieved, audible swallow, and no maternal discomfort). The statistical test was based on the assignment of ranks to the two groups of measure that were then compared. Although infants born to mothers who received no analgesia scored higher than those born to mothers who had epidural during labour and delivery, the difference was not statistically significant (p=209). Details are presented in Table 8.

Table VIII

Breastfeeding at 8-12 hours of Age: Rank Order Comparison between Epidural and No-analgesia Group

	Group			
	No-analgesia N=63	Epidural N=52	Mann-Whitney U	p-value 2-tailed
	M (SD)	M (SD)		
LAC score (0-6)	4.94 (1.33)	4.69 (1.28)		
Mean Rank	61.36	53.93		
Sum of Ranks	3865.50	2804.50	1426.50	.209

Based on the two statistical analyses, the findings of this study do no support the hypothesis that healthy term infants of mothers who received epidural analgesia will breastfeed less effectively at 8-12 hours of age when compared to infants whose mothers received no analgesia.

Hypothesis #2

Healthy term infants of mothers who received epidural analgesia will be more likely to stop breastfeeding by 4 weeks of age when compared to infants whose mothers received no analgesia. To test this hypothesis, the proportion of infants in the epidural group and control group were compared in the type of feeding used during the 4 weeks postpartum follow-up. The mothers were asked if they were breastfeeding, bottle feeding, or doing both. Those who were exclusively breastfeeding or doing both breast and bottle-feeding were grouped together as the "still breastfeeding" group. Eighty-one percent of infants from the no analgesia group and 86.3% infants from the epidural group were still breastfeeding at 4 weeks. Using the Chi-square Test, the difference between the two groups was not statistically significant ($\chi^2 = .575$, df = 1, p = .448). Reported feeding methods at 4 weeks postpartum are presented in Table 9. The results of this study did not support the hypothesis that healthy term infants of mothers who received epidural analgesia will be more likely to stop breastfeeding by 4 weeks of age when compared to infants whose mothers received no analgesia.

Table IX

Breastfeeding Information in the First Four Weeks Postpartum

	Group				
	No-analgesia n (%)	Epidural n (%)	χ^2	df	p-value 2-sided
Feeding Method at 4 Weeks					
Breast	38 (60.3)	30 (58.8)	1.04	2	.594
Bottle	12 (19.0)	7 (13.7)			
Both	13 (20.6)	14 (27.5)			
Still Breastfeeding [a]	51 (81.0)	44 (86.3)	0.58	1	.448
Breastfeeding Problem in Hospital [b]	22 (34.9)	23 (45.1)	1.22	1	.269
Breastfeeding Problem at Home	38 (60.3)	39 (76.5)	3.36	1	.067
Breastfeeding Problem at 4 Weeks[c]	10 (19.6)	11 (25.0)	0.40	1	.528

Note. [a] Hypothesis #2; [b] Hypothesis #5; [c] Hypothesis #6

Hypothesis #3

Healthy term infants of mothers who received epidural analgesia will be less vigorous in the neurobehavioral response at 8-12 hours of age, when compared to infants whose mothers received no analgesia. This hypothesis was tested using two statistical analyses. The parametric approach of independent, one-tailed, t-test was used. The mean NACS score for infants born to mothers who received epidural was lower compared to infants whose mothers received no analgesia. Details are presented in

Table 10. However, the difference was not statistically significant (t= -1.21, df=95.95, p=.115). This hypothesis was also analysed using the non-parametric approach using Chi-square test, after recoding the NACS scores to dichotomous variable (vigorous and non-vigorous). According to the authors of NACS, babies with score of 35 and greater were considered vigorous (Amiel-Tison et al., 1982). Infants who scored less than 35 were considered non-vigorous. The proportion distribution showed that there were less infants born to women who received epidural who scored 35 or greater (vigorous) in NACS than infants born to women who had no analgesia during labour and delivery. The test showed that the difference between the two groups was not statistically significant (χ^2= .063, df =1, p=.802). Details are presented in Table 7. Study findings did not support the hypothesis that healthy term infants of mothers who received epidural analgesia would be less vigorous in the neurobehavioral response at 8-12 hours of age, when compared to infants whose mothers received no analgesia.

Table X

Comparisons Related to NACS Total scores

	Group				
	No-analgesia N=63	Epidural N=52			
Variable	M (SD)	M (SD)	t	df	p-value 1-tailed
NACS total score [a]	33.08 (2.73)	32.37 (3.46)	-1.21	95.95	.115**
	Group				
	LAC=6 N=51	LAC<6 N=64			
	M (SD)	M (SD)			
NACS total score [b]	34.24 (2.58)	31.58 (2.96)	5.06	113	.000*
	Group				
	Stopped Breastfeeding at 4 weeks N=19	Still Breastfeeding at 4 weeks N=95			
NACS total score [c]	31.68 (3.95)	32.94 (2.86)	-1.32	21.94	.101**
	Group				
	Breastfeeding with difficulty at 4 weeks N=21	Breastfeeding with no difficulty at 4 weeks N=74			
NACS total score [d]	31.57 (3.03)	33.32 (2.71)	2.55	93	.006*

Note. [a] Hypothesis # 3; [b] Hypothesis #4 (a); [c, d] Hypothesis #4 (b); * Equal variances assumed; **Equal variances not assumed.

Hypothesis #4

Part (a) of the fourth hypothesis, that neonatal neurobehavioral ability will be positively related to effectiveness of breastfeeding at 8-12 hours of age was tested. To test this hypothesis, two methods of inferential statistics were utilized. When using the raw scores in the LAC (0-6) with the NACS scores, Spearman's rho tested for correlation. Correlation was significant at .01 level (one-tailed) with correlation coefficient of .475 (see Table 11). Using the nominal level of measurement for effective breastfeeding (LAC=6 as effective, and LAC<6 as non-effective) with the NACS total score, independent, one-tailed, t-test was used. Infants who breastfed effectively also achieved higher score in the NACS compared to infants who did not breastfeed effectively at 8-12 hours of age. The difference between the two groups was statistically significant (t=5.059, df=113, p= .000). Details are presented in Table 10. Thus, the hypothesis that neonatal neurobehavioral ability will be positively related to effectiveness of breastfeeding at 8-12 hours of age was supported by the findings of this study.

Table XI

Correlation between Effective Breastfeeding and Neurobehavioral Status at 8-12 Hours Age

			Effective Breastfeeding (LAC score)	Neurobehavioral Status (NACS score)
Spearmans rho	Effective Breastfeeding (LAC score)	r	1.00	.474*
		Sig. (1-tailed)	-	.000
		N	115	115
	Neurobehavioral Status (NACS score)	r	.474*	1.00
		Sig. (1-tailed)	.000	-
		N	115	115

Finally, the second part of the fourth hypothesis, that neonatal neurobehavioral ability at 8-12 hours of age will be positively related to continuation of breastfeeding and absence of breastfeeding difficulty at 4 weeks of age, was tested. To test this hypothesis, two methods of inferential statistics were utilized. When using the NACS scores, with the categories of still breastfeeding, stopped breastfeeding, breastfeeding with difficulty (s), and breastfeeding with no difficulty at 4 weeks of age, independent, one-tailed, t-test was used (see Table 10). Infants who were still breastfeeding at 4 weeks of age had higher mean NACS total score at 8-12 hours of age, than those who already stopped breastfeeding at 4 weeks. The difference in mean scores was not statistically significant ($t=-1.32$, $df=21.94$, $p=.101$). Mothers who reported breastfeeding with no difficulty at 4 weeks postpartum were those mothers of infants who had higher mean NACS total score at 8-12 hours of age compared to mothers who reported breastfeeding with difficulty (s) at 4 weeks postpartum. The difference in mean scores was statistically significant

(t=2.55, df=93, p=.006). When using the categories of vigorous and non-vigorous of NACS with the categories of still breastfeeding, stopped breastfeeding, breastfeeding with difficulty (s), and breastfeeding with no difficulty (s) at 4 weeks of age, Chi-square test was utilized. The proportion of infants who were still breastfeeding at 4 weeks of age was greater for those who tested vigorous (n=32, 84.2%), than for those who tested non-vigorous (n=63, 82.9%) on the NACS at 8-12 hours of age. The difference was not statistically significant (χ^2=.03, df=1, p=.859). The proportion of mothers who reported breastfeeding with no difficulty at 4 weeks postpartum was greater for those whose infants tested vigorous (n=28, 87.5%), than for those who tested non-vigorous (n=46, 73.0%) on the NACS at 8-12 hours of age. The difference was not statistically significant (χ^2=2.59, df=1, p=.125, Fisher's Exact Test). Therefore, Hypothesis #4 (b) was partially supported. Neonatal neurobehavioral ability at 8-12 hours of age is not related to continuation of breastfeeding at 4 weeks of age. The result of the t-test showed that neurobehavioral ability at 8-12 hours is positively related to the absence of breastfeeding difficulty at 4 weeks of age. However, this was not supported by the Chi-square test analysis.

Secondary Hypotheses

The fifth hypothesis was: Healthy term infants and their mothers who received epidural during labour and delivery will be more likely to have breastfeeding difficulties in hospital when compared to infants and their mothers who had no analgesia. This hypothesis was tested using Chi-square Test. Data were obtained from the results of the follow-up phone call at 4 weeks postpartum. Breastfeeding difficulty was indicated when the mothers responded yes to having breastfeeding problem (s) in the hospital.

More mothers in the epidural group (45.1%) reported having breastfeeding difficulties in hospital compared to mothers in the no-analgesia group (34.9%). Details are presented in Table 9. However, inferential testing did not support the hypothesis that healthy term infants and their mothers who received epidural during labour and delivery will be more likely to have breastfeeding difficulties in hospital when compared to infants and their mothers who had no analgesia.

The sixth hypothesis tested was that mother and baby dyads is the epidural group will be more likely have breastfeeding difficulties at 4 weeks postpartum when compared to mother and baby dyads in the no-analgesia group. The Chi-square Test was used to analyze the results for this hypothesis (see Table 9). Of the 114 participants who were able to complete the 4 weeks postpartum follow-up portion of the study, 95 were still breastfeeding (either exclusively or in combination with bottle-feeding). Of the 44 women in the epidural group who were still breastfeeding, 25% reported continued breastfeeding difficulties at 4 weeks postpartum. Of the 51 women who were still breastfeeding in the no analgesia group, 19.6% reported continued breastfeeding difficulties at 4 weeks postpartum. The difference was not statistically significant ($\chi^2 = .399$, df =1, p= .528). Therefore, the hypothesis that mother and baby dyads in the epidural group are more likely to have breastfeeding difficulties at 4 weeks postpartum than mother and baby dyads in the no-analgesia group was not supported by the findings of this study.

The seventh hypothesis was that mothers who received epidural analgesia will evaluate the breastfeeding session at 8 to 12 hours postpartum less positively than mothers who received no analgesia. Following the breastfeeding observation at 8-12

hours postpartum, mothers were asked how they felt about the breastfeeding session. Their response choices were not pleased (0), somewhat pleased (1), pleased (2), or very pleased (3). Due to the non-parametric nature of the variable in question, the Mann-Whitney U Test was used for this hypothesis. Although there was a trend toward mothers who did not receive any analgesia during labour and delivery to evaluate their breastfeeding more positively than the mothers from the epidural group, the difference was not statistically significant (p=.226). Results are presented in Table 12. The study results did not support the hypothesis that mothers who received epidural analgesia will evaluate the breastfeeding session at 8-12 hours postpartum less positively than mothers who received no analgesia.

Table XII

Maternal Evaluation of Breastfeeding Session at 8-12 hours Postpartum

	Group			
	No-analgesia N=63	Epidural N=52	Mann-Whitney U	p-value 2-tailed
Maternal Evaluation	M=2.23	M=0.45		
Mean Rank	61.15	54.18	1439.50	.226
Sum of Ranks	3852.50	2817.50		

The final hypothesis tested in this study was: Effective breastfeeding at 8-12 hours of age will be a positive predictor of effective breastfeeding at 4 weeks of age. Ninety-five study participants were still breastfeeding at 4 weeks. The proportion of

infants in the effective breastfeeding at 8-12 hours of age (n=44) who were still breastfeeding and had no breastfeeding difficulties at 4 weeks was 81.8% (n=36). Of the 51 infants who did not breastfeed effectively at 8-12 hours of age, 74.5% (n=38) were still breastfeeding and had no breastfeeding difficulties at 4 weeks of age. More infants from the effective breastfeeding group at 8-12 hours of age were breastfeeding with no difficulties at 4 weeks, compared to infants who did not breastfeed effectively at 8-12 hours of age. However, the difference was not statistically significant (χ^2=0.73, df=1, p=.392). Therefore, the hypothesis that effective breastfeeding at 8-12 hours of age is a positive predictor of effective breastfeeding at 4 weeks of age, was not supported by the findings of this study.

Accounting for Confounding Factors

As outlined in the literature review, there are many factors that determine initiation and continuation of breastfeeding. These factors were considered in the final analysis of the study variables. Some of these variables may have real effect on the dependent variables and others may have no significance at all. Therefore, to determine which (if any) of the variables had a genuine relationship with the dependent variables, to determine the strength and nature of the relationship, and to make sense of the multiple influences that may have been present in the study, multiple regression and logistic regression were utilized.

The backward, stepwise multiple regression was used to determine which known predictor variables had the greatest influence on the LATCH-R scores obtained during the observed breastfeeding session at 8-12 hours postpartum. With the backward, stepwise solution all known predictor variables were entered in the equation and the least

influential variable was dropped at every step. Known predictor variables entered into the analysis were: (a) maternal age, (b) education, (c) marital status (married/living with partner versus single), (d) smoker status, (e) total prior breastfeeding experience in weeks, (f) infant gestation in weeks, (g) epidural use, (h) supplementation or complementation prior to observed feeding, (i) racial background (Caucasian versus all other racial backgrounds), (j) parity (nulliparity versus multiparity), (k) income (<$25,000 versus $25,000 and higher), and (l) NACS total score. The final step showed that NACS total score and nulliparity accounted for 29.2% of the variance (R^2=.292, p=.000) in LATCH-R scores (see Table 13). There was a positive relationship between NACS total scores and LATCH-R scores, which indicate that the higher the NACS total score, the higher the LATCH-R score. There was a negative relationship between nulliparity and LATCH-R scores, which indicate that nulliparas had lower LATCH-R scores.

Table XIII

Multiple Regression for LATCH-R (Final Steps in Backward, Stepwise Solution)

	B	SE B	Beta	95% Confidence Interval for B Upper	Lower
Step 10					
(Constant)	-5.41	5.55		-16.41	5.60
Gestation in weeks	0.18	0.14	0.11	-0.10	0.46
NACS total score	0.26	0.05	0.43*	0.16	0.36
Nulliparity	-1.12	0.35	-0.27*	-1.80	-0.43
Step 11					
(Constant)	1.46	1.65		-1.82	4.73
NACS total score	0.27	0.05	0.44*	0.17	0.37
Nulliparity	-1.16	0.35	-0.28*	-1.84	-0.47

Note. R^2= 0.303 for step 10; R^2= 0.292 for step 11; * $p<.05$.

The prediction equation based on the result is:

LATCH-R score= 1.46 + 0.27 (NACS total score) – 1.16 (if nullipara)

When the dependent variable has only two possible outcomes, logistic regression is used to determine which independent variable affects the probability of particular outcome (Norman & Streiner, 1997). The backward, stepwise logistic regression was used to determine which variables affected the probability of having ineffective breastfeeding (LAC<6) at 8 to 12 hours of age, and breastfeeding difficulties at four weeks of age. Based on factors identified in the literature, the same variables entered in

the multiple regression for LATCH-R were included in the logistic regression to determine which variables significantly affected breastfeeding at 8-12 hours. To determine the factors which significantly affected breastfeeding at 4 weeks of age, the LAC score (ineffective versus effective) was also added in the equation. Logistic regressions to determine the two outcome variables were also done without using NACS total score as it was already shown to be highly correlated with effective breastfeeding when tested as hypothesis 4. Details are presented in Table 14.

Table XIV

Logistic Regression for Ineffective Breastfeeding at 8-12 hours of age

			95% Confidence Interval Odds Ratio	
Variable	β	Odds Ratio	Lower	Upper
With NACS				
Step 1				
Age	0.08	1.08	0.97	1.22
Total education in years	-0.13	0.87	0.71	1.07
Marital status (single)	0.30	1.35	0.22	8037
Smoker status	0.38	1.46	0.17	12.80
Total breastfeeding experience	.00	1.00	0.99	1.01
Gestational age	-0.29	0.75	0.47	1.19
Epidural	0.66	1.93	0.68	5.52
NACS total score	-0.36	*0.70	0.58	0.83
Supplementation	-0.69	0.50	0.02	11.06
Non-Caucasian	-0.39	0.68	0.24	1.94
Nulliparity	0.30	1.35	0.41	4.42
Income	0.22	1.24	0.30	5.17
Constant	22.85	*8.35E+09		
Step 12				
NACS total score	-0.35	*0.71	0.60	0.83
Constant	11.71	*121464.04		

Without NACS				
Step 1				
Age	0.08	1.09	0.98	1.21
Total education in years	-0.13	0.88	0.73	1.06
Marital status (single)	0.06	1.07	0.21	5.37
Smoker status	-0.05	0.96	0.18	5.11
Total breastfeeding experience	-0.00	1.00	0.99	1.01
Gestational age	-0.36	0.70	0.47	1.05
Epidural	0.78	2.19	0.86	5.57
Supplementation	0.02	1.02	0.05	20.72
Non-Caucasian	-0.22	0.81	0.32	2.04
Nulliparity	0.20	1.22	0.42	3.57
Income	0.36	1.44	0.39	5.26
Constant	13.36	634583.95		
Step 10				
Gestational age	-0.39	*0.68	0.47	0.99
Epidural	0.61	1.83	0.82	4.10
Constant	15.22	*4078189.2		
Step 11				
Gestational age	-0.34	0.71	0.50	1.02
Constant	13.53	750575.38		
Controlling for only 4 variables				
Age	0.07	1.07	0.99	1.12
Education	-0.13	0.88	0.76	1.02
Gestational age	-0.36	0.70	0.48	1.02
Epidural	0.81	2.25	0.98	5.17
Constant	13.79	970544.33		

Note. * $p < .05$

When controlling for variables including NACS total score, Step 1 showed that only NACS total score had a significant effect on effective breastfeeding. The final step showed that higher NACS score has a protective effect on ineffective breastfeeding at

8-12 hours of age. Results indicate that for every point increase in the NACS score, the risk for ineffective breastfeeding at 8-12 hours of age is reduced by 29%. When NACS total score was excluded from the equation, logistic regression showed that gestational age has a negative relationship with ineffective breastfeeding at 8-12 hours of age. Therefore, higher gestational age has a protective effect on ineffective breastfeeding at 8-12 hours of age. The result indicates that with each week added to gestation, infants are 29% less likely to have ineffective breastfeeding. Interestingly, one of the steps in the logistic regression showed that epidural use was nearly as significant as gestational age. Adjusting for maternal age, education, and gestational age, epidural use increases the odds of ineffective breastfeeding at 8-12 hours of age by 2.25 to 1 (95% CI=0.98, 5.17). Results are shown in Table 14.

In testing for risk factors associated with breastfeeding difficulties at 4 weeks of age, results showed that there was a negative relationship between total prior breastfeeding experience and breastfeeding difficulties at 4 weeks. When NACS was included in the regression, it also showed a negative relationship with breastfeeding difficulties at 4 weeks of age. Findings outlined in Table 15 indicate that for every week added to prior breastfeeding experience, breastfeeding difficulties at 4 weeks is 2% less likely to occur. Results also indicate that for every point increase in the NACS score, the risk for breastfeeding difficulties at 4 weeks is reduced by 18%.

Recognising the effects of other independent variables is significant. Accounting for confounding factors may clarify the findings of statistical testing of the study hypotheses.

Table XV

Logistic Regression for Breastfeeding Difficulties at 4 weeks of age

Variable	β	Odds Ratio	95% Confidence Interval Odds Ratio Lower	Upper
With NACS				
Step 1				
Income	-0.27	0.76	0.10	5.83
Marital status (single)	2.07	7.91	0.67	92.85
Racial background (non-Caucasian)	0.11	1.11	0.29	4.30
Smoker status	-0.18	0.84	0.05	14.76
Prior breastfeeding experience	-0.03	*0.97	0.94	1.00
Nulliparity	-0.62	0.54	0.10	2.80
Gestational age	-0.03	0.98	0.56	1.70
Epidural	-0.33	0.72	0.21	2.49
Supplementation	-5.581	0.00	0.00	3.35E+16
NACS total score	-0.22	*0.80	0.64	1.00
Ineffective breastfeeding (LAC<6)	-0.11	0.89	0.25	3.20
Education	0.11	1.11	0.85	1.46
Age	0.02	1.02	0.88	1.20
Constant	5.95	385.43		
Step 12				
Prior breastfeeding experience	-0.02	0.98	0.96	1.00
NACS total score	-0.20	*0.82	0.68	0.99
Constant	5.657	286.16		
Without NACS				
Step 12				
Prior breastfeeding experience	-0.02	*0.98	0.96	1.00
Constant	-0.65	0.52		

Note. *p<.05

Summary

The first part of this chapter presented a summary of the demographic and childbirth information of the women and infants enrolled in the study. The information included maternal data such as age, income, education, and breastfeeding history. Labour and delivery information obtained from charts included information about the number of pregnancies and live births for each of the participants, the duration of each stages of their labour, and labour and delivery use of epidural. Data about the infant were also collected as part of the demographic and childbirth history information. These included sex, birth weights, and Apgar scores. Results of the breastfeeding observation and neurobehavioral testing of all infants at 8-12 hours of age were briefly included. Greater details were provided on the hypotheses testing section of this chapter. Results from the Breastfeeding follow-up Information were also presented with focus on breastfeeding difficulties experienced in the hospital and at home, breastfeeding support, breastfeeding frequency and intentions, and suggestions from study participants on how breastfeeding experience may be improved in hospital and/or in the community.

The study hypotheses were then tested using inferential statistics. The findings of this study supported one of the primary hypotheses. That is, neonatal neurobehavioral ability will be positively related to effectiveness of breastfeeding at 8-12 hours of age (Hypothesis #4, a), and absence of breastfeeding difficulty at 4 weeks of age (Hypothesis #4, b). The first hypothesis that healthy term infants of mothers who received epidural analgesia will breastfeed less effective at 8-12 hours of age when compared to infants whose mothers received no analgesia was not supported. In addition, the third hypothesis that healthy term infants of mothers who received epidural analgesia will be less vigorous

in the neurobehavioral response at 8-12 hours of age, when compared to infants whose mothers received no analgesia was not supported by the findings of this study. The results did not support the second hypothesis that healthy term infants of mothers who received epidural analgesia will be more likely to stop breastfeeding by 4 weeks of age when compared to infants whose mothers received no analgesia. Also, one part of the fourth hypothesis which states that neonatal neurobehavioral ability at 8-12 hours of age will be positively related to continuation of breastfeeding at 4 weeks of age was not supported by the results of this study.

The secondary hypotheses also lacked support from this study. This study did not support the hypothesis that healthy term infants and their mothers who received epidural during labour and delivery will be more likely to have breastfeeding difficulties in hospital when compared to infants and their mothers who had no analgesia. The results also showed that mother and baby dyads is the epidural group are not more likely to have breastfeeding difficulties at 4 weeks postpartum when compared to mother and baby dyads in the no-analgesia group (Hypothesis #6). The hypothesis that mothers who received epidural analgesia will evaluate the breastfeeding session less positively than mothers who received no analgesia at 8-12 hours of age was not supported. Finally, the hypothesis that effective breastfeeding at 8-12 hours of age is a positive predictor of continued effective breastfeeding at 4 weeks of age, was not supported by the findings of this study.

Equally important to hypotheses testing is identifying other independent variables that may have relationship with the dependent variables. The results of testing for

confounding factors were included for better understanding and interpretation of the findings of this research.

CHAPTER V

Discussion

This study was designed to examine the relationship between epidural analgesia analgesia during labour and delivery and the initiation and continuation of effective breastfeeding. The theoretical frameworks that guided this study were the Mutual Regulation Model by Tronick (1989), and the Skill Theory (Fisher & Hogan, 1989). The application of the Mutual Regulation Model addressed the dyadic relationship between mother and her fetus during pregnancy as well as the relationship between mother and her infant during breastfeeding. Given that breastfeeding is also a process affected by infant capabilities to perform the necessary skills to effectively breastfeed, the Skill Theory was applied.

The 115 mother and baby dyads who participated were separated into two study groups which were the epidural analgesia group (n=63) and the no-analgesia group (n=52). Data based on the Demographic and Childbirth History information, results of the neonatal neurobehavioral testing using NACS and breastfeeding observation at 8-12 hours of age using the LATCH-R, maternal evaluation of the breastfeeding, and self report information obtained during the 4 weeks postpartum follow-up phone call were analyzed using descriptive statistics and inferential statistics. Hypotheses testing through statistical analysis were carried out to demonstrate any relationships between variables.

In this chapter, the results of the study are discussed in relation to previous literature. Results of hypothesis testing are also addressed in relation to the theoretical framework of this study. Finally, the strengths and limitations of the study, implications for practice, and recommendations for future research are discussed.

Hypotheses Testing

A greater proportion of healthy term infants (61.5%) of mothers who received epidural during labour and delivery did not breastfeed effectively (LAC <6), compared to the infants (50.8%) whose mothers received no analgesia. In addition, using a statistical analysis based on ranked orders of LAC scores, infants in the epidural group scored lower than infants in the no-analgesia group. However, these differences were not statistically significant. Therefore, the findings of this study did not support the first hypothesis that healthy term infants of mothers who received epidural analgesia will demonstrate less effective breastfeeding at 8-12 hours of age when compared to infants whose mothers received no analgesia.

The results of this study are similar to the findings of earlier research by Reid and Ly (2001) which showed that ultra-low dose epidural analgesia does not influence immediate breastfeeding behavior or success. The earlier study was a prospective, single blinded observation that looked at breastfeeding during immediate postpartum period and at 4 weeks, which is similar to this study. Beyond these similarities, further comparison can not be made as the earlier study used a different breastfeeding assessment tool, IBFAT, whereas this study used the LATCH-R tool. The study groups in the earlier research and this research are different in that the epidural group had different types of epidural solution and duration of use. The groups also differed in that the earlier study combined those who had inhalation analgesia with their non-epidural group. By using Chi square test, IBFAT scores were not found to be different between the two groups ($p=0.848$).

In contrast, another study using the IBFAT by Riordan et al. (2000) found a significant difference in the mean IBFAT scores between unmedicated and medicated groups (epidural only, intravenous narcotics, and combination epidural and intravenous analgesia). In comparing the groups, the no labour analgesia group had significantly higher total score on readiness to feed, rooting, fixing and suckling (mean = 11.1) compared to the other groups (mean= 8.5) at significance level $p < .0001$.

The study by Riordan et al. (2000) was also prospective, and multisite similar to this present study. Both studies were unable to control for dosage of labour medications given to mothers and duration of drug administration. The earlier research had 4 study groups, two of which were similar to this study's groups. Again it is difficult to compare the two studies due to differences in breastfeeding assessment tools used, epidural solutions used, and duration of epidural use. The two studies were also different in when the breastfeeding observations were carried out. In the study by Riordan et al. (2000), observations ranged from 1-50 hours of age (M=10.7) whereas this present study limited the eligibility criteria to infants who could be observed at 8-12 hours of age. The actual age of infants in the study ranged from 8.01 to 12.48 hours (M= 9.7, SD=1.2).

The 115 mothers and infants separated into two study groups were not statistically different in almost all demographic and childbirth information, as outlined in the previous chapter. However, the mothers in the two study groups were statistically different in age, total breastfeeding experience, gravity and parity, and duration of first and second stage. Although the two groups of infants were shown to differ significantly in their arterial pH, and venous pH levels, neither group had cord gas values outside the norm that might indicate that one group was stressed compared to the other. This is important because the

two study groups significantly differed in the duration of first stage and second stage of labour. The results of this study found that the epidural group had longer first stage (M= 723.71 minutes, SD=387.95) and second stage labour (M=73.98 minutes, SD=61.50) compared to the no-analgesia group at first stage (M=380.14, SD=395.15) and second stage (M=23.48, SD=36.79). The literature review touched on the stress imposed on the mother and their fetus during labour and delivery, especially when the duration of labour is long (Cheek et al., 1994; King, 1997; Lowe, 1996; Vincent & Chestnut, 1998). However, the infants did not differ in their Apgar scores, use of oxygen by mask, or use of positive pressure ventilation, indicating that neither group was more stressed or required more care than the other. Also, time of the breastfeeding assessment did not significantly differ between the two groups. This apparently homogenous group of infants, differed mainly in the study group they belonged to, and did not show any significant difference in their ability to breastfeed effectively during the 8-12 hours of their lives.

Why was the difference between healthy term infants of mothers who received epidural analgesia and infants whose mothers received no analgesia in their ability to breastfeed effectively at 8-12 hours of age not statistically significant?

A possible explanation takes the discussion to the analysis of the study instrument. The study used a modified LATCH breastfeeding assessment tool developed by Jensen et al., (1993). Adams & Hewell (1997) found high interrater reliability (85.7-100%) among lactation consultants using the LATCH tool. Riordan et al. (2001) found significant correlation between mothers' rating of how well she thought breastfeeding went (0=not at all well to 3= very well) and evaluators' LATCH scores

(n=132, r= 0.56, p=.001), thus, supports construct validity of the tool. In this present study, there was significant correlation between mother's perception of how well she thought breastfeeding went (0=no pleased to 3=very pleased) and evaluators' LAC scores (n=115, r=.52, p=.01).

"The reliability of an instrument is the degree of consistency with which it measures the attribute it is supposed to be measuring", (Polit & Hungler, 1999, p. 411). According to Polit and Hungler (1999), testing for reliability coefficients is an important indicator of the quality of a quantitative measure. They also state that a measure that is unreliable interferes with an adequate testing of a research hypothesis. "If data fail to confirm a research prediction, one possibility is that the measuring tools were unreliable—not necessarily that the expected relationships do not exist", (Polit & Hungler, 1999, p. 416). Although the reliability of the LATCH tool has been tested before, the modified use of the tool, that is, LAC and LATCH-R, were not. The test for Cronbach's alpha, which measures internal consistency for LAC, LATCH-R and LA in this study resulted in reliability coefficients of 0.65. 0.62, and 0.90 respectively. According to Polit and Hungler (1999), coefficients of 0.80 or greater are more desirable in making group-level comparisons, such as in this present study. Therefore, to see whether the LA measure with its high reliability coefficient would produce a different result from the study findings, it was used to examine the difference in breastfeeding effectiveness between the two study groups. The results showed that difference between the epidural group and no analgesia group was not statistically significant (χ^2= 1.58, df=1, p= .282).

The question then comes to, whether the instrument was sensitive enough to discriminate between different individuals. As the scoring criteria set out for each category were clear (e.g. latched, need help to keep latch, or did not latch, swallows heard or not heard, there is pain or no pain), it is reasonable to say that the instrument was sensitive to distinguish differences between individuals. As the LATCH-R assessment tool is observational, measures are subject to the effects of different factors. However, because only the infant contribution was being measured with LAC, reactivity and response-set bias should not apply. That is, infants at 8-12 hours of age do not have the ability to know that they are part of a study and therefore, could not chose to present a favorable image. However, transitory personal factors, such as stress, and effect of labour medication, could have altered infant behavior. Keeping the investigators blinded to participants' use or non-use of epidural during labour and delivery eliminated observer bias.

The sample had sufficient power to detect medium effect size between groups. However, if the effect size was small, the sample size may have been inadequate to detect a difference.

It is important to note at this point that the epidural group used a wide range of epidural solutions (a total of 7 different solution mixtures). There was also a wide range in duration of use from initiation of the epidural continuous infusion to time of delivery (range=11 to 1017 minutes), and also the amount of epidural solution infused (range= 5.33 to 196.25 ml.). Most drugs including anesthetics readily cross the placenta. Two of the four factors that influence placental transfer are the concentration of free drugs in maternal blood, and the physiochemical characteristics of local anesthetic itself

(Briggs, 2002; Santos et al., 1994; Santos & Finster, 2002). Maternal blood concentration of drugs is determined by the dose, the site of administration, metabolism and excretion, and effects of adjuvants (Santos et al., 1994; Santos & Finster, 2002). According to Santos et al. (1994), for a given local anesthetic, the maternal blood concentration determines fetal drug exposure. Therefore, the higher dose led to higher maternal and fetal blood concentration. The dose related effect is difficult to apply because the study did not control for the dose received by the participants. In this study, there were 7 combinations of epidural solutions. The two types of anesthetics (Bupivacaine and Ropivacaine) have different physicochemical characteristics. Most epidural solutions in the study contained an opioid, Fentanyl. The addition of Epinephrine enhance analgesia and delay the uptake of drug from the site of administration (deJong, 1994; Santos et al., 1994; Stoelting, 1987). In this study, not all epidural solutions contained Epinephrine. Because of this variety of epidural solutions used, duration of epidural use, and volume infused, the homogeneity of the epidural group is questionable. The statistically non-significant finding of this study may be related to the lesser effect of epidural for some infants who received minimal dosage of epidural solution. It is possible that only those who had stronger concentrations or larger volume of epidural solutions could show the effects of epidural if any on their abilities to breastfeed effectively 8-12 hours of age.

Finally, the effects of known predictor variables need to be recognized to better understand why a statistically significant difference was not achieved in the testing of the first hypothesis. Statistical analysis using logistic regression showed that early gestational age has a negative relationship with effective breastfeeding at 8-12 hours of

age. According to MacMullen and Dulski (2000), physiologic factors such as prematurity interfere with suck and swallow coordination necessary for feeding. Prematurity is related to delayed ability to initiate breastfeeding (Furman et al., 1998; Martell et al., 1993; Medoff-Cooper & Ray, 1995). This follows that those who are only 37 weeks are less mature in their sucking, and swallowing ability than those who are older in gestation. Gestational age of infants in the study ranged from 37 to 41 weeks.

One of the steps in the logistic regression showed that epidural use was nearly as significant as gestational age as a risk factor for ineffective breastfeeding at 8-12 hours of age. Adjusting for maternal age, education, and gestational age, epidural use was shown to increase the odds of ineffective breastfeeding at 8-12 hours of age 2.25 fold (95% CI= 0.98, 5.17).

The results of this study also did not support the second hypothesis that healthy term infants of mothers who received epidural analgesia during labour and delivery will be more likely to stop breastfeeding by 4 weeks of age when compared to infants whose mothers received no analgesia. Eighty-one percent of infants from the no analgesia group and 86.3% infants from the epidural group were still breastfeeding (either exclusively or in combination with bottle-feeding) at 4 weeks. The difference between the two groups was not statistically significant.

The result of the present research confirms the findings of Riordan et al. (2000). The study by Riordan et al. (2000) compared 129 infants' feeding ability using the Infant Breastfeeding Assessment Tool (IBFAT) in the immediate postpartum. Participants were also called at about 6 weeks postpartum and asked about the length of breastfeeding. The proportion of participants who were successfully contacted in the unmedicated and the

medicated groups were similar. Breastfeeding duration was defined as the postpartum week in which the mother had not breastfed in the past 24 hours and did not intend to breastfeed the baby further. The researchers found that mothers who had no labour pain relief medication did not breastfeed significantly longer than those who had analgesia. It is important to note that the researchers did not separate the mothers who had epidural only from all other types of medication used during labour.

In this study, the data used to test this hypothesis was obtained by using self-reports at 4 weeks postpartum. The lack of support for the study hypothesis may be related to the risk of using this kind of data collection. Self-reports can be affected by bias either from the interviewer or from the respondents. There is a risk for respondents to distort their responses. In regards to the question of are you bottle-feeding, breastfeeding or both, there might be a participant's tendency to present a favorable image of herself. The social desirability response bias is the tendency of some individuals to misrepresent their responses consistently by giving answer that are in line with prevailing social mores (Polit & Hungler, 1999). Because breastfeeding is the preferred and promoted way of infant feeding, some mothers may not want to admit that they have switched to bottle-feeding. Switching to bottle-feeding may represent a failure to them and may not want this to be known. Because the participants knew the purpose of the study, their beliefs about epidural use, either in favour for or against, may have influenced their responses.

The third hypothesis that healthy term infants of mothers who received epidural analgesia will be less vigorous in their neurobehavioral response at 8-12 hours of age, when compared to infants whose mothers received no analgesia was not supported by the

findings of this study. The mean NACS score for infants born to mothers who received epidural was 32.37 (SD=3.46), and for infants whose mothers received no analgesia was 33.08 (SD=2.73). The difference was not statistically significant. After recoding the NACS scores to dichotomous variable (vigorous and non-vigorous), 67.3% (n=41) of infants born to women who received epidural scored less than 35 in NACS (non-vigorous), compared to 65.1% (n=35) infants born to mothers who received no analgesia during labour and delivery. The difference between the two groups was not statistically significant. These findings suggest that epidural analgesia does not adversely affect infant's neurobehavioral ability.

The finding of this present research confirms the results reported by Abboud et al. (1982), Abboud et al. (1983), Abboud, David, et al. (1984), Abboud, Afrasiabi, et al. (1984), Celleno and Capogna (1988), Kangas-Saarela et al. (1987), Kileff et al. (1984), Lieberman et al. (1979), and Scanlon et al. (1976), that epidural analgesia during labour does not affect neurobehavioral outcome.

Abboud et al. (1982) compared the neurobehavioral status of 170 infants, 50 were born to mothers who received 0.5% epidural Bupivacaine, 50 with 2% epidural 2-Chloroprocaine, 50 with 1.5% epidural Lidocaine, and 20 in an unmedicated control group. Using the ENNS, neonatal neurobehavior status was evaluated at 2 and 24 hours of life. Abboud et al. (1982) concluded that giving a small volume and low concentration of local anesthetics do not adversely affect the neurobehavioral performance of the neonates. In a subsequent study, Abboud, Afrasaibi, et al. (1984) had similar findings using similar medications with continuous infusions, and no-medication group. Using the NACS, they found no significant difference between any epidural group and the

no-medication group at 2 and 24 hours of age.

The findings of this present study do not confirm the negative effects of epidural analgesia during labour on neurobehavioral outcome found by Brazelton (1961), Corke (1977), Hodgkinson et al. (1978), Lieberman et al. (1979), Loftus et al. (1995), Murray et al. (1981), Rosenblatt et al. (1981), Scanlon et al. (1974), Sepkoski et al. (1992), Standley et al. (1974), and Tronick et al. (1976). Among these, Murray et al. (1981), and Sepkoski et al. (1992) are the only studies that included unmedicated control groups.

Murray et al. (1981) compared the neurobehavioral status of 20 infants whose mothers received Bupivacaine (0.25% with Epinephrine), 20 infants whose mothers received epidural Bupivacaine and Oxytocin, and 15 control infants whose mothers received no medication for vaginal delivery. Using the BNBAS, infants from the epidural group, scored more poorly on the motor, state control, and physiologic response clusters compared to the unmedicated group in the first 24 hours after delivery. In a different study, Sepkoski et al. (1992) tested the neurobehavioral outcomes of 60 infants, 38 were born to mothers who received 0.5% epidural Bupivacaine, and 22 who were born to unmedicated mothers (control group). They also used the BNBAS to test the infants at 3 hours of age. Results support the findings of Murray et al. (1981) that Bupivacaine used during labour has a significant and consistent negative effect on neonatal neurobehavioral performance.

Comparison of studies is difficult because of differing operational definitions of study variables, methodologies, samples, medication regimes and timing of testing. The differences or similarities in findings may be related to the tests chosen to evaluate

neonatal neurobehavioral outcome. Do the tests differ in sensitivity? The two studies that used BNBAS found a difference in their outcomes. Brockhurst et al. (2000) reviewed 71 articles that reported studies that used NACS to correlate neonatal outcome with maternal medication during labour and delivery. They found that few studies reported statistically significant differences in the total NACS. These authors speculated that this could be due to lack of actual differences, design limitations, or lack of sensitivity on the NACS to detect small effects or deviations from the norm. Although the BNBAS provides the most complete assessments of neonate's behavior, an examination of one individual infant could take 30 minutes or longer and requires extensive training for examiners to achieve high interrater reliability (Goldsmith & Starrett, 1991). The NACS is an abbreviated assessment of infant behavior, which emphasizes evaluation of active and passive muscle tone. The NACS, which has 20 behaviors elicited and rated, has 15 items in common with BNBAS. The NACS screens for more gross distortions of certain neonatal behaviors, but does not require an extended amount of time to administer (Goldsmith & Starrett, 1991). Prior to data collection the primary investigator and the research assistant achieved high interrater reliability ($N=10$, $r=.982$, $p<.01$) with NACS.

The first part of the fourth hypothesis that effectiveness of breastfeeding will be positively related to neonatal neurobehavioral ability at 8-12 hours of age was supported by the findings of this study. Correlation was significant at .01 level (one-tailed) with correlation coefficient of 0.475. Infants who breastfed effectively also achieved higher scores in the NACS.

It is known that term neonates are born with reflexes that facilitate feeding such as rooting, sucking, and swallowing. Behavioral states are also important in facilitating reciprocal communication and relationship between the mother and infant during feeding. Neonatal neurobehavioral testing includes testing of reflexes and behavioral states. MacMullen and Dulski (2000) state that depressed nervous system may interfere with suck and swallow coordination necessary for feeding. These associations are confirmed by the findings of this present research that effective breastfeeding was positively related to neonatal neurobehavioral ability at 8-12 hours of age.

There have been no other studies that examined the correlation between breastfeeding and neonatal neurobehavioral ability. However, findings from earlier studies testing for the effect of epidural on neurobehavioral outcomes also found effects on the reflexes that facilitate feeding.

Scanlon et al. (1974) examined 41 infants born to mothers who used epidural and did not use epidural analgesia. Using the neonatal neurobehavioral test ENNS, research showed that epidural analgesia negatively affected neonatal neurobehavioral outcomes. This research also reported less vigorous rooting behavior in epidural block group at 4, 6, and 8 hours of age.

While examining the effect of epidural analgesia on neonatal neurobehavioral outcome, Kileff et al. (1984), also found that at 24 hours of age, infants whose mother received 0.5% Bupivacaine had depressed sucking responses compared to infants whose mother received 2% Lidocaine. Similarly, Abboud et al (1983), found that greater proportion of infants in epidural group had lower suckling scores compared to infants in

the unmedicated group. Both these studies did not find that epidural negatively affected neonatal neurobehavioral outcome, but found negative effect on sucking responses.

More mothers in the epidural group (45.1%) reported having breastfeeding difficulties in hospital compared to mothers in the no-analgesia group (34.9%). However, inferential testing did not support the hypothesis that healthy term infants and their mothers who received epidural during labour and delivery will be more likely to have breastfeeding difficulties in hospital when compared to infants and their mothers who had no analgesia.

The result of this study was similar to the findings in a prospective, cohort study of 189 mother-infant couples by Halpern et al. (1999). The researchers found no association between labour analgesia and early breastfeeding problems. However, it is important to note that all 189 mothers in the study received medication during labour which included epidural analgesia (59%), intramuscular opioid within 24 hours prior to delivery (18%), and parenteral opioids within 5 hours of delivery (3%). The epidural group consisted of combination epidural/spinal and pure epidural of differing combinations of medications. A limitation of the study included the lack of a control group (no medication), making comparison difficult to determine the actual contribution of labour medication to breastfeeding problems. Breastfeeding outcomes were described by the use of supplementary and complementary feeds rather than actual difficulties related to breastfeeding. Although participants reported difficulties initiating breastfeeding in hospital related to sore nipples or difficulty latching, the lack of control group make it difficult to discriminate the effects of epidural on breastfeeding if any.

Thus, this research study could not demonstrate an association between labor analgesia and early breastfeeding problem.

Earlier research by Reid and Ly (2001), found that ultra-low dose epidural analgesia did not influence immediate breastfeeding behavior or success. Reid and Ly (2001) also looked at breastfeeding at 4 weeks postpartum similar the present research. However, it is difficult to compare the findings of their study with the present research because a detailed description of their methodology and definition of success were not available. Depending on whether their definition of success meant absence of breastfeeding difficulties or continued breastfeeding, the present study can only speculate that it confirms their research findings that ultra-low dose epidural analgesia does not influence breastfeeding success.

It is important to recognize at this point the drawbacks of using interview questions. First is interviewer bias in which the interviewers might have unintentionally affected the way participants responded to the questions. As the participants were aware of the purpose of the study, it might have influenced them in how they responded to the questions. It is possible that women who had epidural, who believed in epidural, did not want to project the possibility that their choice in labour may have affected their infants' ability to breastfeed.

Statistical analysis also tested for the effects of potential confounding factors associated with breastfeeding. Multiple regression showed that NACS total score and nulliparity accounted for 29.2% of the variance (R^2 =.292, p=.000) in LATCH-R scores (see Table 13). There was a positive relationship between NACS total scores and LATCH-R scores, which indicate that the higher the NACS total score, the higher the

LATCH-R score. There was a negative relationship between nulliparity and LATCH-R scores, which indicate that nulliparas automatically had lower LATCH-R scores. There was significant difference between the two study groups in relation to parity. Fourteen percent of women who had no analgesia and 42.3% of women who used epidural were nulliparous. This might offer a possible explanation for the higher proportion of mother and baby dyads in the epidural group who were having breastfeeding difficulties in hospital (45.1%), compared to the mother and baby dyads from the no-analgesia group (34.9 %).

The second part of the fourth hypothesis that neonatal neurobehavioral ability at 8-12 hours of age will be positively related to continuation of breastfeeding and absence of breastfeeding difficulty at 4 weeks of age was partially supported. Neonatal neurobehavioral ability at 8-12 hours of age is not related to continuation of breastfeeding at 4 weeks of age. Current literature showed that duration of breastfeeding are influenced by many factors such as maternal marital status, socio-economic status (Scott & Binns ,1999; Dennis, 2002), early initiation of breastfeeding, demand feeding, use of supplementary or complementary feeds (Coreil & Murphy,1988; DiGirolamo et al., 2001), social support, maternal confidence and commitment (Scott & Binns, 1999). During the follow-up interview, of the primary reasons for stopping breastfeeding given by the 19 mothers who were no longer breastfeeding their infants, one reported "baby will not suck", and one "baby too sleepy". These two reasons could be characteristics of poor neurobehavioral ability. Sore nipples and insufficient milk supply were the two most reported primary reasons for stopping breastfeeding.

The result of the t-test showed that neurobehavioral ability at 8-12 hours is positively related to the absence of breastfeeding difficulty at 4 weeks of age. This finding is supported by the results of the logistic regression looking at risk factors associated with breastfeeding difficulties at 4 weeks of age. The logistic regression indicates that for every point increase in the NACS score, the risk for breasfeeding difficulties at 4 weeks is reduced by 18%. Thus showing a positive relationship between neonatal neurobehavioral ability at 8-12 hours of age with absence of breastfeeding difficulty at 4 weeks of age. However, this was not supported by the Chi-square test analysis. The non-significant statistical difference may be accounted by the mean NACS score for both groups being less than 35. Since the cut-off to describe vigorous infants was arbitrarily selected by Amiel-Tison et al. (1982), findings of this study indicate that the cut-off may not be appropriate.

The findings of this study did not support the hypothesis that mother and baby dyads in the epidural group will be more likely to have breastfeeding difficulties at 4 weeks postpartum when compared to mother and baby dyads in the no-analgesia group. Of the 114 participants who were able to complete the 4 weeks postpartum follow-up portion of the study, 95 were still breastfeeding (either exclusively or in combination with bottle-feeding). More mother and baby dyads in the epidural group (76.5%) reported having breastfeeding difficulties at home compared to (60.3%) mother and baby dyads in the no-analgesia group. Furthermore, greater proportion of mother and baby dyads in the epidural group (25%) reported continued breastfeeding difficulties at 4 weeks postpartum than mother and baby dyads in the no-analgesia group (19.6%). However, the difference between the two groups was not statistically significant.

Statistical analysis also tested for the effects of other risk factors associated with breastfeeding difficulties in the postpartum period. Logistic regression showed that there was a negative relationship between total prior breastfeeding experience and breastfeeding difficulties at 4 weeks. Findings indicate that for every week added to maternal breastfeeding experience, breastfeeding mother and baby dyads are 2% less likely to experience breastfeeding difficulties at 4 weeks postpartum. There was significant difference between the two study groups in relation to the total breastfeeding experience of the mothers. This follows the difference in proportion of nulliparous women in the two study groups. The mean total breastfeeding experience of the no analgesia group was 45.86 weeks (SD=56.33), whereas for the epidural group, the mean was 19.19 weeks (SD=30.82). This might offer a possible explanation for the higher proportion of mother and baby dyads in the epidural group who were having breastfeeding difficulties at 4 weeks (25%), compared to the mother and baby dyads from the no-analgesia group (19.6 %).

The study results did not support the hypothesis that mothers who received epidural analgesia will evaluate the breastfeeding session at 8-12 hours postpartum less positively than mothers who received no analgesia. Statistical testing showed that mothers who did not receive any analgesia during labour and delivery evaluated their breastfeeding more positively (mean rank= 61.15) than the mothers from the epidural group (mean rank= 54.18), but the difference was not statistically significant (p=.226).

Maternal breastfeeding evaluation ranged from not pleased (0) to very pleased (3). Matthews (1991) found that the scores of effective breastfeeding are positively correlated with maternal satisfaction with their neonates' breastfeeding behavior. In comparing

LATCH scores with maternal satisfaction, Schlomer et al. (1999) found that as LATCH scores increased, maternal satisfaction tended to increase. More infants in the no-analgesia group breastfed effectively, therefore, one would expect that more mothers in this group would evaluate their breastfeeding session at 8-12 hours postpartum, more positively than the epidural group. This was the case for this study, but the difference was not statistically significant. To assess if mothers whose infants breastfed effectively (LAC=6) evaluated the breastfeeding more positively than the mothers whose infants did not breastfeed effectively (LAC<6), the Mann-Whitney U test was done. The results showed significant difference between the two groups (p=.000), where the mean rank for maternal perception of breastfeeding when breastfeeding was ineffective was 46.41, and for maternal perception of breastfeeding when breastfeeding was effective was 72.55.

There are several factors that may have influenced the responses in the study rather than just the effectiveness of breastfeeding. First, maternal expectations and attitudes may have influenced the responses. Breastfeeding women who considered themselves to be successful have been shown to be positive thinkers and problem solvers who were determined to succeed and perceived difficulties as "normal" (McNatt & Freston, 1992). Women who see themselves less successful have been shown to be self-doubting, anxious, rigid in their breastfeeding practices, focused on the negative aspects of breastfeeding, and more likely to be discouraged with breastfeeding difficulties (McNatt & Freston, 1992). This might account for the differences in maternal evaluation of the observed breastfeeding. Secondly, the participants were aware of the purpose of the study. It is possible that those who had epidural and had a positive experience with it did not want anything negative that might be linked to epidural use. That is, they would

want to project themselves as still being pleased even when their infants did not latch or did not suck at the breast.

The hypothesis that effective breastfeeding at 8-12 hours of age is a positive predictor of effective breastfeeding at 4 weeks of age, was not supported by the findings of this study. Results of this study showed that more infants from the effective breastfeeding group (81.8%) than the non-effective breastfeeding group (74.5%) at 8-12 hours of age, were still breastfeeding and had no breastfeeding difficulties at four weeks of age, but the difference was not statistically significant.

The predictive value of breastfeeding assessment in the initial postpartum was confirmed by the findings of Riordan et al. (2000). When they divided the IBFAT scores, into low, medium and high, and compared with the duration of breastfeeding, dyads with low scores breastfed for a significantly shorter period of time than those with medium or high scores ($H=107.7$, $p<.001$).

Riordan et al. (2001) examined the effectiveness of the LATCH Breastfeeding Assessment Tool in predicting duration of breastfeeding. The study included 127 mother-baby dyads in two Midwestern US community hospitals. Breastfeeding was assessed using the LATCH tool at 24-72 hours postpartum by nurses who were also certified lactation consultants. At 8 weeks postpartum, each mother was called and asked the mode of infant feeding. In this study, "not breastfeeding" was defined as not having breastfed in the previous 24 hours and not intending to breastfeed the baby further. The study results showed that women who were breastfeeding at 6 weeks postpartum had significantly higher total LATCH scores (9.3 ± 0.9) than those who had weaned

(8.7 $\pm$ 1). All means of individual LATCH components tended to be higher in the group still breastfeeding at 6 weeks, but the differences were not significant. Researchers concluded that LATCH scores predicted whether or not the mother would breastfeed for up to 6 weeks.

It is interesting to note that although previous studies have examined the predictive values of breastfeeding assessment tools in determining duration of breastfeeding, none have evaluated the predictive value in determining the quality of breastfeeding for those who continue.

All but one hypothesis was not supported by the findings of this study. Lack of statistical significance may be explained by limitations imposed by the instruments used, data collection methods, and sample size. However, differences in results show some clinical significance that will be addressed in the clinical implication section of this chapter.

Theoretical Framework.

The study hypotheses were based on the Mutual Regulation Model (Tronick, 1989) and the Skill Theory (Fischer & Hogan, 1989). According to the Mutual Regulation Model, there are environmental regulators that may influence the mother/infant dyad in a positive or negative way. Beeghly and Tronick (1994) state that when environmental regulators are present such as maternal illness or drug use, the mother's or infant's ability to self-regulate may fail. This model was applied to maternal-fetal relationship during labour and delivery. Maternal-fetal relationship focuses on physiologic interaction. Environmental regulator of interest is the use of medication during labour and delivery, specifically that of epidural. The mechanism of

placental transfer is highly significant in the physiologic interaction or mutual regulation within the mother-fetal relationship. As previously discussed in the literature review, most drugs including anesthetics readily cross the placenta. Again, factors that influence placental transfer are: (a) the concentration of free drugs in maternal blood, (b) the physiochemical characteristics of local anesthetics itself, (c) the permeability of the placenta, and (d) the hemodynamic events occurring within the fetal-maternal unit (Briggs, 2002; Santos et al., 1994; Santos & Finster, 2002).

According to Santos et al. (1994), for a given local anesthetic, the maternal blood concentration determines fetal drug exposure. Therefore, the higher dose led to higher maternal and fetal blood concentration. The dose related effect is difficult to apply in this study because it did not control for the dose received by the participants. However, to determine if there was correlation between the total volume of epidural solution received by the mother from initiation of epidural to delivery and neurobehavioral outcome, data was tested using Pearson correlation. Results showed a negative relationship, but was not statistically significant ($r = -.035$, $p = .085$). Repeated injections or continuous infusion of drug may lead to accumulation in the maternal plasma (deJong, 1994; Santos et al., 1994). The epidural used by all participants were continuous infusions with repeated injections of same solutions for those who used patient controlled epidural analgesia or those given boluses of different epidural solutions. The addition of Epinephrine, which enhances analgesia and delays the uptake of drug from the administration site, was not used consistently in the study.

Passive diffusion within the intervillous space is determined by drug physicochemical properties (Santos & Finster, 2002) namely its molecular weight,

ionization and lipid solubility, and protein binding. Molecular weight less than 500 daltons easily cross placenta (Santos et al., 1994). The low molecular weight of Ropivacaine (274 daltons), and Bupivacaine (288 daltons) received by the epidural group in this study would indicate that these anesthetics easily crossed the placenta. Fetal acidosis can result in accumulation of local anesthetics in the fetus (Santos et al., 1994; Stoelting, 1987). However, analysis of cord gases did not indicate that any of the infants in the study was acidotic that might imply possible accumulation of anesthetic in the fetus. According to Santos and Finster (2002), high molecular weight, poor lipid solubility, and a high degree of ionization will impede but not totally prevent the transfer of a drug across the placenta.

Placental transfer of drugs may also be affected by changes in placental permeability. As part of the normal maturational process, the placenta undergoes considerable changes throughout gestation. In the normal course of events, there is increasing placental surface area and placental thinning with the growth of the fetus. Placental transfer of drugs diminishes under conditions that either decrease the surface area or increase the thickness of the placenta (Garland, 1998). It is worth to consider in this point the differences in gestational age of infants in the study, which ranged from 37 to 41 weeks.

Any drug that reaches the fetus undergoes metabolism and excretion. The elimination half-life for Bupivacaine maybe as long as 14 hours for the neonate (Santos et al., 1994). Metabolites have been found in the neonate for as long as 48-72 hours (King, 1997; Lieberman et al., 1979; Loftus et al., 1995; Ortega et al., 1999). Comparison between Bupivacaine and Ropivacaine has found higher maternal and fetal

plasma concentration of Ropivacaine but shorter half-life (Datta et al., 1995). This short-half life has an advantage over Bupivacaine regarding neurobehavioral outcome (Stienstra et al., 1995). In this present study, seventy-five percent of the study participants were given Bupivacaine of varied concentrations, and 25% received Ropivacaine of either 0.08% or 0.2% in concentration. Some of the epidural solutions received by the study participants also contained Fentanyl 2 μg/ml. Fentanyl, a potent opioid analgesic has been found to rapidly penetrate placenta and is detectable in fetal blood within 1 minute after maternal epidural administration (Hale, 1999). However, because it is highly protein bound, overall transfer to the fetus may be reduced. The half-life in neonates range from 3-13 hours (Hale, 1995).

The woman and her fetus are in essence one entity. What happens to one affects the other. Therefore, there exists a mutual regulation within the mother-fetal relationship. Medication (i.e. through epidural) from the mother to her fetus via the physiologic interaction of placental transfer follows the Mutual Regulation Model.

In examining the effect of epidural analgesia during labour and delivery on the initiation and continuation of effective breastfeeding, both the Mutual Regulation Model and the Skill Theory were applied.

Breastfeeding is both a feeding method and a process of connection involving the mother and her infant, thus, the Mutual Regulation. The method of breastfeeding combines maternal and infant contributions, including the abilities or skills needed for effective breastfeeding (Jensen et al., 1993; Matthew, 1988; Mulford, 1992; Shrago & Bocar, 1989). The LATCH-R Breastfeeding Assessment Tool used in this study incorporates both maternal and infant contributions. Based on this model, maternal

components such as age, marital status, socioeconomic status, racial background, parity, and breastfeeding experience which has been shown in previous research that affect breastfeeding are important to consider in the final analysis of this study. When controlling for these factors, stepwise, backward, multiple regression deleted each variable one by one, based on the degree of its influence on the overall achievement of effective breastfeeding measured by the total LATCH-R. The final step of the multiple regression analysis showed that the infant neurobehavioral status and maternal parity significantly influenced the achievement of effective breastfeeding.

The "T", "H", and "R" components of the LATCH-R Breastfeeding Assessment Tool measure maternal contributions to the breastfeeding relationship. These components are maternal nipple type (T), ability to hold and position infant properly to the breast (H), and responsiveness to infant cues, and confidence to breastfeed (R). The two study groups were compared based on these maternal contributions that could account for any differences in the overall achievement of effective breastfeeding. These maternal factors did not significantly differ between the two groups.

The Skill Theory was applied in examining the infant contribution to the breastfeeding process. Infant contribution is measured by the achievement of a latch and rhythmic suck (L), sign of milk transfer evidenced by audible swallows (A), maintenance of breast and nipple health measured by absence of discomfort or nipple trauma (C). These are the "L", "A", and "C" components of the LATCH-R Breastfeeding Assessment tool.

According to the Skill theory, the acquisition of skill is affected by infant capacities that are dependent on multiple factors including infant health and

environmental support (Fischer & Hogan, 1989). The factor in this present study that was considered to affect infant capacities is maternal use of epidural analgesia during labour and delivery. Factors such as maternal health, perinatal risks, infant health, and environmental regulators such as hospital practices were controlled for as much as possible by having strict criteria for eligibility to participate in the study.

Based on the Mutual Regulation Model, the infant's ability to breastfeed depends on how well his self-regulatory mechanisms are working. It was hypothesized that these self-regulatory mechanisms will be affected by epidural analgesia used by the mother during labour and delivery via placental transfer. The effect will be seen in the neurobehavioral outcomes measured by NACS in this present study. That is, infants born to mothers who used epidural during labour and delivery were expected to have self-regulatory mechanism that is compromised, i.e. poor neurobehavioral outcomes. The results of this study showed that infants from the no-analgesia group scored slightly higher on NACS than infants from the epidural group. However, the difference in neurobehavioral outcome between infants from the epidural group and no-analgesia group was not statistically significant.

The Skill Theory focuses on parameters that may affect the ability of the infant to perform motor skills for a specific task. Based on this theory, it was hypothesized that the ability for infants to carry out the task of breastfeeding and perform the necessary skills to breastfeed effectively will be affected by maternal use of epidural analgesia during labour. The results of this study showed that greater proportion of infants from the no-analgesia group than the epidural group achieved effective breastfeeding at 8-12 hours of age. However, the difference was not statistically significant.

Following The Mutual Regulation Model and The Skill Theory, it was hypothesized that if infants' self-regulatory mechanisms are affected by epidural analgesia via placental transfer the motor skills and arousal states that would allow infants to perform breastfeeding will also be affected. However, there was no significant difference in infant neurobehavioral outcome between the two groups. The findings of this study showed that neurobehavioral status and effectiveness of breastfeeding are positively correlated which supports the Skill Theory. Based on The Skill theory, the acquisition of skill is affected by infant capacities. Therefore, it was hypothesized that infants who were capable to breastfeed effectively at 8-12 hours of age also attain the breastfeeding skills necessary to continue with breastfeeding. However, the results of this study did not support this. It is important to note that The Skill theory also recognizes that infant capabilities are dependent on multiple factors that may be related to the mother, the infant, or environment. In accounting for other influencing factors, it was found that infant neurobehavioral status affected the continuation of effective breastfeeding. When the effect of infant neurobehavioral status was removed, findings indicate that maternal total prior breastfeeding experience impacted on the continuation of effective breastfeeding. Prior breastfeeding experience would most likely result in increased maternal confidence, which has been found to have a positive impact on continuation of breastfeeding (Buxton et al, 1991; Coreil & Murphy, 1988; Dennis, 2002; Fahy & Holschier, 1988). During the follow-up interview, approximately 33% of the respondents reported that their previous breastfeeding experience helped them with their current breastfeeding management.

The study has supported The Skill Theory but did not fully support the Mutual Regulation Model in examining the relationship between epidural and breastfeeding and neurobehavioral outcomes. Through the application of the model and theory, the complexity of breastfeeding as a relationship and skill affected by many factors were put into context.

Strengths and Limitations

There are several factors that strengthen the quality of this research. This study was guided by a theoretical framework, which enabled the exploration of the relationship between the mother and her fetus during labour and delivery, and provides some insight into the potential effect of epidural on neurobehavioral and breastfeeding outcomes. Through the theoretical framework, this study was able to address the complexity of the breastfeeding process influenced by the unique responses of the mother and her infant, and the environment.

Power analysis determined the sample size that would detect medium effect on the outcome variables of this study. The desired sample size of at least 51 in each study group was achieved. This study was able to maintain the required sample for the follow-up portion of study at 4 weeks postpartum due to high response rate (99%).

Using two research settings increased the generalizability of the findings of this study. Participants were recruited at two tertiary hospitals located in the city of Winnipeg. Many of the hospital clients for these two settings reside within the city, but a substantial number also come from outside, since the two facilities are major referral centers for obstetrical patients not only within Manitoba, but also from Northwestern Ontario, Northwest Territories, and Nunavut.

Although the presence of naturally occurring groups necessitated an ex post facto design, several mechanisms were put into place to control extraneous variables. The study focused on healthy term newborns. The study also had strict eligibility criteria to participate, collected data on other factors known to be associated with breastfeeding, and used statistical analysis to address them. In addition, the study maintained a consistent assessment time frame (8-12 hours) following delivery.

Although data collection required observation that is vulnerable to a number of biases, using single-blind study reduced the risk. The risk that the researchers' preconceptions might unconsciously bias the objective collection of data was controlled by blinding the primary investigator and research assistant to the conditions prior to and during the newborn assessment and breastfeeding observation.

Another strength of this study is its high interrater reliability ($r=.982$, $p < .01$) between the primary investigator and the research assistant in using the neonatal neurobehavioral test instrument (NACS). In addition, both observers are obstetrical nurses skilled in using the LATCH-R Breastfeeding Assessment Tool and have used it in their jobs for at least one year. In addition, maternal evaluations of the breastfeeding session at 8-12 hours of age were positively correlated with the primary investigator's and the research assistant's breastfeeding evaluation of LAC using the LATCH-R ($r=0.52$, $p=.01$). Thus, supports construct validity of the breastfeeding assessment tool.

Certain limitations of this study are identified. The first limitation relates to the research design. An ex post facto design is weak in its ability to reveal cause and effect relationships (Polit & Hungler, 1999). The study groups are not formed randomly but by a self-selecting process. Therefore, the study cannot assume that the groups being

compared were similar before the occurrence of the independent variable (Polit & Hungler, 1999). Surely, there were pre-existing differences between the study groups in this present study. The women in the epidural group were younger, mainly nulliparous, and had less breastfeeding experience compared to the women in the no-analgesia group. Pre-existing differences could account for differences found in the dependent variables.

Due to voluntary participation, non-response bias was a risk. That is, a nonrandom portion of people invited to take part in the study did not participate (Polit & Hungler, 1999). Of the 141 postpartum women who were approached within the first 12 hours after delivery, 9 declined to participate prior to study invitation. Five eligible participants declined participation after explanation of the study with invitation to participate. Demographics about those who refused participation were not obtained. This information would have been valuable in determining the nature and direction of any biases (Polit & Hungler, 1999).

Despite the strict criteria set for participant selection and to control for potential confounding factors, variables related to epidural dosage that might have influenced the findings of this study were not controlled for. Data analysis showed that there were wide variations in the type, and concentrations used for epidural, and a wide range for the duration and volume used.

Although strict eligibility criteria were used to reduce the effect of certain confounding factors, the ability to generalize the findings of this study was reduced. The interpretation and application of the results are limited to those women with similar characteristics as those who participated in the study. Women of Caucasian racial background, and who are married or living with partners were over represented in this

study. The findings of this study can only be applied to women with uncomplicated pregnancies, labours, and deliveries. The generalizability of the findings of this study is limited to healthy term infants, and to labour and delivery units where early initiation of breastfeeding, rooming-in, and demand feeding are part of the norms. Most importantly, the findings of this study can only be applied to infants who are 8-12 hours of age and to breastfeeding practice up to 4 weeks postpartum.

Information acquired through chart review depended on the accuracy of charting such as details about times epidural infusion started, total volume infused, and delivery information such as suctioning or use of oxygen. Demographic information and breastfeeding information acquired through self-report were subject to response bias, which may have affected the validity of the information obtained. However, the availability of investigators to clarify some questions may have strengthened the reliability of answers as well as reduce missing information.

Power analysis was conducted to determine adequate sample size to detect medium effect when using t-test to explore group differences. However, other inferential tests were employed in this research. The sample size requirements for each inferential test employed to detect medium effect may not have been met.

Information on the reliability and validity of LATCH Breastfeeding Assessment Tool and NACS was limited to what has been provided in the discussion of the instruments. The test for Cronbach's alpha for both LAC and LATCH-R resulted in a reliability coefficient that may have been insufficient in making group-level comparisons.

This study is also limited by the one time assessment of the breastfeeding and infant neurobehavioral status. A one- time assessment may not be sufficient to determine

infant's ability to breastfeed effectively, nor recognize any changes that occur as the infant matures.

With strengths and limitations, this study is one of the few that has explored the relationship between epidural use during labour and delivery on the initiation and continuation of breastfeeding. It is the first study to employ both neurobehavioral testing and a breastfeeding assessment tool. Finally, this study not only explored the duration of breastfeeding, but also the existence of any feeding problems for those who were still breastfeeding. The extensive data collected through interviews, chart-review and observations have strengthened the interpretability of results, determination of implications for practice, and recommendations for future research.

Implications for Practice

The purpose of this study was to look at the relationship between epidural use during labour and delivery and the initiation and continuation of effective breastfeeding. The results showed that epidural use does not affect initiation of effective breastfeeding. Some health care professionals have strong belief that epidural analgesia affect breastfeeding based on anecdotal evidence. However, the findings of this study failed to support this belief. Health care professionals must base their teaching and practice on evidence. Therefore, caution must be taken when providing information about the effects of epidural to women and their significant others who are in the process of deciding labour analgesia. This study supports informing women that epidural analgesia does not appear to affect the initiation or continuation of effective breastfeeding.

The results also showed that there is a positive relationship between neonatal neurobehavioral status and effective breastfeeding at 8-12 hours of age. There may be a

place for neurobehavioral assessment in identifying infants who may have difficulties with breastfeeding. Newborn observations should include assessment of infant tone, activity, alertness, and responsiveness. Early recognition of mother and baby dyads who may have more difficulties achieving effective breastfeeding will help in the prevention of increased breastfeeding problems, early maternal disappointment, and subsequently, early cessation of breastfeeding. Health professionals caring for the breastfeeding couple must make sure that assistance is always available during breastfeeding. Hospital nurses have the ability and are in the position to foster learning, establish skills, instill maternal confidence, and provide a positive early breastfeeding experience, which would promote continuation of breastfeeding after leaving the hospital. Most participants in this study mentioned the value of hospital nurses in helping mothers and their infants with their breastfeeding.

Furthermore, there is a positive relationship between neonatal neurobehavioral status at 8-12 hours of age and absence of breastfeeding difficulty at 4 weeks of age. This suggests that neurobehavioral assessment may also help identify infants who may continue to have breastfeeding difficulties long after discharge from the hospital. Therefore, it is important to recognize the need for additional support for these infants, not only during their hospital stay but also after discharge. The need for immediate follow-up must be communicated to the public health nurses who will take over the care of the mother and infant dyads who are breastfeeding. Public health nurses must ensure that these infants are followed closely and supported until no longer necessary.

Greater proportion of infants in the epidural group achieved less effective breastfeeding and had lower neurobehavioral scores at 8- 12 hours of age than infants in the no-analgesia group. More mothers in the epidural group reported having breastfeeding problems in hospital and at home compared to mothers in the no-analgesia group. Also, more mothers in the epidural group reported continued breastfeeding difficulties at 4 weeks compared to mothers in the no-analgesia group. These differences were not statistically significant but may be relevant in clinical practice. The trend shown by the results of this study will help care providers better anticipate mother and baby dyads who may be at greater risk for experiencing breastfeeding difficulties. Primary care providers, whether nurses or midwives should make sure that frequent assessment of breastfeeding takes place in hospital so that any difficulties or needs are identified early, and discharge planning is more meaningful. Breastfeeding assessment and support for every breastfeeding mother-baby dyad regardless of whether analgesia (if any) was used during labour and delivery is essential in their care.

During the data collection, many participants asked how breastfeeding would be measured. The use of a structured scoring system facilitated the teaching and learning process among the research participants during the breastfeeding observation for the study. The breastfeeding observation was an ideal opportunity to teach mothers about recognizing infant cues for readiness to feed, proper latch, effective sucks, swallows, positioning, and comfort. Hamelin and McLennan (2000) state that the use of an objective assessment tool (LATCH) requiring nursing presence throughout the entire feeding session allows for intense maternal teaching and support. Study participants identified education as important in improving their breastfeeding experience in hospital.

Utilization of a structured breastfeeding tool as an objective means of assessing the breastfeeding can assist nurses in recognizing the critical maternal and infant variables essential in the early breastfeeding process, in defining areas of need, and determining priorities in patient care and teaching. The continued application of a structured breastfeeding assessment tool in the community may represent a consistent approach that might improve the care for the breastfeeding mother-baby dyad.

Hospital stays are short and many families are discharged within 48 hours of delivery. Instructions and advice are essential prior to discharge. If a mother or infant has risk factors that might interfere with ongoing breastfeeding, then early postpartum follow-up by nurses in the community is vital. Mothers who participated in the study reported breastfeeding difficulties at home related to a number of reasons including sore nipples, baby not latching, not sucking, and having a sleepy baby. All community follow up should include an objective breastfeeding assessment and "hands-on" support by public health nurses or lactation consultants. Continued support in the community means making resources available and accessible. There are several community resources available to breastfeeding families, including community health units, lactation consultants, La Leche League, breastfeeding clinics, and a breastfeeding hotline. A large proportion of mothers in the study identified public health nurses as their source of help with their breastfeeding. Public health nurses are in the position to continue the care and support provided by hospital nurses to breastfeeding mother and baby dyads.

At four weeks, 17% of the participants had stopped breastfeeding. Only 59.6% continued to breastfeed exclusively. The findings of this study support previous reports that there is a rapid decline in breastfeeding the first 4-8 weeks after birth (Barber et al.,

1997; Dennis, 2002). Literature is abundant on factors affecting duration of breastfeeding. Therefore, it is important for health care professionals caring for mother and baby dyads who are breastfeeding to keep current and apply such information into practice. The findings of this study suggest that the first 4 weeks are critical in determining the continuation of exclusive breastfeeding or even continuing breastfeeding whether exclusively or not. Prenatal educators are in the position to establish breastfeeding knowledge for childbearing women. With the background knowledge, women intending to breastfeed are better prepared and equipped to manage breastfeeding. The additional education provided by nurses and/or lactation consultants in the hospital reinforces this prenatal knowledge. While in hospital, evidence-based knowledge and practice will support mothers and their infants in establishing the skills required for breastfeeding as well as recognizing potential problems and identifying those who will need further breastfeeding support after leaving the hospital. Consistent, individualized, and comprehensive education and support were identified by the study participants as important in improving their breastfeeding experience in the hospital. This is consistent with the findings of Vogel and Mitchell (1998) after conducting a focus group discussion with mothers and health care workers about their perceptions of important factors influencing breastfeeding. Communications of any breastfeeding concerns to public health nurses is imperative so that immediate and continued support is prioritized for those mother and baby dyads who need it most. Since effective breastfeeding is positively correlated with maternal satisfaction with their neonates' breastfeeding behavior, the woman's voice must be heard. The public health nurses have the ability to assist mother and baby dyads to achieve their breastfeeding goals. Collaboration between

the breastfeeding mothers, and health care providers involved with breastfeeding women is vital to a comprehensive approach to care.

Sore nipples, not latching, and "not enough milk" are the most common problems in hospital and at home identified by study participants. The same problems were also the most frequently identified reasons for early cessation of breastfeeding. Vogel and Mitchell (1998) found that both mothers and health care workers identified early experiences as central to the overall establishment of breastfeeding. Therefore, hospital nurses will be most influential in facilitating the support required by mothers in establishing their breastfeeding. Early assessment, education, and support are crucial in preventing the common breastfeeding problems. Righard and Alade (1992) found that correcting sucking techniques, and providing consistent advice and help reduced the occurrence of breastfeeding problems with nipple pain, and insufficient milk supply, and increased the duration of breastfeeding. Emphasis must be placed on: (a) proper latching and unlatching; (b) alternating breastfeeding positions to change the location maximum friction exerted by the infant's mouth during feeding; (c) avoiding prolonged non-nutritive sucking; and (d) removing infant from the breast when the breast remains painful after the first minute of breastfeeding (Bell & Rawling, 1998; Melnikow & Bedinghaus, 1994; Health Canada, 2000b). Some study participants suggested that more help with latching would improve their breastfeeding experience. Teaching mothers how to care for already sore nipples is also essential (Bell & Rawling, 1998). Livingstone (1996) confirms that one of the common reasons for early cessation of breastfeeding is insufficient milk syndrome. Inadequate milk synthesis, inefficient milk transfer or inadequate infant milk intake may cause inadequate milk supply (Livingstone, 1996;

Riordan & Auerbach, 1993). Anticipatory guidance regarding common indicators of adequate milk supply will avoid anxiety and prevent premature cessation of breastfeeding (Bear & Tigges, 1993). Education should include growth (appetite) spurts that typically occur at approximately 24-48 hours, 3 weeks, 6 weeks, and 3 months of age (Bear & Tigges, 1993; Riordan & Auerbach, 1993). Unless a mother has been prepared for these appetite spurts, she may assume that her milk supply is inadequate. One study participant stated that if she had known what to expect with feeding frequency, she would not have supplemented.

The implications for practice suggested in this section require knowledgeable and skilled nurses or lactation consultants who can be available to provide the much needed guidance and support by the mother and baby dyads with their early breastfeeding experiences. Hospital administrators and nurse managers must become aware of these needs and recognize the necessity to reevaluate the adequacy of resources available.

The findings of this study emphasize the importance of early identification of individuals at risk for breastfeeding difficulties. This can be achieved through neurobehavioral assessment and objective breastfeeding assessment. Nurses and lactation consultants in hospital involved with the early breastfeeding experience are most influential in establishing the basic knowledge, skills, and support required by mother and baby dyads. Communication between hospital nurses and public health nurses are crucial in the continuity of supportive breastfeeding care. There is also a place for an objective breastfeeding assessment tool in the community setting. Public health nurses are in the position to reinforce breastfeeding knowledge and skills, provide

continued assessment, encouragement, and "hands-on" support to breastfeeding mother and baby dyads.

Recommendations for Future Research

The findings of this study showed that more infants in the no-analgesia group were able to breastfeed effectively and scored higher in the neonatal neurobehavioral testing at 8-12 hours of age than infants in the epidural analgesia group. However, the differences were not statistically significant. Therefore, suggestions for future research include a further look at the effect of epidural on the initiation of effective breastfeeding and neonatal neurobehavioral outcome. It is important to assess if a similar pattern of results is found when more extraneous variables are controlled. This means controlling for the type of epidural medication used as well as the duration and volume infused. One epidural solution may be selected during the study period. It is also important to limit the range in duration or volume, that is, include only those who had continuous epidural for a certain amount of time (e.g. 2-4 hours), and/or received a given total volume (e.g. 30-50 ml of epidural solution). These ranges are selected arbitrarily as it is not known which epidural solution (if any) affect breastfeeding, or what volume would show any effects. Although this added control eliminates additional confounding factors, it will also limit the generalizability of the findings.

Future research may be a replication of this study using a larger sample size to detect small effects. A replication study using different breastfeeding assessment tool and/or neurobehavioral testing would assess if a similar pattern of results is found when other instruments are employed in data collection

More mothers in the no-analgesia group reported difficulties with latching in hospital than mothers in the epidural group, a difference approaching significant level. This finding raises the question on why this would be the case. The difference between the epidural group and no analgesia group in effective breastfeeding at 8-12 hours of age was not statistically significant. However, this difference in proportions of mothers reporting difficulty with latching during hospital stay warrants further investigation. The finding of this study was limited by making only one time observation of breastfeeding to determine effectiveness. There may be greater potential to discover breastfeeding differences (if any) between the two groups if multiple breastfeeding observations are employed. If differences are not found, there is also the potential to identify infant feeding patterns as infant matures.

This research found that neonatal neurobehavioral ability is positively related to effectiveness of breastfeeding at 8-12 hours and at 4 weeks of age. Therefore, an evaluation research to assess the value of neonatal neurobehavioral assessment in the hospital in identifying infants who may have breastfeeding difficulties both in hospital and following discharge, may identify an intervention that could have an impact on the support and protection of breastfeeding.

Twenty-two percent of mother who were still breastfeeding at 4 weeks postpartum reported continued breastfeeding difficulties. It is anticipated that further investigation in this area will enhance the breastfeeding support currently available to the breastfeeding mother and baby dyads. Future research in this area may discover reasons why current supports are not being accessed, or discover any gaps in community supports currently available. The use of a structured breastfeeding assessment tool in the hospital

has been beneficial in identifying mother and baby dyads requiring additional help while in hospital and continued breastfeeding support after discharge. Using a similar structured breastfeeding assessment tool in the community may also prove beneficial in identifying mother and baby dyads needing continued breastfeeding support at home. An evaluation research could identify the impact of implementing a structured breastfeeding assessment tool in the community.

Data in this study also uncovered two trends associated with epidural that are clinically relevant. First, data showed that almost half of the study participants who used epidural were nulliparous women. Inspite of the popularity of epidural, controversy remains regarding the effects of intrapartum use on the mother, fetus, labour and delivery, and the neonate, yet more nulliparous women are choosing to have epidural. These findings warrant further investigation. Research on factors that influence nulliparous women's choices should be explored. It is anticipated that greater understanding of these choices will help health care providers identify the unique needs of this group of women.

Secondly, the duration of first and second stage of labour for the epidural group was approximately doubled compared to the no-analgesia group. Howell and Chalmers (1992) (as cited in Health Canada, 2000b) documented the negative effect of epidural on the progress of labour, especially among women having their first babies. Therefore, the difference in proportion of nulliparous women who used epidural and those who did not have any analgesia in this study may explain the difference in the duration of labour between the two groups. However, when controlling for parity, previous research have found increased duration of labour with the use of epidural (Dickinson et al., 1997; Howell et al, 2001; Manyonda et al., 1990; Thorp et al., 1991; Thorp et al., 1993).

Further investigation of the findings of this study will help explore the relationship between epidural use and duration of labour. Did participants in this study select to have epidural because they were already having long labours? Did epidural use affect the duration of labour?

Future investigations that would further explore the effects of epidural (if any) on the initiation and continuation of breastfeeding, are warranted. Research of this kind will help identify factors that may affect the breastfeeding relationship between the mother and her infant, and assists health care professionals in prioritizing care and, as such, makes valuable contribution to the care of breastfeeding families. Continued research will always add to the body of evidence that would enable care providers to reevaluate their current practice and knowledge.

Conclusion

Health care is constantly evolving to incorporate practices that are evidence-based. Current practices and knowledge are continuously being questioned in order to improve health care. In the obstetrical setting, the effect of epidural on breastfeeding remains inconclusive. The purpose of this study was to examine the relationship between epidural use during labour and delivery and the initiation and continuation of effective breastfeeding. The conclusions that can be made from this study are:

1. Epidural use during labour and delivery is not related to the initiation and continuation of effective breastfeeding.
2. Epidural use during labour and delivery is not related to infant neurobehavioral outcome.
3. Infant neurobehavioral status and effective breastfeeding are positively correlated.

The application of Mutual Regulation Model and The Skill Theory provided a logical connection between the variables in this study. The physiologic relationship between the mother and her fetus, and the interrelationships of influencing factors in the maternal and infant relationship related to breastfeeding is highly complex. The findings of this study add to current knowledge about factors that may or may not affect the unique breastfeeding relationship between the mother and her infant. Although results of this study did not support many of the study hypotheses, findings may serve as a stepping-stone for future research as well as a source of new information that would require health care providers to reexamine their current thinking and practice.

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Appendix A

Ethical Approval and Approval for Access

UNIVERSITY OF MANITOBA | Office of the President

Office of Research Services
244 Engineering Building
Winnipeg, MB R3T 5V6
Canada
Telephone: (204) 474-8418
Fax: (204) 261-0325

APPROVAL CERTIFICATE

18 July 2001

TO: **Zorina Marzan Chang**
Principal Investigator

FROM: **Lorna Guse, Chair**
Education/Nursing Research Ethics Board (ENREB)

Re: **Protocol #E2001:057**
"Epidural Analgesia During Labour and Delivery: Effects on the Initiation and Continuation of Effective Breastfeeding"

Please be advised that your above-referenced protocol has received human ethics approval by the **Education/Nursing Research Ethics Board**, which is organized and operates according to the Tri-Council Policy Statement. This approval is valid for one year only.

Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.

UNIVERSITY OF MANITOBA | OFFICE OF RESEARCH SERVICES

ORS
244 Engineering Building
Winnipeg, Manitoba R3T 2N2
Telephone (204) 474-8418
Fax (204) 261-0325
www.umanitoba.ca/vpresearch/ors

RENEWAL APPROVAL

28 August 2002

TO: **Zorina Marzan Chang**
Principal Investigator

FROM: **Lorna Guse,** Chair
Education/Nursing Research Ethics Board (ENREB)

Re: **Protocol #E2001:057**
"Epidural Analgesia During Labour and Delivery: Effects on the Initiation and Continuation of Effective Breastfeeding"

Please be advised that your above-referenced protocol has received approval for renewal by the **Education/Nursing Research Ethics Board.** This approval is valid for one year only.

Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.

Health Sciences Centre

OFFICE OF THE DIRECTOR OF RESEARCH

MS7 - 820 SHERBROOK STREET
WINNIPEG, MANITOBA R3A 1R9

DIAL DIRECT (204) 787-4514
FAX (204) 787-4547

MEMORANDUM

DATE: October 1, 2001

TO: Ms Z. Marzan Chang, Principal Investigator, WRS2

FROM: Robert P. Murray, Ph.D., Acting Director of Research, HSC, MS7

SUBJECT: **PROTOCOL APPROVAL:** EPIDURAL ANALGESIA DURING LABOUR AND DELIVERY: EFFECTS ON THE INITIATION AND CONTINUATION OF EFFECTIVE BREASTFEEDING.

ETHICS #: E2001:057 RIC #: RI01:104

The above-named protocol, **has been evaluated and approved** by the H.S.C. Research Impact Committee.

My sincere best wishes for much success in your study.

cc: Dr. K. Oen, Chairperson, PRCC, RR149
Ancillary Services, Finance Division, HSC

/ks

interoffice
MEMORANDUM

Local: 3623 Fax: 237-9860

TO: Zorina Marzan Chang

Winnipeg, MB
R3Y 1K3

FROM: Dr. D. Kassum
Co-Chairperson, Research Review Committee

DATE: October 24, 2001

SUBJECT: **Experimental Protocol Submission - Response**

This is to inform you that I have reviewed your response regarding the protocol entitled "Epidural Analgesia During Labour and Delivery: Effects on the Initiation and Continuation of Effective Breastfeeding", Ref # RRC/2001/0271.

As the recommendations by the Research Review Committee have been met, final approval is now granted.

In our letter dated October 3, 2001, we requested a signed SOP Agreement from you. This Agreement is not needed and was included in the letter in error. Additionally, there will not be a charge by Health Records for this study. Thank you for your cooperation.

DK/mdh

cc: Ms. K. Neufeld, Director - Chief Nursing Officer
Dr. S. Lucash, President of the Medical Staff
Ms. H. Milan, Pharmacy Department
Ms. D. Halhead, Financial Services
Ms. D. French, Health Records
Ms. A. Lemieux, Manager, Quality, Research and Evaluation

Appendix B

Sample Letter: Research Notification

Appendix B
Letter

(Date)

(Obstetricians, and Midwives with admitting privileges
to Health Sciences Centre and St. Boniface General Hospital)
Address

To _____:

I am a Registered Nurse enrolled in the Master of Nursing Program at the University of Manitoba. In fulfillment of the requirement of the program, I am now in the process of doing my thesis. The working title of my thesis is "Epidural analgesia during labour and delivery: Effects on the initiation and continuation of effective breastfeeding". Epidural analgesia is the most effective method of pain relief for women during labour and delivery. Like other medical interventions, it is accompanied by risks related to the labour and delivery process, mother, fetus, and the newborn. The health, nutritional, psychosocial, environmental, and economic benefits of breastfeeding are reasons why women choose breastfeeding. However, events and practices occurring during the labour and delivery period and in postpartum may challenge the opportunity for mothers to carry out their plans.

The purpose of this study is to examine the effects of epidural analgesia use during labour and delivery on the initiation and continuation of effective breastfeeding. Research in this area will be useful in: (1) the identification of medical intervention that may adversely affect the newborn, (2) anticipating newborn needs following delivery, and (3) increasing knowledge to facilitate true informed choice for childbearing women.

Participants will be recruited at the Women's Family Birthplace and LDRP Unit at St. Boniface General Hospital. Investigation will include newborn assessment using the Neurologic and Adaptive Capacity Scoring System developed by Amiel-Tison, Barrier, and Shnider, and breastfeeding observation at 8-12 hours postpartum. Some of the patients who volunteer to participate in the study may be your patients.

This project has been approved by the Education and Nursing Research Ethics Board at the University of Manitoba. This project has received approval for access from Department of Research at Health Sciences Centre and St. Boniface General Hospital.

If you have any questions, or wish to discuss this further, you may contact my research advisor Maureen Heaman at 474-6222 at the Faculty of Nursing, University of Manitoba or myself at (w) 787-2115 or (h)

Yours truly,

Zorina Marzan Chang, BN, IBCLC

(Date)

(Women's Family Birthplace,
LDRP Unit St. Boniface General Hospital Unit Managers,
and Nursing Staff
Address

To _____:

I am a Registered Nurse enrolled in the Master of Nursing Program at the University of Manitoba. In fulfillment of the requirement of the program, I am now in the process of doing my thesis. The working title of my thesis is "Epidural analgesia during labour and delivery: Effects on the initiation and continuation of effective breastfeeding". Epidural analgesia is the most effective method of pain relief for women during labour and delivery. Like other medical interventions, it is accompanied by risks related to the labour and delivery process, mother, fetus, and the newborn. The health, nutritional, psychosocial, environmental, and economic benefits of breastfeeding are reasons why women choose breastfeeding. However, events and practices occurring during the labour and delivery period and in postpartum may challenge the opportunity for mothers to carry out their plans.

The purpose of this study is to examine the effects of epidural analgesia use during labour and delivery on the initiation and continuation of effective breastfeeding. Research in this area will be useful in: (1) the identification of medical intervention that may adversely affect the newborn, (2) anticipating newborn needs following delivery, and (3) increasing knowledge to facilitate true informed choice for childbearing women.

Participants will be recruited at the Women's Family Birthplace and LDRP Unit at St. Boniface General Hospital. Investigation will include newborn assessment using the Neurologic and Adaptive Capacity Scoring System developed by Amiel-Tison, Barrier, and Shnider, and breastfeeding observation at 8-12 hours postpartum.

This project has been approved by the Education and Nursing Research Ethics Board at the University of Manitoba. This project has received approval for access from Department of Research at Health Sciences Centre and St. Boniface General Hospital.

Your support will be very much appreciated. A brief presentation about the purpose, nature, and procedure of the study will be presented to all unit staff prior to commencing the study.

If you have any questions, or wish to discuss this further, you may contact my research advisor Maureen Heaman at 474-6222 at the Faculty of Nursing, University of Manitoba or myself at (w) 787-2115 or (h)

Yours truly,

Zorina Marzan Chang, BN, IBCLC

Appendix C

Research Eligibility Criteria

Research: Epidural analgesia during labour and delivery: Effects on the initiation and continuation of effective breastfeeding.

Eligibility Criteria

- Have delivered in the LDRP units (either Women's Hospital or St. Boniface General Hospital)
- Received ***no forms of analgesia*** during labour and delivery OR received ***only epidural*** during labour and delivery
- Is ***breastfeeding***
- ***Less than 8 hours postpartum***
- Read or speak English
- 18 years old and up
- singleton pregnancy
- parity ≤ 5
- at least 3 prenatal visits documented
- ≥ 37 weeks and ≤ 42 weeks gestation
- baby is rooming-in
- anticipated to go home with baby
- has telephone contact number

Exclusion Criteria

- Presence of any chronic health condition
- Associated health concerns during pregnancy such as Pregnancy Induced Hypertension controlled with medication (PIH), Insulin Dependent Gestational Diabetes (IDGD), anemia (90 g/L), obesity (> 40 body mass index)
- Alcohol or substance use during pregnancy
- Baby has congenital anomalies
- Baby is receiving any intravenous therapy either for blood sugars or antibiotics
- Mother has undergone any procedure requiring anesthetics within 8-12 hours after delivery.

Participants will be withdrawn from the study if:

- Use of pain medication during labour and delivery become known to the primary investigator or research assistant during the observation and assessment period.

OR

- Participants elect to withdraw from the study.

Appendix D

Sample Scripts

Sample Scripts

For Nursing Staff

"Zorina Chang is a Master of Nursing student at the University of Manitoba. She is doing a study about the effect of epidural use during labour and delivery on the initiation and continuation of effective breastfeeding. The study would compare babies born to mothers who receive epidural with those who are born to mothers who did not get any pain medicine at all. Are you willing to talk to her or her research assistant so she can explain it and you can decide if you want to participate?"

(If yes) Please ***do not tell*** them whether or not you received epidural during your labour and delivery. It is very important for the study that they ***do not know*** this.

For Primary Investigator and Research Assistant during recruitment

Hello, my name is _____. I am the primary investigator/research assitant involved in the study about the effects of epidural analgesia use during labour and delivey on the initiation and continuation of effective breastfeeding. Your nurse has informed me that you are interested in learning more about the research and may consider participating. Is this a good time for me to talk to you about the research? (If yes, provide the written invitation to participate and present verbally. Answer questions as required) or (If no, arrange a mutually convenient time within the next hour).

Having the information provided to you about the purpose, nature and procedures of the study, are you willing to participate in this study? (If yes, present the consent form and allow potential participant to read or offer to read to her if she wishes).

(If participating) Thank you for agreeing to participate in this study.

(If not participating) Thank you for time and for considering participation.

For primary investigator or research assistant during withdrawal of participation.

I am sorry to inform you that your participation has been withdrawn from the study because_____.
Thank you for participating and for your time.

OR

I am sorry that you are withdrawing from the study. Thank you for having considered being involved in the study and for your time.

For primary investigator or research assistant during Breastfeeding Follow-up Interview.

Hello, this is _____, the primary investigator/research assistant for the study looking at the effects of epidural analgesia use during labour and delivery on initiation and continuation of effective breastfeeding. (May engage in an informal conversation with participant as appropriate).

It has been 4 weeks since the baby was born, and I would like to do the second part of the study. Is this a good time to do the follow-up interview? (If yes, start interview, reminding participants that they are not obligated to answer any questions they are not comfortable answering. If no, arrange a mutually convenient time within the same day or following day.)

(After completion of interview).
We have now completed the study. Do you have any questions?
Your participation is very valuable to this research.
Thank you for your time and all your help. All the best to you and your baby.

Appendix E

Invitation to Participate

Invitation to Participate

My name is Zorina Marzan Chang and I am a Registered Nurse enrolled in the Master of Nursing Program at the University of Manitoba. I am doing a study to find out if epidural use during labour and delivery for pain relief affects the ability of babies to breastfeed. I am asking you to take part in this study that will compare babies born to mothers who receive epidural with those who are born to mothers who did not get any medicine at all.

Your participation in the study is entirely voluntary. If you choose not to participate, your care will not be affected.

If you take part in the study, you will be asked to fill out a brief form about yourself including questions about your age, education, and income. You are not obligated to answer all the questions. It will take about 5 minutes to fill out and if you wish, the research assistant or I can help you.

If you agree to participate in the study, a research assistant or I will do our own newborn test and observe a breastfeeding session within the 8-12 hour period following delivery. The research assistant or I will identify ourselves to you and will be available to answer any questions you may have. The newborn test will check for your baby's tone, reflexes, and senses. This will be carried out in your room before your breastfeeding session in that 8-12 hour period following the delivery and will take approximately 5 minutes to do. The breastfeeding session will be observed for 15 minutes. After the feeding observation, you will be asked how you felt about the breastfeeding session and your answer will be recorded. The research assistant or I are not to ask you any questions about your labour and delivery or whether you received anything for pain. In agreeing to participate, I ask you not to discuss your labour and delivery or mention what you received for labour pain if any. If the researchers learn about your use of medication prior to the completion of assessment or observation, your participation will be withdrawn. The research assistant or I will be there strictly to observe the breastfeeding. Therefore, should you require any assistance during this time, your nurse will be notified to help you.

After completing the newborn test and breastfeeding observation, both your hospital chart and baby's chart will be reviewed to collect additional information about your labour and delivery such as the type of medication used (if any), progress of your labour, your baby's weight, and Apgar scores.

As part of the study, you will receive a follow-up phone call at approximately four weeks following delivery. The phone call will involve asking questions about your feeding practice (breastfeeding or not) during that time. It will take approximately 10 minutes. Again you will not be obligated to answer all the questions.

You may withdraw from the study at any time and it will not affect your care. The research assistant or myself will inform you if your participation is withdrawn (which could happen at any time during your hospital stay) or following completion of your participation during the follow-up phone call at four weeks.

All information gathered in the course of the study would be kept completely confidential, and at no time will your identity be revealed. However, if child abuse is disclosed, the research assistant or I are obligated by law to report the abuse. Your name will not be on any of the data collection records. A code number will be assigned to you and will appear on all the forms. Your name can be matched to the forms at a later date. Access to the data is restricted to the research assistants, faculty advisor, statistician, and myself. The results will be based on group data, not individual responses. All data will be stored in a locked filing cabinet and destroyed when the study is completed. The data gathered in this study will be used for my master's thesis. The results of the study, presented as group data, may be published in a journal article. A summary of the study findings will be made available to those who would like them.

Although there will be no immediate benefits to participants, the study may produce valuable information about the effect of epidural, if any, on breastfeeding which will help nurses better anticipate the needs of mother and infant couples who are breastfeeding. This research will also provide valuable information for future mothers in their decisions about pain management during labour and delivery. There are no known negative consequences to study participants. This project has been approved by the Education and Nursing Research Ethics Board at the University of Manitoba and any complaint regarding a procedure used in this study may be reported to the Human Ethics Secretariat (474-7122).

Thank you for considering this opportunity to help us gain more information about the effect of epidural, if any, on breastfeeding. If you agree to participate, you will be asked to sign consent. The consent is for you and for your baby who is not legally or practically able to give their valid consent to participate. If you have any questions, or wish to discuss this further, you can contact my research advisor Maureen Heaman at 474-6222 at the Faculty of Nursing, University of Manitoba or myself at (h) or 787-2115 (w).

Thank you,

Zorina Marzan Chang, BN, IBCLC

Appendix F

Consent to Participate

Helen Glass Centre for Nursing
Winnipeg, Manitoba
Canada R3T 2N2
Telephone (204) 474-7452
Fax (204) 474-7682

UNIVERSITY OF MANITOBA | Faculty of Nursing

Consent to Participate

Epidural analgesia during labour and delivery:
Effects on the initiation and continuation of effective breastfeeding

I, _____, agree to participate in a research project that will look at the effects of epidural analgesia during labour and delivery on the initiation and continuation of effective breastfeeding. Zorina Marzan Chang, a Master of Nursing student at the University of Manitoba, is conducting the research. I understand that my participation in this study is entirely voluntary. I am free to refuse to answer any questions I consider personal or objectionable. I also understand that I may withdraw my participation at any time, without affecting my care.

I have read the attached information sheet on this study. I understand that my participation includes filling out a brief form, that the primary investigator or a research assistant will be doing a newborn assessment (approximately 5 minutes), and observing at least 15 minutes of a breastfeeding session, within the 8-12 hour period after delivery. I am also aware that the primary investigator or a research assistant will ask me how I felt about the breastfeeding session following their observation, which will be recorded as part of the study. In participating, I agree not to discuss the course of my labour and delivery with the primary investigator or the research assistant or provide any information about my labour pain management while the study is underway. I understand that my participation may be withdrawn if the researchers learn my use of pain medication during labour and delivery before the newborn assessment and breastfeeding observation is completed. I also understand that if withdrawn from the study, the care I will receive will not be affected.

I am aware and agree that the primary investigator or research assistant will read both my chart and my baby's chart for additional information about the labour and delivery such as the type of medication used (if any), progress of my labour, my baby's weight, and Apgar scores. In participating, I am agreeable to being called at four weeks following delivery, as a follow-up portion of the study to find out about my feeding practice at that time. I am aware that the phone call will involve answering questions that could take approximately 10 minutes to complete.

I understand that my identity will not be revealed at any time or to any one. I am also aware that if child abuse is disclosed, Zorina Marzan Chang and her research assistant are obligated by law to report the abuse. I understand that my name will not be placed in any of the data forms. Health records that contain my identity will be treated as confidential in accordance with the Personal Health Information Act of Manitoba, and only used for research purposes. I am aware that access to my data will be available only to Zorina Marzan Chang, her advisor Maureen Heaman, research assistant, and a statistician, who are directly involved in this research project. My name will not be linked with the results of the study, or in any future presentations or publications.

I understand that in signing this consent, I am also giving consent for my baby who is not legally and practically able to give their valid consent to participate.

This research has been approved by the Education and Nursing Research Ethics Board at the University of Manitoba. I understand that I may report any complaints regarding a procedure in this study to the Human Ethics Secretariat (474-7122). I have had all my questions answered to my satisfaction and freely agree to participate in the study. I have been offered a summary of the project. I understand that I may contact either Zorina Marzan Chang (or 787-2115) or her advisor, Maureen Heaman (474-6222), at the Faculty of Nursing, University of Manitoba, if I have concerns, questions, or need additional information.

Date: _____

Participant: _____ Witness: _____

(2 copies – one for participant and one for the researcher)

Epidural analgesia during labour and delivery:
Effects on the initiation and continuation of effective breastfeeding

If you would like to receive a summary of the results of this study, please complete the information below and give it to the Researcher or to the Research Assistant. Thank you.

Name: _____

Address: _____

_____

Appendix G

Demographic and Childbirth History Information

Epidural analgesia during labour and delivery: Effects on the initiation and continuation of effective breastfeeding.

Participant Identification # _____ Facility: (circle one)
Women's 1 or St. Boniface 2

Demographic and Childbirth History Information

PART I: (To be completed by the participant and/or researcher at the time of consent)

1. How old are you in years? _____

2. What was your total combined family income (before taxes) last year?
   Less than 10,000 _____
   $10,000-24,999 _____
   $25,000-39,999 _____
   $40,000-54,999 _____
   $55,000-69,999 _____
   $70,000-89,999 _____
   $90,000 and over _____

3. Please circle the highest education grade you have completed

Grade School
1 2 3 4 5 6 7 8

High School
9 10 11 12

Community College/Vocational School
1 2 3 4

University
1 2 3 4 5 6 7 8 9 10

4. What is your marital status?
   Single _____
   Married/living with a partner _____
   Separated _____
   Divorced _____
   Widowed _____

5. What is you racial background?
   White _____
   Aboriginal _____
   Asian _____
   Black _____
   Other _____

Participant Identification # _____ **History Information page 2**

6. Have you taken any prenatal classes? Yes _____ (how many: _____) No _____

7. Do you smoke? Yes _____ (How many cigarettes do you usually smoke per day? _____
   No _____

8. Have you breastfed before? Yes_____ No_____
   If yes, circle for which child and indicate how long in days, weeks, or months: 1st _____ 2nd _____ 3rd _____ 4th _____ 5th _____

9. Rate the following based on the importance of their support of your breastfeeding decision (4 being the most important and 1 least important). Please indicate how supportive they are with your breastfeeding decision.

___*Partner*	Very Supportive ___	Somewhat Supportive ___	Not supportive___	N/A ___
___*Mother*	Very Supportive ___	Somewhat Supportive ___	Not supportive___	N/A ___
___*Friends*	Very Supportive ___	Somewhat Supportive ___	Not supportive___	N/A___
___*Others*	Very Supportive___	Somewhat Supportive ___	Not supportive___	N/A___

(Part II and Part III to be completed by primary investigator or research assistant)

PART II:

1. Gavida _____ Para _____

2. Gestation _____(weeks)

3. Duration of Labour (hours and minutes)
   First Stage _____
   Second Stage _____
   Third Stage _____

4. Time of Delivery _____

5. Instrumental delivery yes ____ (circle: vacuum or forceps) no_____

6. Epidural:
   Type: Circle:
   1 Bupivacaine 0.05% with Fentanyl 2mcg/ml and Epinephrine 2 mcg/ml
   Rate: 10 11 12 13 14 ml/hr
   2 Bupivacaine 0.04% with Fentanyl 2mcg/ml and Epinephrine 2 mcg/ml
   Rate: 10 11 12 13 14 ml/hr
   3 Bupivacaine 0.03% with Fentanyl 2mcg/ml and Epinephrine 2 mcg/ml
   Rate: 10 11 12 13 14 ml/hr
   4 Bupivacaine 0.0625 % with Fentanyl 2mcg/ml and Epinephrine 2 mcg/ml
   Rate: 6 7 8 9 10 11 12 ml/hr

Participant Identification # _____ **History Information page 3**

5 Bupivacaine 0.1% with Fentanyl 2mcg/ml
Rate: 6 7 8 9 10 11 12 ml/hr
6 Ropivacaine 0.08% with fentanyl 2 mcg/ml
Rate: 10 11 12 13 14 15 ml/hr
7 Ropivacaine 0.2%
Rate: 4 5 6 7 8 9 10 11 12 ml/hr

Date and time established: _____
Date and time(s) infusion stopped: _____
Change in epidural rates:
Rate: _____ ml/hr. Date & time start: _____ Date & time stopped: _____
Rate: _____ ml/hr. Date & time start: _____ Date & time stopped: _____
Rate: _____ ml/hr. Date & time start: _____ Date & time stopped: _____

Complications with epidural (Circle)
1 Maternal Hypotension Corrective action: _____
Duration: _____
2 Fetal Bradycardia Corrective action: _____
Duration: _____
3 Maternal temp Corrective action: _____
Duration: _____
4 Others & duration: _____
Corrective action: _____

Bolus: Circle: 1 Bupivacaine 0.25% (5ml q1h prn) Times: _____
2 Ropivacaine 0.2% (3 4 5 ml) Times: _____
3 Fentanyl 50 mcg diluted to 5 ml with preservative free normal saline (q4h prn) Times: _____
4 Other _____ Times: _____

Date & time epidural catheter removed: _____

7. Episiotomy _____ Tear _____

8. Use of local anesthetics (Circle) Yes___No___
If yes, Type and amount _____
Time: _____

10. Syntocinon during labour: yes___ no ____
Duration from initiation to delivery: _____
Rate at delivery:_____mu/min

11. Antibiotic: For GBS pos ____ Maternal Fever ____
Prolonged rupture of membrane ____ Other_____

Participant Identification # _____ **History Information page 4**

Type: _____ Dose:_____ Total given: _____
Type: _____ Dose:_____ Total given: _____

PART III: Infant

1. Sex 1 Male or 2 Female

2. Birthweight _____(grams)

3. Nuchal Cord Yes ____ (circle: loose, tight, clamped, cut) No ____

4. Apgars 1 min _____ 5 min_____

5. Suctioning Yes _____ No ____

6. Oxygen therapy Yes ____ per mask____ (How long? _____)
   per PPV____ (How long? _____)

7. Meconium yes _____(circle one: thin or thick) no _____

8. Percentile: (Circle)
   1. > 90^{th} (LGA)
   2. < 10^{th} (SGA)
   3. between 10^{th} and 90^{th} (AGA)

9. Umbilical Cord Blood Gas Values:

	Venous	Arterial
pH	(7.35 ± .05)	(7.28 ± .05)
PO2	(29 ±5.9)	(18 ± 6.2)
PCO2	(38 ±5.6)	(49 ± 8.4)
Base Excess	(-4 ± 2)	(-4 ± 2)
HC03	(20± 2.1)	(22 ± 2.5)

10. Use of supplementary or complementary feeds (prior breastfeeding observation):
    1 Yes Circle for which feed (s): 1^{st} 2^{nd} 3^{rd} 4^{th} 5^{th} 6^{th} 7^{th}
    Circle all methods used: Bottle SNS FF Cup
    Reason: _____
    2 No

Appendix H

The Neurologic and Adaptive Capacity Scoring System (NACS)

Epidural analgesia during labour and delivery: Effects on the initiation and continuation of effective breastfeeding.

Neurobehavioral Assessment Record (NACS)

Participant Identification # _____
Date and time: _____
Age: _____in hours and minutes
Examiner:_____

			0	1	2
Adaptive Capacity	1. Response to sound		absent:	mild:	vigorous:
	2. Habituation to sound		absent:	7–12 stimuli:	< 6 stimuli:
	3. Response to light		absent:	mild:	brisk blink or startle:
	4. Habituation to light		absent:	7–12 stimuli	< 6 stimuli
	5. Consolability		absent:	difficult:	easy:
Total			Adaptive Capacity		
			0	1	2
Passive Tone	6. Scarf sign		encircles the neck:	elbow slightly passes midline:	elbow does not reach midline:
	7. Recoil of elbows		absent:	slow: weak:	brisk: reproducible:
	8. Popliteal angle		>110°	100°–110°	≤ 90°
	9. Recoil of lower limbs		absent:	slow: weak:	brisk: reproducible:
Active Tone	10. Active contraction of neck flexors (from lying position)		absent or abnormal:	difficult:	good: head is maintained in the axis of the body:
	11. Active contraction of neck extensors (from leaning forward position)		absent or abnormal:	difficult:	good: head is maintained in the axis of the body:
	12. Palmar grasp*		absent:	weak:	excellent: reproducible:
	13. Response to traction (following palmar grasp)		absent:	lifts part of the body weight:	lifts all of the body weight:
	14. Supporting reaction (upright position)		absent:	incomplete: transitory:	strong: supports all body weight:
*Primary Reflexes	15. Automatic walking*		absent:	difficult to obtain:	perfect: reproducible:
	16. Moro reflex*		absent:	weak: incomplete:	perfect: complete:
	17. Sucking*		absent:	weak:	perfect: synchronous with swallowing
General Assessment	18. Alertness		coma:	lethargy:	normal:
	19. Crying		absent:	weak: high pitched: excessive:	normal:
	20. Motor activity		absent or grossly excessive:	diminished or mildly excessive:	normal:
Total			Neurological		

Total Score ☐ At _____ minutes of life

Amiel-Tison, C., Barrier, G., Shnider, S.M., Levinson, G., Hughes, S.C., & Stefani, S.J. (1982). A new neurologic and adaptive capacity scoring system for evaluating obstetric medications in full-term newborns. Anesthesiology, 56 (5), p.341.

Appendix I

LATCH-R Feeding Record

Mother's Perception of Breastfeeding

Epidural analgesia during labour and delivery: Effects on the initiation and continuation of effective breastfeeding.

Participant Identification # _____
Date and Time: _____ Age in hours and minutes: _____
Examiner: _____

LATCH-R FEEDING RECORD

Type: BR-breast F-formula EBM-Expressed breast milk **Amount**: Breast: time and side
Method: B-bottle SNS-Supplemental nursing system FF-finger feeding C-cup Formula: mls.
****Based on 15 minutes observation****

Date	Time	Feeding	L	A	T	C	H	R	Total	Comments

LATCH-R BREASTFEEDING ASSESSMENT GUIDE

	0	1	2
LATCH	• Too sleepy or reluctant • No latch achieved	• Repeated attempts • Hold nipple in mouth • Stimulate to suck	• Grasp breast • Tongue down • Lips flanged • Rhythmical suckling
AUDIBLE SWALLOWING	• none	• a few with stimulation	• spontaneous and intermittent < 24 hrs. • spontaneous and frequent >24 hrs.
TYPE OF NIPPLE	• Inverted	• flat	• everted after stimulation
COMFORT (Breast / Nipple)	• engorged • cracked, bleeding, large blisters or bruises • severe discomfort	• filling • reddened, small blisters or bruises • mild/moderate discomfort	• soft • non-tender
HOLD	• full assist	• minimal assist • teach one side, mother does other • staff holds, mother takes over	• no assist from staff • mother able to position and hold baby
MOTHER'S RESPONSIVENESS TO INFANT CUES, CONFIDENCE TO BREASTFEED	• mother does not respond to infant feeding cues • mother does not feel confident about her ability to breastfeed	• mother requires help to interpret infant feeding cues • mother requires confidence building	• mother responds appropriately to infant feeding cues • mother feels confident about her ability to breastfeed

MOTHER'S PERCEPTION OF BREASTFEEDING (Circle One)
After 15 minutes of breastfeeding observation

0 Not Pleased 1 Somewhat pleased 2 Pleased 3 Very Pleased

Winnipeg Regional Health Authority | Office régional de la santé de Winnipeg

July 18, 2001

Zorina Marzan Chang
91 Battleford Bay
Winnipeg, MB R3Y 1K3

Dear Zorina:

RE: LATCH-R Breastfeeding Assessment Tool

Thank you for your letter of July 13, 2001 requesting permission to use the LATCH-R Breastfeeding Assessment Tool.

Permission is hereby granted for the use of this tool to assist with your proposed study. The topic is quite interesting and we look forward to reviewing the outcome.

Best wishes in your studies.

Sincerely,

Beth Brunsdon-Clark, Nursing Director,
Women's Health Program

BETH BRUNSDON-CLARK RN, BN, MN
Nursing Director
Women's Health Program

Women's Hospital, WR117
735 Notre Dame Avenue
Winnipeg, Manitoba R3E 0L8

Office: (204)787-3987
FAX: (204)787-2887
E-mail:bbrunsdon-clark@hsc.mb.ca

From: "Jensen | **Block Address** | **Add to Address Book**

To: "' ,m>

Subject: Latch assessment tool use

Date: Wed, 1 Aug 2001 12:27:49 -0700

I am responding to your request to use LATCH in your research. I and the other authors are pleased to give you permission to use the tool with authorship cited. This email should serve to give you permission. If you need written permission I would be happy to mail it to you. We have been very interested in the epidural question! It has become a very popular choice of analgesia in the area that we practice and so we look forward to the results of your study.

Sincerely,

Debbie Jensen RNC, IBCLC

Appendix J

Name and Phone Record for Follow-up

Research: Epidural analgesia during labour and delivery: Effects on the initiation and continuation of effective breastfeeding.

Name	Phone #	DOB of infant	ID #	Hospital # A=HSC B=SBG	Date at 4 weeks

Appendix K

Breastfeeding Follow-up Interview

Breastfeeding Follow-Up Interview

Participant Identification # _____ Date: _____

1. How are you feeding your baby now?

   1 Breast
   2 Bottle
   3 Both

2. Are you satisfied with the way you are currently feeding your baby?

   1 Yes
   2 No

3. Please explain.

   _____
   _____
   _____
   _____
   _____

4. Did you have any breastfeeding problems in the hospital?

   1 Yes
   2 No (go to #6)

5. If yes, what type of problem(s) did you have at the hospital? (Please say Yes or No to any one of the following)

	Yes	No	What helped?
Sore nipples	1	2	_____
Engorgement	1	2	_____
Not enough milk	1	2	_____
Baby not latching on	1	2	_____
Baby not sucking	1	2	_____
Fussy baby	1	2	_____
Fatigue	1	2	_____
Baby sleepy	1	2	_____
Baby sick	1	2	_____
Other _____	1	2	_____

6. Did you come home together with your baby?
   1 Yes
   2 No

Participant Identification# _____ **Follow-up Interview 2**

7. Did you have to stay longer in the hospital because of breastfeeding problem (s)?

   1 Yes
   2 No

8. Have you had any breastfeeding problems since your baby was discharged from the hospital?

   1 Yes
   2 No (go to #11)

9. If yes, what type of problem (s) have you had? (Please say Yes or No to any one of the following)

	Yes	No	What did you do to help?	Is this still a problem? Yes	No
Sore nipples	1	2	_____	1	2
Engorgement	1	2	_____	1	2
Not enough milk	1	2	_____	1	2
Baby not latching on	1	2	_____	1	2
Baby not sucking	1	2	_____	1	2
Fussy baby	1	2	_____	1	2
Fatigue	1	2	_____	1	2
Baby sleepy	1	2	_____	1	2
Baby sick	1	2	_____	1	2
Other _____	1	2	_____	1	2

10. If you experienced sore nipples at home, please rate this pain from 1 to 5, with 1 being the least pain and 5 being the most severe pain.

    1 2 3 4 5

    What did you do to lessen the pain?

    _____
    _____
    _____

    Did you have bruised nipples?
    1 Yes
    2 No

    Did you have cracked nipples?
    1 Yes
    2 No

Participant Identification # _____ **Follow-up Interview page 3**

Did you have bleeding nipples?

1 Yes
2 No

11. If you experienced "not enough milk", how did you decide that you had this problem? Please say yes or no to any of the following:

	Yes	No
Fussy baby	1	2
Baby feeding too often	1	2
Baby not gaining enough weight	1	2
Other _____	1	2

What did you do about the problem?

_____
_____
_____
_____

12. Who helped you to breastfeed? Please say yes or no to any of the following:

	Yes	No
Physician	1	2
Community/Public Health Nurse	1	2
Breastfeeding Hotline	1	2
Breastfeeding Clinic	1	2
Peer Counsellor	1	2
La Leche League	1	2
Mother/relative	1	2
Other _____	1	2
No one	1	2

13. If you are not presently breastfeeding, how many weeks did you breastfeed after your baby was born?

1 <1 week
2 1-2 weeks
3 2-3 weeks
4 3-4 weeks

14. What is the <u>single most important</u> reason why you stopped breastfeeding?
1 Sore nipples
2 Not enough milk
3 Fussy baby

4 Fatigue
5 Embarrassed
6 Baby won't latch
7 Baby won't suck
8 Baby too sleepy
9 Not convenient
10 You were sick
11 Baby was sick
12 Returned to work/school
13 You felt ready to stop
14 Other_____(eg. Husband's wishes, no support)

15. In a typical 24 hour day, how often do you (did you) breastfeed your baby?

1 Less than 4 times
2 4-8 times
3 9-12 times
4 more than 12 times

16. Do you (did you) feed your baby anything else besides breastmilk?

1 Yes
2 No

17. What else do (did) you feed your baby? You may select as many as necessary.

1 Nothing
2 Plain water
3 Sugar water
4 Juice
5 Formula
6 Combination of supplements
7 Solid foods
8 Other _____

18. If you are still breastfeeding, how many months do you plan to breastfeed your baby?

1 2-4 months
2 5-7 months
3 8-10 months
4 10-12 months
5 over 12 months
6 Don't know

Participant Indentification # _____ Follow-up Interview page 5

19. How old was your baby when discharged from the hospital? _____(hours)

20. Do you have any suggestions for health care professionals to improve the breastfeeding experience?

While in hospital:

_____
_____
_____
_____
_____
_____

After discharge:

_____
_____
_____
_____
_____
_____

Your participation is very valuable to this research.
Thank you for your time and all your help.
All the best to you and your baby.

Appendix L

Interrater Testing for NACS

UNIVERSITY OF MANITOBA | Faculty of Nursing

Helen Glass Centre for Nursing
Winnipeg, Manitoba
Canada R3T 2N2
Telephone (204) 474-7452
Fax (204) 474-7682

OR
91 Battleford Bay
Winnipeg, MB
R3Y 1K3,Canada

Oct. 16, 2001

Lori Wahoski. Unit Manager
Women's Family Birthplace
Women's Hospital
735 Notre Dame Ave.
Winnipeg, MB
R3E 0L8

Dear Ms. Wahoski:

In preparation for the study: "Epidural analgesia during labour and delivery: Effects on the initiation and continuation of effective breastfeeding", an Interrater Reliability testing need to be done for one of the research instruments. Testing will involve the newborn assessment using the Neurologic and Adaptive Capacity Scoring System (NACS) developed by Amiel-Tison, Barrier, and Shnider. Please see enclosed copy of the test. The Education and Nursing Research Ethics Board at the University of Manitoba have approved this preparatory step.

Recruitment for this Interrater Testing will take place in the Women's Family Birthplace and the Combined Care Unit. It would only take 1-2 hours in the units.

I would only request the nurses to ask the mothers if they are willing to see me to discuss about recruitment for the assessment of their newborns. Please see enclosed invitation to participate and consent forms. Only mothers agreeing to be seen will be approached. Mothers consenting to the participation of their newborn may choose to be present during the assessment.

If you have any questions, or wish to discuss this further, you may contact my research advisor Maureen Heaman at 474-6222 at the Faculty of Nursing, University of Manitoba or myself at (w) 787-2115 or (h)

Yours truly,

Zorina Márzan Chang, BN, IBCLC

Invitation to Participate

A study to compare newborn assessment ratings

My name is Zorina Marzan Chang and I am a Registered Nurse enrolled in the Master of Nursing Program at the University of Manitoba. I am doing a study to find out if medication use during labour and delivery for pain relief affects the ability of babies to breastfeed. In preparation for this study, my research assistant and I need to compare how similar our ratings are on newborn assessment. I am asking you to give permission for us to assess your baby.

Your decision to have your baby participate is entirely voluntary. If you choose not to participate, your care or your baby's care will not be affected in any way. If you agree to your baby's participation, a research assistant (who also is a registered nurse) and I will conduct an assessment of your baby. The newborn assessment will check for your baby's tone, reflexes, and senses, and will take about 10 minutes to complete. This will be carried out in the nursery and you may choose to be present during the testing. You may withdraw your participation at any time and will not affect your care or your baby's care. This newborn assessment in not for diagnostic purposes, but to help increase accuracy in carrying out the assessment between the researcher and her research assistant.

All information gathered in the assessment will be kept completely confidential, and at no time will your identity be revealed. However, if child abuse is disclosed, the research assistant or I are obligated by law to report the abuse. Your name will not appear on any of the data collection records. A code number will be assigned to your child and will appear on all the forms. Access to the data is restricted to the research assistant, my research advisor, and me. All data will be stored in a locked filing cabinet and destroyed when the study is completed.

Although there will be no immediate benefits to participants, this preparatory testing will help increase the reliability of the study findings. There are no known negative consequences to study participants. This project has been approved by the Education and Nursing Research Ethics Board at the University of Manitoba and any complaint regarding a procedure used in this study may be reported to the Human Ethics Secretariat (474-7122).

Thank you for considering this opportunity to help us prepare for a study that is aimed to promote initiation and continuation of effective breastfeeding. If you agree to have your baby participate, you will be asked to sign consent. The consent is on behalf of your baby who is not legally or practically able to give their valid consent to participate. If you have any questions, or wish to discuss the study further, you can contact my research advisor Dr. Maureen Heaman at 474-6222 at the Faculty of Nursing, University of Manitoba or myself at or 787-2115 (w).

Thank you,

Zorina Marzan Chang, BN, IBCLC

(September, 2001)

Helen Glass Centre for Nursing
Winnipeg, Manitoba
Canada R3T 2N2
Telephone (204) 474-7452
Fax (204) 474-7682

UNIVERSITY OF MANITOBA | Faculty of Nursing

Consent to Participate

A study to compare newborn assessment ratings

I, _____, agree to have my newborn be examined by Zorina Marzan Chang, a Master of Nursing student at the University of Manitoba, and her research assistant, in preparation for a research. I understand that in signing this consent, I am giving consent for my baby who is not legally and practically able to give their valid consent to participate. I understand that our participation is entirely voluntary. I also understand that I may withdraw our participation at any time, without affecting our care.

I understand that participation includes that the primary investigator and a research assistant will be doing a newborn assessment (approximately 10 minutes) on my baby. I am aware that the newborn assessment will check for my baby's tone, reflexes, and senses. I am aware that the testing will take place in the nursery and that I may choose to be present during the testing. I also understand that the newborn assessment is not for diagnostic purposes, but to help increase accuracy in carrying out the assessment between the researcher and her research assistant.

I understand that our identity will not be revealed at any time or to any one. I am also aware that if child abuse is disclosed, Zorina Marzan Chang and her research assistant are obligated by law to report the abuse. I understand that our names will not be placed in any of the data forms. Health records that contain our identity will be treated as confidential in accordance with the Personal Health Information Act of Manitoba. I am aware that access to my child's data will be available only to Zorina Marzan Chang, her research assistant, and her research advisor. My name and my child's name will not be linked with the results of newborn assessment.

This study has been approved by the Education and Nursing Research Ethics Board at the University of Manitoba. I understand that I may report any complaints regarding a procedure in this study to the Human Ethics Secretariat (474-7122). I have had all my questions answered to my satisfaction and freely agree to participate in the study. I understand that I may contact either Zorina Marzan Chang (or 787-2115) or her advisor, Maureen Heaman (474-6222), at the Faculty of Nursing, University of Manitoba, if I have concerns, questions, or need additional information.

Date: _____

Participant: _____ Witness: _____

(2 copies – one for participant and one for the researcher)

Correlations

Correlations

		NACs scoring by Zorina	NACs scoring by Janelle
NACs scoring by Zorina	Pearson Correlation	1	.982**
	Sig. (2-tailed)	.	.000
	N	10	10
NACs scoring by Janelle	Pearson Correlation	.982**	1
	Sig. (2-tailed)	.000	.
	N	10	10

**. Correlation is significant at the 0.01 level (2-tailed).