PRIMARY CARE MANAGEMENT OF THE LATE-PRETERM INFANT FOR THE FAMILY NURSE PRACTITIONER: A LITERATURE REVIEW

by

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Table of Contents

Abstract

It can be said that the family nurse practitioner (FNP) may feel stressed and overwhelmed when caring for older adults with complex health needs in the primary care setting (Hill & Sawatzky, 2011). Whilst there is no direct evidence, it is likely that this is also the case when managing a late-preterm infant (LPI) too. The LPI appears deceivingly innocent (Darcy, 2009), as they are often the size and weight of a full-term infant (FTI) and because of this, they are quickly discharged into the primary care setting (Lapillonne, O'Connor, Wang and Rigo, 2013) and are then treated by parents and the FNP as though they are developmentally mature and at low risk of morbidity. Mally, Hendricks-Muñoz and Bailey (2010) discuss that the FNP who is involved in managing the LPI would benefit from a clear understanding of the potential differences in risks faced by LPIs when compared with their FTI counterparts. The FNP who manages the LPI needs to have an understanding of the potential manifestations that may occur in the primary care setting. Therefore, the purpose of this literature review is to create a poster presentation that will highlight the primary care management of the LPI for the FNP. The author believes that this will help build FNPs confidence and competence, whilst enabling FNPs to safely manage this vulnerable yet resilient population.

Key words: *novice, late-preterm infant, primary care, evidence-based management, nurse practitioner, discharge, readmission, neonatal complications, neonatal mortality, neonatal morbidity*

Primary Care Management of the Late-Preterm Infant for the Family Nurse Practitioner: A Literature Review

It can be said that FNPs feel stressed and overwhelmed when caring for older adults with complex health needs in the primary care setting (Hill & Sawatzky, 2011). Whilst there is no direct evidence, it is likely this is the case when managing a LPI. The FNP may feel unable to provide optimal patient care due to reduced confidence (Hill & Sawatzky, 2011) in managing this vulnerable, yet resilient population. In addition, there is an organizational expectancy that a FNP should be clinically competent in managing complex patients (College of Registered Nurses of British Columbia [CRNBC], 2017) which can contribute to feelings of inadequacy and incompetence (Hill & Sawatzky, 2011). Furthermore, this can introduce internal and external stressors (e.g., feelings of anger, fear and worry), whilst increasing the potential of misdiagnosis, mismanagement, and significantly reduced referral rates in this population (Brown & Olshansky, 1998). Mally et al. (2010) discuss that FNPs involved in managing the LPI would benefit from a clear understanding of the potential differences in risks faced by these LPIs when compared with their FTI counterparts. The purpose of this literature review is to promote awareness of the multitude of clinical problems that LPIs may face in the primary care setting. To disseminate this information, the author shall be creating a poster presentation that will highlight how the FNP can manage the LPI in primary care. In conclusion, this will allow FNPs to build their confidence and competence, whilst enabling FNPs to safely manage this vulnerable yet resilient population.

Search Strategy

A thorough literature search was conducted using various bibliographic databases that included Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, Google

Scholar, and the Cochrane Library. The search strategy utilized selected key MeSH terms and free text terms which included a combination of the following: novice, late-preterm infant, primary care, evidence-based management, nurse practitioner (NP), discharge, readmission, neonatal complications, neonatal mortality, neonatal morbidity. Articles were included if they correlated with the clinical statement and had been published from 2000-2017. Articles published prior to 2000 were included if they represented accurate pathophysiology and professional organizational guidelines that continue to shape current best practices pertaining to the management of the late-preterm infant in primary care. The results were limited to articles in English only. The articles were excluded if they did not correlate with the clinical statement, did not mention the late-preterm infant as a major focus, or were editorials or opinion pieces. In total, 59 research articles were yielded with the search strategy and of the 59 research articles, 32 were utilized for this cumulative project.

Defining the NP Profession

The FNP is a relatively new yet innovative profession that is gradually being acknowledged and recognized throughout the Canadian healthcare system (Delamaire & Lafortune, 2010). In British Columbia, NPs belong to one of three streams of practice: family, adult or pediatric (CRNBC, 2017). For the purpose of this culminating project, the author shall only be discussing and referring to the FNP stream. The FNP is educated to provide healthcare services to persons of all ages, including, newborns, infants, toddlers, children, adolescents, adults, pregnant and postpartum women, and older adults (CRNBC, 2017). Furthermore, CRNBC (2017) states that the FNP brings advanced knowledge and experience with persons and families of all ages to the context of practice (e.g., community settings) and may serve as the primary care provider to individuals and their families (Appendix C).

Description of the Problem

The unique physiological and developmental needs of LPIs are yet to be fully understood (Mally et al., 2010). The LPI takes up significant healthcare resources (Appendix A), has increased mortality and/or morbidity rates, and potential long-term neurodevelopmental consequences secondary to their late prematurity (Petrini, 2009; Ramachandrappa & Jain, 2009). The LPI appears deceivingly innocent (Darcy, 2009), as they are often the size and weight of some FTIs (born at $37\,^{0}/_{7}$ through $41^{6}/_{7}$ weeks' gestational age). Consequently, LPIs are quickly discharged into the primary care setting (Lapillonne et al., 2013) and are cared for by parents and primary healthcare providers, as though they are developmentally mature and at low risk of morbidity. However, Shapiro-Mendoza et al. (2006) and Wang, Dorer, Fleming and Catlin (2004) state that LPIs are physiologically and metabolically immature and are at an increased risk of developing medical complications resulting in higher mortality and morbidity rates.

Physiological and metabolic complications of the LPI may not arise until 48 to 72 hours of life, and in many instances, these complications do not appear until they have already been discharged to the primary care setting (Buus-Frank, 2005). In primary care, the LPI can present with a multitude of clinical problems including respiratory distress, hyperbilirubinemia, temperature instability, feeding difficulties, hypoglycemia, and late onset sepsis, subsequently leading to readmission and a prolonged hospital stay (Engle, Tomashek, Wallman, & the Committee on Fetus and Newborn, 2007; Escobar et al., 2005; Escobar, Clark & Greene, 2006; Jain & Eaton, 2006; Raju, 2006; Wang et al., 2004). Moreover, the LPI has a higher rate of readmission to a secondary or tertiary care setting (Kramer et al., 2000; Tomashek et al., 2006) and are two to three times more likely to have a readmission during the neonatal period than FTIs (Radtke, 2011).

The author hopes that the specific healthcare concerns for LPIs in primary care would be highlighted and specific education and/or educational tools would be incorporated into FNP provincial and/or federal clinical guidelines. The author has selected to focus exclusively on British Columbia (BC) as unlike other provinces in Canada, neonatal NPs and pediatric NPs who have advanced knowledge in managing the neonatal population are not readily available for support and guidance. For example, Ahmed (2010) discusses that the advantages of breastfeeding in late-preterm infants appear to be even greater than for full-term infants; however, establishing breastfeeding in late-preterm infants is frequently more problematic. FNPs in the primary care setting not only need to be supported, but they need to be supportive of breastfeeding and they also need to know how to manage uncomplicated breastfeeding problems in the late-preterm infant (Ahmed, 2000).

Adamkin (2006) argues that it is crucial to be able to refer mothers and LPIs immediately to a trained lactation professional for more complicated breastfeeding problems and that a lactation referral should be viewed with the same medical urgency as any other acute medical referral. For instance, feeding problems are a common reason why LPIs are readmitted to hospitals in Canada. However, could any of these readmissions be prevented if the FNP was aware of the challenges these LPIs face? There is a possibility that increased costs associated with educating FNPs regarding clinical manifestations of the LPI in the primary care setting may be perceived as a barrier, however, there is a much greater cost associated with admitting a LPI to a secondary or tertiary setting.

Description of the Project

This culminating project is completed to fulfill the requirements for the Master of Nursing – Nurse Practitioner degree program at the University of British Columbia (The

University of British Columbia, School of Nursing, 2017). A literature review was written with a focus on the clinical manifestations of the LPI in the primary care setting. This will allow the FNP to build their confidence and competence, whilst enabling FNPs to acknowledge these clinical manifestations that may present in this vulnerable yet resilient population. This information will be disseminated to the intended audience by the form of a poster presentation. Furthermore, I will collaborate with my primary and secondary supervisor: Jillian Harding and Jennifer Krist, to develop and guide this poster presentation.

Definition

For the clarity and purpose of this academic paper, the author shall be using the term 'late-preterm infant' exclusively and using the terms 'family nurse practitioner' and 'primary healthcare provider' synonymously unless otherwise stated. The LPI has been called several names: near-term, moderately-preterm, minimally-preterm, and marginally-preterm (Raju, Higgins, Stark, & Leveno, 2006). These terms can be misleading, implying that LPIs are seemingly healthy, although they have increased morbidity and mortality associated with preterm gestation (Wang et al., 2004). In 2005, The National Institute of Child Health and Human Development (NICHD) of the National Institutes of Health (NIH) organized a workshop as there was no general consensus on the definition of 'near term'. It was decided to designate preterm infants born between the gestational age of 34 $^{0}/_{7}$ weeks through 36 $^{6}/_{7}$ weeks (239th-259th day) as 'late-preterm' and to discontinue the use of the phrase 'near term' (Appendix B). It was deemed that 'near term' was misleading, conveying an impression that these infants are 'almost term', resulting in underestimation of risk and less-diligent evaluation, monitoring, and follow-up (Engle et al., 2007); because there is no such thing as a normal preterm infant, 'late-preterm'

conveyed the sense of vulnerability of these infants better than did the phrase ‘near term’ (Cunningham & Williams, 2005).

Several factors were considered in recommending the gestational age range of 34 $^{0}/_{7}$ to 36 $^{6}/_{7}$ weeks to define ‘late-preterm’ (Committee on Fetus and Newborn, 2004; Cunningham & Williams, 2005). Cunningham and Williams (2005) highlighted that in obstetric practice, 34 completed weeks is considered a maturational milestone for the fetus and yet, compared with FTIs, those born between 34 $^{0}/_{7}$ and 37$^{0}/_{7}$ week of gestation suffer from higher rates of morbidity and mortality (Wang et al., 2004). Therefore, The American Academy of Pediatrics and the American College of Obstetricians and Gynecologists confirmed that the gestational age should be rounded off to the nearest completed week, not to the following week; thus, an infant born on the 5th day of the 36th week (35 $^{5}/_{7}$) is at a gestational age of 35 weeks, not 36 weeks (Engle et al., 2007).

Epidemiology

In Canada, 7.7% of infants are born preterm (Public Health Agency of Canada & Canadian Perinatal Surveillance System, 2013) and 75% of these are born late-preterm (Ananth, Friedman, & Gyamfi-Bannerman, 2013; Engle, 2006; Engle et al., 2007). Furthermore, amongst Canadian provinces, British Columbia’s (2015–2016) rate of preterm birth is 7.6% with the highest rate being Central Vancouver Island that averages 9.3% (Canadian Institute for Health Information, 2017). Mally et al. (2010) discusses that as these LPIs represent 75% of the overall preterm population, their deaths constitute a much higher ‘etiologic fraction’ of neonatal mortality than do those who are more premature. In Canada, these LPIs have contributed substantially to overall infant and neonatal mortality, although their mortality rate was

significantly lower than those of infants whose gestational age was less than 33 weeks (Mathews & MacDorman, 2007).

Economic Burden

In the United States, the average cost for treating an extremely-premature infant (EPI) at 25 weeks and a LPI at 35 weeks was $202,000 and $4,200 respectively, but when total cost for each gestational age group was reviewed, the average cost for treating EPIs at 25 weeks' gestation was 38.9 million dollars and the average cost for treating LPIs at 35 weeks' gestation was 41.1 million dollars (Gilbert, Nesbitt & Danielsen, 2003). Although, EPIs are expensive to treat, the overall cost for treating LPIs is similar or higher because of their large numbers (Appendix A) (Gilbert et al., 2003). With 75% of all preterm births being late-preterm and nearly 30% to 50% requiring prolonged hospital stay and subsequent re-hospitalizations, the cost of their care continues to rise (Gilbert et al., 2003; Wang et al., 2004).

Causative Factors of Late-Preterm Births

The author believes that there are likely a multitude of factors accounting for the increase of LPIs; however, there are no specific explanations for the rise of late-preterm births (Mally et al., 2010). It is widely known that preterm labour, pre-eclampsia and premature rupture of membranes are known contributors to late-preterm birth (Bettegowda et al., 2008; Davidoff et al., 2006; Martin et al., 2012). Moreover, maternal demographic transformations, increased demand for assisted reproductive technology (Mally et al., 2010), the older parturient population due to delayed childbearing age (Mathews & Hamilton, 2002) and the increased incidence of multiple gestation pregnancies (Hankins and Longo, 2006; Hauth, 2006) have also played a key role in the increase of late-preterm births. Blencowe et al. (2012) believe the increased incidence may be partially attributed to the ever-increasing rates of childbirth interventions (e.g., caesarean

sections [CS] and inductions). For instance, nearly one in four births today are born by induction of labour; induction rates have more than doubled since 1990 (from 9.5% to 22.5%) with late-preterm births showing the largest increase in induction rates (Hamilton, Martin and Ventura, 2010).

Dimitriou et al. (2010) and Shapiro-Mendoza et al. (2008) found that maternal medical complications and late-preterm birth were independent risk factors for newborn morbidities. When compared to full-term infants with no exposure, late-preterm infants born to mothers with antepartum hemorrhage were 12 times more likely to experience morbidity during the birth hospitalization, and those exposed to hypertensive disorders of pregnancy were 11 times more likely to experience morbidity (Shapiro-Mendoza et al., 2008). However, Shapiro-Mendoza et al. and Dimitriou et al. both highlight that earlier gestational age had a greater effect on late-preterm infant morbidity then maternal medical complications; yet, when early gestational age and maternal medical conditions are combined, an additive effect contributes to late-preterm morbidity (Khashu, Narayanan, Bhargava, & Osiovich, 2009). Furthermore, it remains a major obstetrical challenge to balance and reduce the risks to the fetus and increase the benefits to the mother; whilst continuing a pregnancy versus that of delivering the infant early (Mally et al., 2010).

Artificial Reproductive Technology

It is well documented that assisted reproductive technology is associated with an increased likelihood of multiple gestations; in the last two decades, there has been a threefold increase in the incidence of women successfully delivering a viable infant following artificial reproductive technology (Mally et al., 2010). Increasing use of assisted reproductive technology

is linked to the increasing preterm rates overall and to late-preterm birth rates in particular (Lee, Cleary-Goldman and D'Alton, 2006).

Caesarean Sections

In 2008, 30% of live births were delivered by primary caesarean deliveries, leading to an astounding 50% increased rate of CS in the United States in the last decade (National Center for Health Statistics, 2008). Unfortunately, this same data is not available for primary caesarean deliveries in Canada, as Canada include stillbirths in their CS rate. This dramatic rise in primary CS rates, may be associated with increased subsequent caesarean rates, due to increased likelihood of repeat CS in future pregnancies (Mally et al., 2010). If a woman has a primary CS, she has a 92% probability of having a repeat CS. Primary CS has therefore contributed to the dramatic increase in the total CS rate (Martin et al., 2009). Martin et al. (2009) discusses that in the United States, CS are continuing to increase and are currently at the highest reported level (31.1% of all live births).

Davidoff et al. (2006) discovered a shift towards earlier gestations amongst births by medical intervention (e.g., CS), with the majority of the increases amongst the late-preterm population. On many occasions, CS are clinically indicated; however, there is an increase in maternal demand for CS, driven by the perceived safety of surgical procedures, and the fear of complications and/or risks associated with vaginal birth (Ramachandrappa & Jain, 2008). It is estimated that up to 18% of all live births are being delivered by CS on maternal request (Raju, 2006; Ramachandrappa & Jain, 2008). Declercq, Sakala, Corry & Applebaum (2006) and McCourt et al. (2007) believe that the increase in CS rates are largely caused by changing maternal demographics (e.g., substantial increase in obesity and gestational diabetes) and practice standards of medical professionals (e.g., higher use of intrapartum fetal monitoring), and

the ever-increasing risk of malpractice litigation. Unfortunately, it is difficult to distinguish between caesarean deliveries performed electively at maternal request, and those performed for medical indications from the medical records (National Institutes of Health, 2006).

Providing elective interventions (e.g., CS) in full-term pregnancies can potentially increase the proportion of deliveries resulting in a late-preterm infant because delivery date and gestational age estimation prenatally is an inexact and imperfect science (Kalish & Chervenak, 2005).). Furthermore, there are numerous tested and tried methods to estimate gestational age (e.g., Naegle's rule), however, these are accurate to only within one to two weeks of the actual gestational age, which can provide a significant margin of error that moves an expected full-term delivery into a late-preterm delivery (Kalish & Chervenak, 2005; Laing, Frates & Benson, 2000). To help streamline this process, the Perinatal Services BC (2015) implemented ultrasound guidelines which made estimating gestational age and delivery date more effective. However, there are no current statistics that show that this guideline has actually reduced late-preterm births.

Providing a CS when not clinically indicated may lead to a declining trend of vaginal birth after a previous CS, which then progresses into an acceptance or standardization of repeat caesarean deliveries. This conundrum is potentially contributing to the increase in late-preterm births (Kalish & Chervenak, 2005; Laing et al., 2000; Mally et al., 2010).

Maternal Risk Factors

Maternal age is a risk factor for late-preterm birth, with higher late-preterm birth rates found amongst both younger and older groups of mothers (Mally et al., 2010). Maternal race and ethnicity also appear to play a role in LPI birth rates, and late-preterm birth rates have been found to be 1.5 times higher in non-Hispanic black mothers when compared with Hispanic and

non-Hispanic Caucasian mothers (Mally et al., 2010). However, Ramachandrappa & Jain (2009) discuss that most races including Hispanics, African-American and non-Hispanic Caucasians, have seen an increase in late-preterm births; suggesting that late-preterm births are becoming increasingly prevalent throughout the world (Ramachandrappa & Jain, 2009).

Multiple Gestations

The National Center for Health Statistics (2010) discuss that when compared with singleton births, multiple births were almost five times more likely to result in the birth of a LPI. It is thought that most multiples deliver in the late-preterm period because of either spontaneous preterm labour (e.g., premature rupture of membranes) or iatrogenic interventions (e.g., induced late-preterm delivery) intended to treat maternal and fetal medical complications (Engle, 2011; Mally et al., 2010). As a direct consequence, Engle (2011) discusses that expectant mothers of multiples are almost six times more likely to be hospitalized for obstetrical complications (e.g., preterm labour and premature rupture of membranes). The percentage of infants born before 40 weeks of gestation has increased and the percentage of those born after 40 weeks of gestation have decreased (Davidoff et al., 2006; Miesnik & Reale, 2007).

It is apparent that this shift in gestational age at birth increases the risk for the birth of physiologically immature infants, who are then at an increased risk of developing complications associated with prematurity (Mally et al., 2010). As previously discussed, the increasing trend of electively delivering at earlier gestational ages has raised concerns about the impact that this may have on maternal and fetal health (Mally et al., 2010).

Obstetrical Management

There has been a significant increase of multiple gestations in the last two decades, mostly due to two related modern trends: the older parturient population because of delayed

childbearing age and a rise in the use of artificial reproductive technology (Mally et al., 2010). Furthermore, these multiple pregnancies present with several, unique challenges in obstetrical diagnosis and management. Mally et al. (2010) discusses that current obstetrical management of preterm labour and premature prolonged rupture of membranes may actually influence the percentage of late-preterm infants delivered earlier than expected. It may be feasible to modify current obstetrical management strategies to potentially reduce the incidence of late-preterm births and the associated complications (Ramachandrappa & Jain, 2008). However, Mally et al. believe that further research is needed to identify the best balances between perinatal and neonatal management.

Morbidity and Mortality

LPIs are at significant risk of morbidity and mortality due to their relative physiological immaturity (Appendix D, Table A1). Shapiro-Mendoza et al. (2006) estimated that LPIs born between 34 and 36 weeks' gestation are up to 20 times more likely to experience morbidity. Furthermore, the risk of morbidity and mortality increases with each decreasing week in gestational age (Young, Glasgow, Li, Guest-Warnick & Stoddard, 2007).

A large population-based cohort of linked birth–death certificate data from Canada revealed that LPIs were 4.5 times more likely to die than FTIs (Kramer et al., 2000). It is now apparently clear that prematurity even by a few weeks carries with it significant morbidity and mortality risks (Tomashek et al., 2006). Much of the morbidity is preventable using low cost and low technology interventions, which should become a priority for FNPs (McDonald et al., 2013).

Long-Term Morbidity of Late-Preterm Infants

While the short-term medical risks are common for LPIs, little is known about the long-term outcomes (McGowan et al., 2011). It is hard to believe that LPIs, who are just a few weeks

shy of term gestation can have long-term morbidities associated with their late prematurity (McGowan et al., 2011). It was once thought that LPIs had comparable risks for developmental problems as FTIs (Kugelman & Colin, 2013). However, it is now well known that LPIs are more vulnerable to neurological damage than previously thought (Kinney et al., 2006; Kugelman & Colin, 2013).

Neurological immaturity is associated with the lack of opportunity for the exponential intrauterine brain growth and development that occurs in the last six to eight weeks of gestation (Baron, Litman, Ahronovich, & Baker, 2012). Consequently, myelination and interneuronal connectivity is incomplete and any interruption or insult during this stage of development can lead to poor long-term neurodevelopmental outcomes (Kinney, 2006). The cerebral volume of the late preterm brain is only 53% of the FTI and weighs one third less than the FTIs brain (McGowan et al., 2011; Munakata et al., 2013) and demonstrate less synchrony and responsiveness in parent-child interactions (Ludwig, 2007). It has been found that LPIs born without any congenital anomalies between 1967 and 1983, who were followed until 2003, had a higher incidence of cerebral palsy, global learning difficulties, psychological developmental problems, behavioral and emotional disturbances, and other major disabilities, such as blindness, decreased vision, hearing loss and epilepsy (Moster, Lie & Markestad, 2008). When compared to FTIs, LPIs are suggested to be at increased risk of poorer longer-term outcomes (Kerstjens et al., 2011; McGowan et al., 2011; Samra, McGrath & Wehbe, 2011).

Furthermore, Chyi et al. (2008) believe that LPIs exhibit subtler neurodevelopmental issues (e.g., academic performance or behavioral problems) that may not be recognized. Gurka et al. (2010) found that at school age, late-preterm children were more likely to have poorer cognitive, language and mathematics scores (de Jong, Verhoeven, & van Baar, 2012; Lipkind,

Slopen, Pfeiffer, & McVeigh, 2012; Quigley et al., 2012), be enrolled in special education programs (Shapiro-Mendoza et al., 2013) and have cerebral palsy (Odd, Lingam, Emond & Whitelaw, 2013) and behavioral and emotional problems (de Jong et al., 2012). In addition, males born late-preterm have an increased risk for neurodevelopmental delay, later school achievement, and other long-term outcomes than females born late-preterm (Boyle et al., 2013). Consequently, adults in their twenties, who were born late-preterm were more likely to receive disability allowance and were less likely to attain university or post-secondary education (Ramachandrappa and Jain, 2009).

Pathophysiology, Pathogenesis and Outcomes

Pulmonary System

Physiological events in the final weeks of pregnancy, coupled with onset of spontaneous labour and hormonal changes, affect the fetus and mother in ways resulting in rapid maturation and preparation of the fetus for delivery and neonatal transition (Sarici et al., 2004; Wang et al., 2004). Spontaneous delivery during term gestation is accompanied by a surge in endogenous steroids and catecholamine secretion, responsible for some pulmonary maturational effects (Jain & Eaton, 2006). When delivery occurs during the late-premature gestation age, especially by CS before the onset of labour, the fetus is deprived of these hormonal changes, thus making the neonatal transition more difficult, and increasing the risk of acute respiratory issues in the early neonatal period (Goldenberg & Nelson, 1975).

Normal lung development proceeds from the embryonic period (week three to week seven) through pseudoglandular (week seven to week 16), canalicular (week 17 to week 26) and saccular periods (week 24 to week 36) to the alveolar period; during which alveolar development commences at 36 weeks' gestation and continues into postnatal life (Copland & Post, 2004;

Galambos & Demello, 2008). Unfortunately, late-preterm birth occurs during the most rapid period of lung maturation, at the transition between saccular and alveolar periods (Langston, Kida, Reed & Thurlbeck, 1984). Kinney (2006) define this critical period as a time-sensitive, irreversible decision point in development and, represents a critical period of growth and development of the fetal brain and lungs (Kugelman & Colin, 2013). These maturation processes are proposed to improve parenchymal elastase and airway-tethering (Langston et al., 1984). However, the late-preterm birth interferes with these maturation processes, which consequently leads to a progressive decrease in air-space wall thickness and a simultaneous increase in air-space surface area (Langston et al., 1984).

Furthermore, the functional consequences of late-preterm birth include difficulty protecting functional residual capacity, and vulnerability to airway collapse and increased airway resistance (Colin, McEvoy & Castile, 2010). The lungs in the fetus are filled with fluid, which is rapidly cleared and filled with air soon after birth (Ramachandrappa & Jain, 2009). However, after the late-preterm birth, lung fluid clearance is delayed since this is dependent upon developmentally regulated epithelial sodium channels (Smith et al., 2000). It is now known that these epithelium sodium channels play an important role in the transepithelial movement of fetal lung fluid (Ramachandrappa & Jain, 2009; Wang et al., 2004). The proliferation and activation of these epithelium sodium channels occurs close to birth and subsequently after birth and leads to movement of sodium from the alveolar lumen across the apical membrane into the cell, with subsequent extrusion out of the cell by Na1/K1-ATPase (Dudell, 2006).

Unfortunately, as peak expression of the epithelium sodium channels occurs at term gestation; LPIs are therefore born with lower expression of epithelium sodium channels, which further reduces their ability to clear lung fluid after birth (Dudell, 2006). This provides partial

explanation as to why LPIs have a higher incidence of transient tachypnea of the newborn, respiratory distress syndrome resulting from iatrogenic prematurity, and persistent pulmonary hypertension, with or without hypoxic respiratory failure, than FTIs (Clark, 2005; Escobar et al., 2005; Goldenberg & Nelson, 1975; Jain & Eaton, 2006; Roth-Kleiner et al., 2003; Ventolini, Neiger, Mathews, Adragna & Belcastro, 2008; Wang et al., 2004).

Feeding Difficulties

According to Wang et al. (2004) the highest morbidities experienced by the LPI are feeding difficulties. Bromiker et al. (2005) state that feeding is a challenging, highly skilled and complex process, as the LPI may not be able to fully coordinate the suck-swallow-breathe pattern, due to immature muscle tone, physiologic stability, and neurologic processes needed to maintain the airway (Ludwig, 2007; Pados, 2007). Moreover, Wang et al. state that LPIs have poor suck and swallow coordination because of neuronal immaturity and decreased oromotor tone, which can lead to poor caloric intake and dehydration. Consequently, dehydration from poor caloric intake also exacerbates physiological jaundice and predisposes the LPI to hospital readmissions. Escobar et al. (2005) discusses that nearly 26% of LPIs are readmitted to the hospital for feeding difficulties, with breastfed LPIs 2.2 times more likely to be readmitted compared with those who are not breastfed (Tomashek et al., 2006).

Adamkin (2006) states that breastfeeding provides an even greater challenge with greater risk for inadequate nutrition and readmission, especially if discharge occurs prior to the mother's milk coming in and feeding is successfully established. Moreover, with the LPIs inability to stimulate an adequate milk supply (Adamkin, 2006) and their poor stimulation and emptying of the breast, this leads to fewer awake periods and significantly reduced stamina; resulting in reduced growth and development (Darcy, 2009). Walker (2008) discusses that breastmilk is very

important to LPIs as they have lower antioxidant capacity. This may provide partial explanation of why LPIs are increasingly vulnerable to conditions (e.g., necrotizing enterocolitis) associated with oxidative stress. Furthermore, breastmilk is higher in antioxidant capacity than infant formula and may help neutralize oxidative stress on LPIs (Ezaki, Ito, Suzuki, & Tamura, 2008).

Walker (2008) highlights that mothers of LPIs may be at increased risk for delayed lactogenesis II because of factors that have contributed to their infant's late-preterm birth. These mothers may be overweight or obese, experienced a caesarean delivery, have pregnancy induced hypertension, diabetes, or been treated for preterm labour, all of which are associated with delayed onset of copious milk production (Walker, 2008). Furthermore, late-preterm birth itself often compromises the initiation of lactation by delaying the onset of plentiful milk production (Cregan, De Mello, Kershaw, McDougall, & Hartmann, 2002).

Walker (2008) discusses that some LPIs may be able to electively latch, suck, and swallow colostrum. However, many LPIs will become easily fatigued, be unable to sustain nutritive sucking, or lack the strength to draw the nipple/areola into the mouth and generate the 60 mm Hg of pressure necessary to secure the nipple in place between sucking bursts (Geddes, Kent, Mitoulas, & Hartmann, 2008). This lack of sustained sucking may give a false signal of satiety rather than indicating inadequate intake, leading mothers and primary healthcare providers to erroneously conclude that the infant ingested a sufficient volume of milk (Walker, 2008).

Furthermore, LPIs demonstrate a wide range of variations in sucking patterns, sucking intensity, and frequency and duration of pauses between sucking bursts, which may be mistaken for nutritive feedings, placing LPIs at an increased risk for dehydration, insufficient caloric intake, and elevated bilirubin levels (Walker, 2008). LPIs are at risk of postnatal growth

restriction due to the combined effects of increased nutritional demands associated with respiratory and other morbidities, and of developmental difficulties with feeding, particularly breastfeeding (Meier, Furman & Degenhardt, 2007).

Weight gain in LPIs falls below expected intrauterine norms (Blackwell et al., 2005) and poor growth often persists beyond the neonatal period (Goyal, Fik & Lorch, 2012). Boyle et al. (2013) discuss that the odds of being underweight at three and five years of age increase progressively with decreasing gestation, such that LPIs are at increased risk compared with FTIs. However, early growth restriction, particularly when followed by rapid catch-up growth, is increasingly recognized as a risk factor for obesity (Gluckman, Hanson, Beedle & Raubenheimer, 2008). LPIs are usually subjected to rapid catch-up growth interventions; thus, they are the highest proportion of children classified as obese (Boyle et al., 2013).

It is crucial that LPIs who are being breastfed are seen by their primary healthcare provider at least 48 hours after discharge and parent education and resource utilization is offered and discussed (Darcy, 2009). This approach will make for adequate hydration and steady weight gain for the LPI (Darcy, 2009; Adamkin, 2006).

Neonatal Hypoglycemia

It is well known that neonatal hypoglycemia is a risk factor for neuronal cell death and adverse neurodevelopmental outcomes (Garg & Devaskar, 2006). Ramachandrappa and Jain (2009) discuss that FTIs produce glucose primarily by hepatic glycogenolysis and gluconeogenesis. Typically, after birth, there is a surge of catecholamines and glucacon with a drop in circulating insulin; these changes help in maintaining euglycemic control (Raju et al., 2006). However, LPIs have immature hepatic enzymes for gluconeogenesis and glycogenolysis;

they also have decreased hepatic glycogen stores, which normally accumulate in the third trimester (Raju et al., 2006).

Hormonal regulation and insulin secretion by pancreatic beta cells are immature, resulting in unregulated insulin secretion during hypoglycemia (Garg & Devaskar, 2006). The quick depletion of the inadequate glycogen stores exacerbated by associated conditions (e.g., feeding difficulties), places the LPI at an increased risk for hypoglycemia (Garg & Devaskar, 2006; Raju et al., 2006). Wang et al. (2004) define neonatal hypoglycemia as having a blood glucose under 40 mg/dL. Whereas, Cornblath et al. (2000) and Hay Jr (2009) define neonatal hypoglycemia as the blood glucose concentration at which intervention should be initiated to avoid significant morbidity, especially neurologic sequelae. This definition however, remains elusive because the blood glucose concentration and duration of hypoglycemia associated with poor neurodevelopmental outcome has not been established (Cornblath et al., 2000; Hay Jr, 2009). Wang et al. discuss that hypoglycemia is three times more common in LPIs than FTIs and nearly 27% of LPIs required readmission for intravenous fluids when compared to five percent amongst FTIs (Garg & Devaskar, 2006; Raju et al., 2006).

Hyperbilirubinemia

Hyperbilirubinemia is the most common cause for hospital readmission during the first seven days of life (Watchko, 2006) and while this condition is transitional and normally benign, the LPI is physiologically and metabolically immature in their ability to handle unconjugated bilirubin (Bhutani & Johnson, 2006). Hyperbilirubinemia in the LPI results from excess bilirubin load caused by reduced hepatic uptake or decreased conjugation of bilirubin secondary to decreased activity of a hepatic enzyme and increased enterohepatic circulation caused by immature gastrointestinal function and motility (Bhutani & Johnson, 2006). Furthermore, this

condition puts them at risk for high serum bilirubin levels and sometimes severe, prolonged jaundice, and kernicterus (Bhutani & Johnson, 2006).

Newman et al. (1999) found that LPIs born at 36 weeks' gestation have nearly four times the odds for developing serum bilirubin levels >20 mg/dL (343 mmol/L) when compared to FTIs (Newman et al., 1999). Maisels and Kring (1998) highlight that LPIs at 35 to 36 weeks and 36 to 37 weeks' gestation were 13.2 and 7.7 times more likely to be readmitted to the hospital and require phototherapy for significant hyperbilirubinemia than those greater than or equal to 40 weeks' gestation (Maisels & Kring, 1998). Furthermore, these LPIs had significantly higher bilirubin levels on day five and day seven, indicating that these LPIs have a relatively delayed bilirubin peak with a tendency to persist for a longer duration (Sarici et al., 2004).

Sarici et al. (2004) developed an age-specific percentile-based nomogram-utilizing sensitivity, specificity, and negative and positive predictive values (fifth percentile track with greatest sensitivity and negative predictive value, and 95th percentile track with greatest specificity and positive predictive value) in the assessment of the predictive ability of the six- and 30-hour serum bilirubin value in determining the development of significant hyperbilirubinemia. The LPI requires aggressive treatment based on their risk status using percentile distribution of the serum bilirubin values on postnatal age, rather than using traditional birthweight-based thresholds; a longer follow-up is also required because of the delayed bilirubin peak and prolonged duration of neonatal jaundice (Sarici et al., 2004).

The practice of discharging LPIs before 72 hours of life increases their potential incidence for neonatal jaundice and hyperbilirubinemia (Bhutani & Johnson, 2006); thus, contributing to the disproportionate readmission rate to hospitals for the management of these complications (Watchko, 2006). The American Academy of Pediatrics and the Subcommittee on

Hyperbilirubinemia (2004) released guidelines stating that primary healthcare providers should be able to recognize that LPIs (particularly those who are breastfed) are at higher risk of developing hyperbilirubinemia and require diligent surveillance and monitoring. Therefore, the author believes that the FNP needs to be aware of the signs and symptoms of neonatal jaundice and hyperbilirubinemia to help reduce unnecessary readmissions.

Temperature Instability

Wang et al. (2004) found that LPIs were 10% more likely to present with temperature instability and, if not properly managed, can lead to significant morbidity. Moreover, Pulver, Denney, Silver and Young (2010) found that 31% of LPIs develop hypothermia, subsequently leading to 82% of these LPIs having a prolonged hospital stay. Consequently, Jain and Cheng (2006) found that LPIs also had a higher risk of being readmitted to the hospital for hypothermia than FTIs (2.5%vs. 0.2%). Sedin (2006) state that FTIs can generate heat by breaking down brown adipose tissue with the help of hormones (e.g., norepinephrine and prolactin) which peak at term gestation. However, LPIs have less accumulation of brown adipose tissue stores and hormones necessary for their breakdown (Mally et al., 2010). Thus, making the LPIs less able to generate heat from brown adipose tissue as FTIs do for thermal regulation (Power, Blood & Hunter, 2003). Furthermore, LPIs have an immature epidermal barrier (Mally et al., 2010), limited white adipose tissue for insulation (Engle et al., 2007) and increased body–surface area to body–weight ratio, putting them at further risk for increased heat loss (Power et al., 2003; Sedin, 2006).

Infection

McIntire and Leveno (2008) discuss that many LPIs often exhibit signs of a possible infection (e.g., respiratory distress), LPIs have approximately four times the odds for being

screened for sepsis than FTIs (36.7% versus 12.6%). Many LPIs have sterile blood cultures and rarely is pneumonia a cause for their respiratory distress (Mally et al., 2010). However, the majority of LPIs who were screened for sepsis were treated with antibiotics, even though only 0.4 percent of those screened had culture proven sepsis (McIntire & Leveno, 2008). The rate for late neonatal sepsis varies by both geographical location and hospital setting (Darcy, 2009). Late neonatal sepsis is often acquired in the hospital and occurs after 72 hours of life but most often after five days of life; and the primary risk factor is being a LPI (Lott, 2006).

The LPI has increased susceptibility to infection due to the immaturity of their immune system, which results in decreased phagocytic cellular defenses and a decreased ability to fight infections (Lott, 2006). In addition, Lott (2006) discusses that due to the decreased transmission of maternal antibodies, the LPI also has reduced passive immunity that would have been acquired maternally. Jain and Cheng (2006) found that 8.2% of LPIs were readmitted to the hospital for suspected infection, compared to 6.6% of FTIs admitted for infection. Therefore, to decrease the risk of late neonatal sepsis and the complications associated with it, the FNP needs to recognize the clinical signs and symptoms which may manifest in the primary care setting and prompt them to screen and urgently refer these LPIs for suspected sepsis.

Recommendations for Primary Healthcare Providers

Forsythe and Allen (2013) believe that FNPs should be aware of the risks associated with late-preterm birth (Appendix D, Table B2). The author intended to bridge the gap between the United States and Canada by using research data which originated from Canada. However, there is little to no research data on the percentage of late-preterm births in Canada, nor the percentage of LPIs in Canada. Furthermore, the Canadian Paediatric Society (Whyte & Fetus Newborn Committee, 2010; Jefferies & Canadian Paediatric Society, Fetus and Newborn Committee,

2014) has minimal research data, and the research data that they have is based off of researched data from the United States. It is important to note that although the Canadian Paediatric Society (Whyte & Fetus Newborn Committee, 2010; Jefferies & Canadian Paediatric Society, Fetus and Newborn Committee 2014) may have been utilizing the same data as the American Academy of Pediatrics (AAP & the Committee on Fetus and Newborn, 2010), the influence that the expert panel from the Canadian Paediatric Society (Whyte & Fetus Newborn Committee, 2010; Jefferies & Canadian Paediatric Society, Fetus and Newborn Committee, 2014) had in interpreting the data and making recommendations may be different from the United States.

Early Hospital Discharge

As discussed earlier, LPIs appear deceivingly innocent (Darcy, 2009), as they are often the size and weight of some FTIs and because of this, they are discharged earlier into the primary care setting (Lapillonne et al., 2013). Consequently, the LPIs instability in adapting to extrauterine life may not be discovered during the birth hospitalization if the LPI is discharged early (Escobar et al., 2005). The LPI is then treated by parents, caregivers and primary healthcare providers as though they are developmentally mature and at low risk of morbidity (Lapillonne et al.).

Early discharge is not recommended due to the multiple morbidity risks associated with LPIs (AAP & the Committee on Fetus and Newborn, 2010). Early discharge is defined as less than 48 hours after a vaginal birth or 96 hours after a CS; early discharge should be limited to singleton births with gestational ages 38 to 42 weeks; however, discharge of the late-preterm population still occurs (AAP & the Committee on Fetus and Newborn, 2010; Goyal, Fager, & Lorch, 2011).

During the birth hospitalization, the LPI should have frequent assessments for respiratory distress, hyperbilirubinemia, poor feeding, hypoglycemia, temperature instability, and infection (Forysthe & Allen, 2013; Mally et al., 2010; Wang et al., 2004). This close monitoring should not automatically require admission to the neonatal intensive care (NICU) unless the LPI is symptomatic; however, standard well-baby nursery care may not be appropriate (Pulver et al., 2010). Multiple secondary and tertiary care settings have proposed late-preterm initiatives that include education of all healthcare providers in the well-baby nursery and parents on the morbidities of LPIs, as well as having special markings or tags on the LPIs cribs as a reminder of the need for these extended assessments (Corso & DeButy, 2011; Stoltz, Straughn, & Kupsick 2011).

These initiatives could help prevent many LPI morbidities through early recognition of symptoms, which then can be managed and resolved prior to discharge from the hospital (Forysthe & Allen, 2013). Although, the American Academy of Pediatrics and Committee on Fetus and Newborn (2010) recommends that LPIs should not be discharged early from the hospital, this still frequently occurs (Goyal et al., 2011). If the LPI is discharged early before these morbidities manifest or are corrected, these issues will be assessed by the FNP in the primary care setting, likely during the first two weeks of life (Forysthe & Allen, 2013; Mally et al., 2010; Wang et al., 2004).

It is recommended that LPI should be evaluated three to five days after birth or 48 to 72 hours after discharge from the hospital, and LPIs who are discharged from the hospital less than 48 hours after delivery should be evaluated by a primary healthcare provider within 48 hours (AAP & the Committee on Fetus and Newborn, 2010; Hagan, Shaw, & Duncan, 2008). The LPI should be seen within 24 to 48 hours of discharge to evaluate bilirubin levels, feeding practices,

weight gain, temperature stability, respiratory effort, and signs of possible infection, allowing the FNP to intervene early if necessary (AAP & the Committee on Fetus and Newborn, 2010; Forysthe & Allen, 2013). After the initial visit, the next routine visit for the healthy FTI is typically at two weeks of life, and then again at two months (Hagan et al., 2008). However, the FNP needs to know that morbidities in LPIs are most likely to occur within the first 28 days of life, so LPIs may benefit from having an additional visit at one week and four weeks of life to be evaluated for these potential morbidities (Tomashek et al., 2006).

Parental Stress

There is an abundance of literature regarding early-preterm birth (less than 32 weeks' gestation) and parenting stress (Howe, Sheu, Wang & Hsu, 2014; Treyvaud, 2014). However, LPIs are a recently identified population (Engle, 2006), and it is unclear whether the stress experienced by parents of early-preterm infants (EPIs) can be extended to parents of LPIs (Treyvaud, 2014). Parenting stress has been linked to developmental delays in the EPI, but little is known about its effects on the development of the LPI (Engle, 2006). In addition, parental age (Sutcliffe, Barnes, Belsky, Gardiner, & Melhuish, 2012), and education (Bornstein, Putnick, Suwalsky, & Gini, 2006) can affect the development of the LPI. Parenting stress is one aspect of the family environment associated with suboptimal outcomes for any infant (Coletti et al., 2015) and may be particularly important for LPIs who have greater risk of developmental delays.

It can be said that parental stress is different for mothers compared to fathers and therefore, the FNP needs to tailor these supports accordingly (Mughal, Ginn, Magill-Evans, & Benzies, 2017). Furthermore, parenting support and education, including strategies for stress management, should be offered by the FNP, as it is essential to educate new mothers and fathers about realistic expectations of parenting a LPI (Mughal et al., 2017). LPI behaviors include more

frequent crying, decreased parent-child interaction and bonding, and LPIs not meeting expectations (e.g., physical characteristics) in comparison to a FTI (Mughal et al., 2017).

Parent Education

It is imperative that the FNP reinforce parent teaching at the first primary care visit (Forysthe & Allen, 2013). It is crucial that new parents are aware of the need for close monitoring of their LPI and the possible complications their infant may experience adjusting to extrauterine life (Forysthe & Allen, 2013). Parents should be educated on the recognition of feeding cues and how to feed a LPI with an uncoordinated suck (Ludwig, 2007; Forysthe & Allen, 2013). Moreover, proper positioning for feeding, the need for scheduled feedings to support steady and healthy weight gain, what to do if the infant starts to choke, and when to notify the FNP of concerns or symptoms, must all be discussed with the parents at their first primary care visit (Ludwig, 2007).

The Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) (AWHONN, 2010) highlight that signs of dehydration (e.g., low urine output, poor skin turgor, dry, pale and cool skin, and lethargy) should be discussed with the parents. Forsythe and Allen (2013) discuss that parents require education on temperature management (e.g., reviewing the use of an open crib). LPIs usually need to be dressed in one additional layer of clothing and swaddled in a light-weight blanket to maintain their temperature (Forysthe & Allen, 2013). Furthermore, parents should have a thermometer for home use and feel confident in using it (AWHONN, 2010). It is recommended that the FNP observes a trial of parents taking their infants temperature with their home thermometer and interpreting the readings (Forysthe & Allen, 2013; AWHONN, 2010).

Forysthe and Allen (2013) state that the FNP should instruct the parents to return to the primary care clinic or go to their emergency department if the temperature of their LPI is above 38.6° Celsius (100.4° Fahrenheit) or below 36.1° Celsius (97° Fahrenheit) within the first 28 days of life. Finally, parents should be able to recognize the signs of cold stress (e.g., lethargy, mottled appearance, tachypnea, and poor colour) and the signs of infection (e.g., irritability, hypotonia, respiratory distress, poor perfusion, vomiting and diarrhea, and rashes) in their LPI (AWHONN, 2010).

Supporting Parents

The immature, inconsistent, and disorganized behaviours that LPIs demonstrate (e.g., decreased parent-child interaction and bonding), due to their biological and developmental immaturity (Shapiro-Mendoza, 2009) can generate angst for parents in interpreting and being responsive to the needs of their infant (Bakewell-Sachs, 2007; Brandon et al., 2011; DeMauro, Patel, Medoff-Cooper, Posencheg & Abbasi, 2011; Leahy Warren, 2005). Moreover, early hospital discharge places extreme pressure on the parents to monitor for signs and symptoms associated with their infant's relative physiological immaturity (Premji et al., 2017).

In the postpartum period, maternal stress resulting from complexities surrounding care, undoubtedly influences maternal confidence with regards to the care of their late-preterm infant (Olafsen et al., 2007). Furthermore, situational circumstances, particularly readmission for management of morbidities, may increase this maternal stress (Leigh & Milgrom, 2008; Tu et al., 2007) and anxiety even more (Hummel, 2003; Singer et al., 2003). The increase in healthcare utilization observed amongst LPIs, particularly in the first 30 days following discharge from the hospital (Kuzniewicz, Parker, Schnake-Mahl & Escobar, 2013; Shapiro-Mendoza et al., 2006; Young, Korgenski & Buchi, 2013) may be due in part to incongruences between expected and

observed LPI characteristics, inconsistencies in care between primary healthcare providers and heightened concerns related to morbidities associated with being a LPI (Premji et al., 2017).

Above all, parents need accurate information and a therapeutic approach from their FNP that fosters confidence in care. Perhaps, an integrated care approach with well-defined standards and pathways of care specifically for LPIs can: limit duplication of services (e.g., multiple primary care providers managing the same challenges), ensure a higher consistency in care, and enable the right primary healthcare provider to provide holistic, patient-centered care at the right time and in the right place, albeit while reducing maternal anxiety, stress, and fatigue (Premji et al., 2017).

Maternal Mental Health

Research has found that at six years of age (not taking into account the maternal intelligence quotient (IQ) and socioeconomic status), children born late-preterm were more likely to have a lower IQ and exhibit behavioral problems when compared to children who were born at full-term (Talge et al., 2011). These findings align with Chyi, Lee, Hintz, Gould and Sutcliffe (2008) and Morse, Zheng, Tang and Roth (2009) who found an increased risk for adverse school-age outcomes for LPIs. Furthermore, Gurka, LoCasale-Crouch & Blackman (2010) discuss that early childhood development of LPIs puts them at an increased risk of poor developmental outcomes (e.g., neurodevelopmental disabilities, poor educational ability, early-intervention requirements) up to school age compared to FTIs (McGowan, Alderdice, Holmes & Johnston, 2011). The potential threats to development are also understudied for children born late-preterm; these outcomes include maternal and family health factors (McCormick, Litt, Smith & Zupancic, 2011) and emotional responses.

Voegtline and Stifter (2010) have suggested that mothers of LPIs have increased rates of depression and anxiety in both the short and long-term. This is of particular concern given the influence of maternal mental health on LPIs and early childhood development (Avan, Richter, Ramchandani, Norris & Stein, 2010; Barker, Jaffee, Uher & Maughan, 2011; Grace, Evindar & Stewart, 2003; Murray & Cooper, 1997; Murray, Fiori-Cowley, Hooper & Cooper, 1996). However, further research is needed to inform the evidence base that drives clinical practice and policy recommendations (Karatzias, Chouliara, Maxton, Freer & Power, 2007). Zanardo et al. (2011) found that on day three or four postpartum, mothers of LPIs have increased levels of anxiety, depression, and stress, compared to FTIs, which, in turn, led to earlier cessation of breastfeeding.

Furthermore, Brandon et al. (2011) studied emotional distress amongst mothers LPIs up to one month postpartum and found increased levels of anxiety, depression, post-traumatic stress, and worry compared to mothers of FTIs. In summary, late-preterm births represent 75% of the overall preterm population (Ananth et al., 2013) and, yet there are significant knowledge gaps concerning long-term outcomes for LPIs and their families (McDonald et al., 2013). Furthermore, postpartum mental health for mothers of LPIs constitutes a significant area of investment for further research to identify effective prevention and intervention strategies to support these families (McDonald et al., 2013).

Recommendations for Acute Healthcare Providers

There are many recommendations which could help reduce late-preterm morbidity and mortality. The author believes that refining the discharge-preparation process would reduce the risk of the LPI presenting with medical complications in the primary care setting. As previously discussed, the LPI is being discharged earlier into the primary care setting (Lapillonne et al.,

2013) and although discharging the LPI into the community setting is a tremendous benefit to the LPI's development and to the parent-infant dyad (Kotecha & Allen, 2002), it does not come without higher incidences of mortality and morbidity (Shapiro-Mendoza et al. 2009; Wang et al., 2004). Quinn, Sparks and Gephart (2017) discuss that discharge-preparation interventions related to educating parents before discharge, counseling, and assessing the LPIs parent readiness for discharge may help reduce early discharge in the LPI. If discharge-preparation is done correctly, the prevalence of LPIs presenting in the primary care setting with medical complications would decrease. The American Academy of Pediatrics and Committee on Fetus and Newborn (2008) identifies that three physiological competencies must be met prior to discharge: adequate oral feedings to support growth, the ability to maintain temperature and stability and maturation of respiratory control. Consequently, if these discharge criteria are not met, these physiological complications will manifest in the primary care setting (Buus-Frank, 2005). Therefore, it is crucial that there is a safe and consistent approach to discharge from the secondary or tertiary care setting to the primary care setting.

Quinn et al. (2017) discuss that caring for LPI requires extensive collaboration through a multidisciplinary approach. Specialists in neonatology, pulmonology, gastroenterology, pediatric surgery, developmental, and other disciplines may participate in the LPIs care; each specialist provides important subspecialty insight into the LPIs medical issues. Furthermore, the FNP must help with coordination of these specialist services and provide a holistic view into the LPIs care (Kelly, 2006). Kelly (2006) believes that the FNP is a key member of the LPIs healthcare team; they are uniquely situated to help the LPI to grow and thrive. However, to help facilitate this, the FNP must keep up-to-date of advances in all aspects of late-premature development and ongoing care; nutritional information, immunizations, and screening tests may vary with continued

investigation (Berger & Schaefer, 1985). Kelly states that LPIs who are discharged to the primary care setting should have a detailed, clearly transcribed discharge summary, which is provided to the family and communicated to the receiving FNP at discharge. Furthermore, immunizations, procedures, discharge medications, and feeding plans should be clearly outlined (Kelly, 2006). In summary, good communication of the LPIs hospital course, discharge plan, and follow-up requirements is crucial to the success of the LPI after discharge (Kelly, 2006).

Implications for Further Research

The author believes that this literature review has highlighted the importance of managing the LPI appropriately in the primary care setting, and although there are recommendations and guidelines from established and reputable professional organizations, there are nonetheless, gaps in the literature. Engle, Tomashek, Wallman, & the Committee on Fetus and Newborn (2007) suggest the following are areas in which knowledge and research could be expanded are:

1. causes for late-preterm delivery and short-term fetal, neonatal, and maternal outcomes;
2. developmental immaturity and mechanisms of disease in LPIs;
3. identification tools, educational programs, and screening strategies to identify risk factors and prevent potential medical complications of late-preterm births;
4. recommendations for discharge, early follow-up evaluation, and treatment for jaundice, poor feeding, dehydration, and other complications in LPIs and;
5. long-term medical, neurologic, and developmental outcomes for LPIs.

Conclusion

It is now apparent that the management of the LPI in the primary care setting is far more complicated than many clinical guidelines imply (Darcy, 2009). It cannot be stressed enough that

LPIs are not FTIs and their care should not be defined by the same policies and practices that govern FTIs. The FNP should tailor their approach and conduct individualized risk-focused assessments for this population, completing them at each possible visit opportunity (Mughal et al., 2017). The author believes that the FNP should have an understanding of the pathophysiology that accompanies a late-preterm birth. Furthermore, the FNP should have a heightened awareness of the potential morbidities that may manifest in a LPI. This will enable FNPs to promptly identify, diagnose and treat the potential morbidities that may manifest in the primary care setting. All of these potential morbidities increase total healthcare costs in the late-preterm population when compared with FTIs (McLaurin, Hall, Jackson, Owens & Mahadevia, 2009). Further educational tools and research will help FNPs identify morbidities in the LPI and advocate for appropriate clinical care for this subgroup of premature infants. The author believes these approaches could help prevent unnecessary readmissions and reduce morbidity and mortality rates in the LPIs.

References

Adamkin, D. (2006). Feeding problems in the late preterm infant. *Clinics in Perinatology*, *33*(4), 831-831. doi:10.1016/j.clp.2006.09.003

Ahmed, A. H. (2010). Role of the pediatric nurse practitioner in promoting breastfeeding for late preterm infants in primary care settings. *Journal of Pediatric Health Care*, *24*(2), 116-122. doi:10.1016/j.pedhc.2009.03.005

American Academy of Pediatrics and Committee on Fetus and Newborn. (2008). Hospital discharge of the high-risk neonate. *Pediatrics, 122*(5), 1119-1126. doi:10.1542/peds.2008-2174

American Academy of Pediatrics and Committee on Fetus and Newborn. (2010). Hospital stay for healthy term newborns. *Pediatrics, 125*(2), 405-409. doi:10.1542/peds.2009-3119

American Academy of Pediatrics Subcommittee on Hyperbilirubinemia. (2004). Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. *Pediatrics*, *114*(1), 297.

Ananth, C. V., Friedman, A. M., & Gyamfi-Bannerman, C. (2013). Epidemiology of moderate preterm, late preterm and early term delivery. *Clinics in Perinatology*, *40*(4), 601-610. doi:10.1016/j.clp.2013.07.001

Association of Women's Health, Obstetric, and Neonatal Nurses (AWHONN). (2010). *Assessment and Care of the Late Preterm Infant Evidence-Based Clinical Practice Guidelines*. Washington, DC: AWHONN.

Avan, B., Richter, L. M., Ramchandani, P. G., Norris, S. A., & Stein, A. (2010). Maternal postnatal depression and children's growth and behaviour during the early years of life: Exploring the interaction between physical and mental health. *Archives of Disease in Childhood, 95*(9), 690-695. doi:10.1136/adc.2009.164848

Bakewell-Sachs, S. (2007). Near-term/Late preterm infants. *Newborn and Infant Nursing Reviews, 7*(2), 67-71. doi: 10.1053/j.nainr.2007.05.001

Barker, E. D., Jaffee, S. R., Uher, R., & Maughan, B. (2011). The contribution of prenatal and postnatal maternal anxiety and depression to child maladjustment. *Depression and Anxiety, 28*(8), 696-702. doi:10.1002/da.20856

Baron, I. S., Litman, F. R., Ahronovich, M. D., & Baker, R. (2012). Late preterm birth: A review of medical and neuropsychological childhood outcomes. *Neuropsychology Review, 22*(4), 438-450. doi:10.1007/s11065-012-9210-5

Bettegowda, V. R., Dias, T., Davidoff, M. J., Damus, K., Callaghan, W. M., & Petrini, J. R. (2008). The relationship between cesarean delivery and gestational age among US singleton births. *Clinics in Perinatology, 35*(2), 309-323. doi:10.1016/j.clp.2008.03.002

Bhutani, V. K., & Johnson, L. (2006). Kernicterus in late preterm infants cared for as term healthy infants. *Seminars in Perinatology, 30*(2), 89-97. doi:10.1053/j.semperi.2006.04.001

Blackwell, M. T., Eichenwald, E. C., McAlmon, K., Petit, K., Linton, P. T., McCormick, M. C., & Richardson, D. K. (2005). Inter-neonatal intensive care unit variation in growth rates and feeding practices in healthy moderately premature infants. *Journal of Perinatology, 25*(7), 478-485. doi:10.1038/sj.jp.7211302

Blencowe, H., Cousens, S., Oestergaard, M. Z., Chou, D., Moller, A., Narwal, R., . . . Lawn, J. E. (2012). National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: A systematic analysis and implications. *Lancet (London, England), 379*(9832), 2162. doi:10.1016/S0140-6736(12)60820-4

Bornstein, M. H., Putnick, D. L., Suwalsky, J. T. D., & Gini, M. (2006). Maternal chronological age, prenatal and perinatal history, social support, and parenting of infants. *Child Development, 77*(4), 875-892. doi:10.1111/j.1467-8624.2006.00908.x

Boyle, E. M., Poulsen, G., Field, D. J., Kurinczuk, J. J., Wolke, D., Alfirevic, Z., & Quigley, M. A. (2013). Effects of gestational age at birth on health outcomes at 3 and 5 years of age:

Population-based cohort study. *Obstetric Anesthesia Digest, 33*(2), 84-85. 10.1097/01.aoa.0000429115.40553.95

Brandon, D. H., Tully, K. P., Silva, S. G., Malcolm, W. F., Murtha, A. P., Turner, B. S., & Holditch-Davis, D. (2011). Emotional responses of mothers of late-preterm and term infants. *Journal of Obstetric, Gynecologic, and Neonatal Nursing: JOGNN / NAACOG, 40*(6), 719-731. doi:10.1111/j.1552-6909.2011.01290.x

Bromiker, R., Arad, I., Loughran, B., Netzer, D., Kaplan, M., & Medoff-Cooper, B. (2005). Comparison of sucking patterns at introduction of oral feeding and at term in Israeli and American preterm infants. *Acta Paediatrica*, 94(2), 201-204. doi:10.1080/08035250510025914

Brown, M., & Olshansky, E. (1998). Becoming a primary care nurse practitioner: Challenges of the initial year of practice. *The Nurse Practitioner*, 23(7), 46-66. doi:10.1097/00006205-199807000-00004

Buus-Frank, M. E. (2005). The great imposter. *Advances in Neonatal Care: Official Journal of the National Association of Neonatal Nurses,* 5(5), 233-236. doi: 10.1016/j.adnc.2005.08.012

Callen, P. W. (2000). *Ultrasonography in obstetrics and gynecology* (4th ed.). Philadelphia: W.B. Saunders.

Canadian Institute for Health Information. (2017). *Childbirth indicators by place of residence, 2015–2016.*

Available: https://www.cihi.ca/en/dadhmdb-childbirth-indicators-by-place-of-residence-0

Last Accessed: March 13th, 2018.

Chyl, L. J., Lee, H. C., Hintz, S. R., Gould, J. B., & Sutcliffe, T. L. (2008). School outcomes of late preterm infants: Special needs and challenges for infants born at 32- to 36-week gestation. *Obstetrical & Gynecological Survey, 63*(11), 691-692. doi: 10.1097/01.ogx.0000334732.35212.87

Clark, R. H. (2005). The epidemiology of respiratory failure in neonates born at an estimated gestational age of 34 weeks or more. *Obstetrical & Gynecological Survey, 60*(9), 577-578. doi: 10.1097/01.ogx.0000175807.03513.c4

Coletti, M. F., Caravale, B., Gasparini, C., Franco, F., Campi, F., & Dotta, A. (2015). One-year neurodevelopmental outcome of very and late preterm infants: Risk factors and correlation with maternal stress. *Infant Behavior Development*, 39, 11–20. https://doi.org/10.1016/j. infbeh.2015.01.003

College of Registered Nurses of British Columbia. (2017*). Scope of Practice for Nurse Practitioners*. Available: https://www.crnbc.ca/Standards/Lists/StandardResources/688ScopeforNPs.pdf Last Accessed: March 13th, 2018.

Committee on Fetus and Newborn. (2004). Age terminology during the perinatal period. *Pediatrics, 114*(5), 1362. doi:10.1542/peds.2004-1915

Cornblath, M., Hawdon, J. M., Williams, A. F., Aynsley-Green, A., Ward-Platt, M. P., Schwartz, R., & Kalhan, S. C. (2000). Controversies regarding definition of neonatal hypoglycemia: Suggested operational thresholds. *Pediatrics, 105*(5), 1141-1145. doi:10.1542/peds.105.5.1141

Colin, A. A., McEvoy, C., & Castile, R. G. (2010). Respiratory morbidity and lung function in preterm infants of 32 to 36 weeks' gestational age. *Pediatrics, 126*(1), 115-128. doi:10.1542/peds.2009-1381

Copland, I., & Post, M. (2004). *Lung development and fetal lung growth*. England: Elsevier Ltd. doi:10.1016/S1526-0542(04)90049-8

Corso, K. J., & DeButy, K. (2011). Caution: I'm a late preterm infant. *Journal of Obstetric, Gynecologic & Neonatal Nursing, 40*, S26-S26. doi:10.1111/j.1552-6909.2011.01242_35.x

Cregan, M. D., Mello, T. R. D., Kershaw, D., McDougall, K., & Hartmann, P. E. (2002). Initiation of lactation in women after preterm delivery. *Acta Obstetricia Et Gynecologica Scandinavica, 81*(9), 870-877. doi:10.1080/j.1600-0412.2002.810913.x

Cunningham, F. G., & Williams, J. W. (2005). *Williams obstetrics (22nd ed.)*. New York: McGraw-Hill, Medical Pub. Division.

Darcy, A. E. (2009). Complications of the late preterm infant. *The Journal of Perinatal & Neonatal Nursing, 23*(1), 78-86. doi:10.1097/JPN.0b013e31819685b6

Davidoff, M. J., Dias, T., Damus, K., Russell, R., Bettegowda, V. R., Dolan, S., . . . Petrini, J. (2006). Changes in the gestational age distribution among U.S. singleton births: Impact on rates of late preterm birth, 1992 to 2002. *Seminars in Perinatology, 30*(1), 8-15. doi: 10.1053/j.semperi.2006.01.009

Declercq, E. R., Sakala, C., Corry, M. P., & Applebaum, S. (2007). Listening to mothers II: Report of the second national U.S. survey of women's childbearing experiences: Conducted January-February 2006 for childbirth connection by Harris interactive(R) in partnership with Lamaze international. *The Journal of Perinatal Education, 16*(4), 15.

de Jong, M., Verhoeven, M., & van Baar, A. L. (2012). School outcome, cognitive functioning, and behaviour problems in moderate and late preterm children and adults: A review. *Seminars in Fetal & Neonatal Medicine, 17*(3), 163. doi: 10.1016/j.siny.2012.02.003

DeMauro, S. B., Patel, P. R., Medoff-Cooper, B., Posencheg, M., & Abbasi, S. (2011). Post-discharge feeding patterns in early- and late-preterm infants. *Clinical Pediatrics, 50*(10), 957-962. doi:10.1177/0009922811409028

Dimitriou, G., Fouzas, S., Georgakis, V., Vervenioti, A., Papadopoulos, V. G., Decavalas, G., & Mantagos, S. (2010). Determinants of morbidity in late preterm infants. *Early Human Development, 86*(9), 587-591. doi: 10.1016/j.earlhumdev.2010.07.011

Dudell, G. G., & Jain, L. (2006). Hypoxic respiratory failure in the late preterm infant. *Clinics in Perinatology, 33*(4), 803.

Engle, W. A. (2006, February). A recommendation for the definition of "late-preterm" (near-term) and the birth weight–gestational age classification system. In *Seminars in perinatology* (Vol. 30, No. 1, pp. 2-7). WB Saunders.

Engle, W. A. (2011). Morbidity and mortality in late preterm and early term newborns: A Continuum. *Clinics in Perinatology, 38*(3), 493-516. doi: 10.1016/j.clp.2011.06.009

Engle, W. A., Tomashek, K. M., Wallman, C., American Academy of Pediatrics, & and the Committee on Fetus and Newborn. (2007). "late-preterm" infants: A population at risk. *Pediatrics, 120*(6), 1390-1401. doi:10.1542/peds.2007-2952

Escobar, G. J., Greene, J. D., Hulac, P., Kincannon, E., Bischoff, K., Gardner, M. N., . . . France, E. K. (2005). Rehospitalization after birth hospitalization: Patterns among infants of all gestations. *Archives of Disease in Childhood, 90*(2), 125-131. doi:10.1136/adc.2003.039974

Escobar, G. J., Clark, R. H., & Greene, J. D. (2006). Short-term outcomes of infants born at 35 and 36 weeks' gestation: We need to ask more questions. *Seminars in Perinatology, 30*(1), 28-33. doi: 10.1053/j.semperi.2006.01.005

Ezaki, S., Ito, T., Suzuki, K., & Tamura, M. (2008). Association between total antioxidant capacity in breast milk and postnatal age in days in premature infants. *Journal of Clinical Biochemistry and Nutrition, 42*(2), 133-137. doi: 10.3164/jcbn.2008019

Forsythe, E. S., & Allen, P. J. (2013). Health risks associated with late-preterm infants: Implications for newborn primary care. *Pediatric Nursing, 39*(4), 197.

Galambos, C., & DeMello, D. E. (2008). Regulation of alveologenesis clinical implications of impaired growth. *Pathology, 40*(2), 124-140. doi:10.1080/00313020701818981

Garg, M., & Devaskar, S. U. (2006). Glucose metabolism in the late preterm infant. *Clinics in Perinatology, 33*(4), 853.

Geddes, D. T., Kent, J. C., Mitoulas, L. R., & Hartmann, P. E. (2008). Tongue movement and intra-oral vacuum in breastfeeding infants. *Early Human Development, 84*(7), 471-477. doi: 10.1016/j.earlhumdev.2007.12.008

Gilbert, W. M., Nesbitt, T. S., & Danielsen, B. (2003). The cost of prematurity: Quantification by gestational age and birth weight. *Obstetrics & Gynecology, 102*(3), 488-492. doi: 10.1016/S0029-7844(03)00617-3

Gluckman, P. D., Hanson, M. A., Beedle, A. S., & Raubenheimer, D. (2008). Fetal and neonatal pathways to obesity. *Frontiers of Hormone Research, 36*, 61.

Goldenberg, R. L., & Nelson, K. (1975). Iatrogenic respiratory distress syndrome. an analysis of obstetric events preceding delivery of infants who develop respiratory distress syndrome. *American Journal of Obstetrics and Gynecology, 123*(6), 617.

Goyal, N. K., Fager, C., & Lorch, S. A. (2011). Adherence to discharge guidelines for late-preterm newborns. *Pediatrics, 128*(1), 62-71. doi: 10.1542/peds.2011-0258

Goyal, N. K., Fiks, A. G., & Lorch, S. A. (2012). Persistence of underweight status among late preterm infants. *Archives of Pediatrics & Adolescent Medicine, 166*(5), 424-430. doi: 10.1001/archpediatrics.2011.1496

Grace, S. L., Evindar, A., & Stewart, D. E. (2003). The effect of postpartum depression on child cognitive development and behavior: A review and critical analysis of the literature. *Archives of Women's Mental Health, 6*(4), 263-274. doi: 10.1007/s00737-003-0024-6

Gurka, M. J., LoCasale-Crouch, J., & Blackman, J. A. (2010). Long-term cognition, achievement, socioemotional, and behavioral development of healthy late-preterm infants. *Archives of Pediatrics & Adolescent Medicine, 164*(6), 525-532. doi: 10.1001/archpediatrics.2010.83

Hagan, J. F., Jr, Shaw, J. S., & Duncan, P. M. (2008). *Bright futures: Guidelines for health supervision of infants, children, and adolescents* (3rd ed.). Elk Grove Village, IL: American Academy of Pediatrics.

Hamilton, B. E., Martin, J. A., & Ventura, S. J. (2010). Births: Preliminary data for 2009. *National Vital Statistics Reports: From the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System, 59*(3), 1.

Hankins, G. D. V., & Longo, M. (2006). The role of stillbirth prevention and late preterm (near-term) births. *Seminars in Perinatology, 30*(1), 20-23. doi: 10.1053/j.semperi.2006.01.011

Hauth, J. C. (2006). Spontaneous preterm labor and premature rupture of membranes at late preterm gestations: To deliver or not to deliver. *Seminars in Perinatology, 30*(2), 98-102. doi: 10.1053/j.semperi.2006.02.008

Hay Jr, W. (2009). Knowledge gaps and research needs for understanding and treating neonatal hypoglycemia: Workshop report from Eunice Kennedy Shriver National Institute of Child Health and Human Development. *Journal of Pediatrics, 155*(5), 612-617. doi: 10.1016/j.jpeds.2009.06.044

Hill, L. A., & Sawatzky, J. V. (2011). Transitioning into the nurse practitioner role through mentorship. *Journal of Professional Nursing, 27*(3), 161-167. doi: 10.1016/j.profnurs.2011.02.004

Howe, T., Sheu, C., Wang, T., & Hsu, Y. (2014). Parenting stress in families with very low birth weight preterm infants in early infancy. *Research in Developmental Disabilities, 35*(7), 1748-1756. doi: 10.1016/j.ridd.2014.02.015

Hummel, P. (2003). Parenting the high-risk infant. *Newborn and Infant Nursing Reviews, 3*(3), 88-92. doi: 10.1016/S1527-3369(03)00035-7

Huppi, P., Warfield, S., Kikinis, R., Barnes, P., Zientara, G., Jolesz, F., . . . Volpe, J. (1998). Quantitative magnetic resonance imaging of brain development in premature and mature newborns. *Annals of Neurology, 43*(2), 224-235. doi:10.1002/ana.410430213

Jain, S., & Cheng, J. (2006). Emergency department visits and rehospitalizations in late preterm infants. *Clinics in Perinatology, 33*(4), 935.

Jain, L., & Eaton, D. C. (2006). Physiology of fetal lung fluid clearance and the effect of labor. *Seminars in Perinatology, 30*(1), 34-43. doi: 10.1053/j.semperi.2006.01.006

Jefferies, A., & Canadian Paediatric Society, Fetus and Newborn Committee. (2014). Going home: Facilitating discharge of the preterm infant. *Paediatrics & Child Health, 19*(1), 31-36. 10.1093/pch/19.1.31

Johnston, K. M., Gooch, K., Korol, E., Vo, P., Eyawo, O., Bradt, P., & Levy, A. (2014). The economic burden of prematurity in Canada. *BMC Pediatrics*, *14*(1), 93-93. doi:10.1186/1471-2431-14-93

Kalish, R. B., & Chervenak, F. A. (2005). Sonographic determination of gestational age. *The ultrasound review of Obstetrics and Gynecology*, *5*(4), 254-258

Karatzias, T., Chouliara, Z., Maxton, F., Freer, Y., & Power, K. (2007). Post-traumatic symptomatology in parents with premature infants: A systematic review of the literature. *Journal of Prenatal and Perinatal Psychology and Health*, *21*(3), 249.

Kelly, M. M. (2006). The medically complex premature infant in primary care. *Journal of Pediatric Health Care, 20*(6), 367-373. doi: 10.1016/j.pedhc.2006.01.003

Kerstjens, J. M., de Winter, A. F., Bocca-Tjeertes, I. F., ten Vergert, E. M. J., Reijneveld, S. A., & Bos, A. F. (2011). Developmental delay in moderately preterm-born children at school entry. *The Journal of Pediatrics, 159*(1), 92-98. doi: 10.1016/j.jpeds.2010.12.041

Khashu, M., Narayanan, M., Bhargava, S., & Osiovich, H. (2009). Perinatal outcomes associated with preterm birth at 33 to 36 weeks' gestation: A population-based cohort study. *Pediatrics, 123*(1), 109-113. doi: 10.1542/peds.2007-3743

Kinney, H. C. (2006). The near-term (late preterm) human brain and risk for periventricular leukomalacia: A review. *Seminars in Perinatology, 30*(2), 81-88. doi: 10.1053/j.semperi.2006.02.006

Kotecha, S., & Allen, J. (2002). Oxygen therapy for infants with chronic lung disease. *Archives of Disease in Childhood, 87*(1), F11-F14.

Kramer, M. S., Demissie, K., Yang, H., Platt, R. W., Sauvé, R., Liston, R., & for the Fetal and Infant Health Study Group of the Canadian Perinatal Surveillance System. (2000). The

contribution of mild and moderate preterm birth to infant mortality. *Journal of the American Medical Association, 284*(7), 843-849. doi: 10.1001/jama.284.7.843

Kugelman, A., & Colin, A. A. (2013). Late preterm infants: Near term but still in a critical developmental time period. *Pediatrics, 132*(4), 741-751. doi: 10.1542/peds.2013-1131

Kuzniewicz, M. W., Parker, S., Schnake-Mahl, A., & Escobar, G. J. (2013). Hospital readmissions and emergency department visits in moderate preterm, late preterm, and early term infants. *Clinics in Perinatology, 40*(4), 753-775. doi: 10.1016/j.clp.2013.07.008

Laing, F. C., Frates, M. C., & Benson, C. B. (2000). Ultrasound evaluation during the first trimester of pregnancy. *Ultrasonography in obstetrics and gynecology*, *4*, 105-45.

Lapillonne, A., O'Connor, D. L., Wang, D., & Rigo, J. (2013). Nutritional recommendations for the late-preterm infant and the preterm infant after hospital discharge. *The Journal of Pediatrics, 162*(3 Suppl), S90-S100. doi: 10.1016/j.jpeds.2012.11.058

Langston, C., Kida, K., Reed, M., & Thurlbeck, W. M. (1984). Human lung growth in late gestation and in the neonate. *The American Review of Respiratory Disease, 129*(4), 607.

Leahy Warren, P. (2005). First-time mothers: Social support and confidence in infant care. *Journal of Advanced Nursing, 50*(5), 479-488. doi: 10.1111/j.1365-2648.2005.03425.x

Lee, Y. M., Cleary-Goldman, J., & D'Alton, M. E. (2006). Multiple gestations and late preterm (near-term) deliveries. *Seminars in Perinatology, 30*(2), 103-112. doi: 10.1053/j.semperi.2006.03.001

Leigh, B., & Milgrom, J. (2008). Risk factors for antenatal depression, postnatal depression and parenting stress. *BMC Psychiatry, 8*(1), 24-24. doi: 10.1186/1471-244X-8-24

Leone, A., Ersfeld, P., Adams, M., Meyer Schiffer, P., Bucher, H., & Arlettaz, R. (2012). Neonatal morbidity in singleton late preterm infants compared with full-term infants. *Acta Paediatrica, 101*(1), e6-e10. doi: 10.1111/j.1651-2227.2011.02459.x

Lipkind, H. S., Slopen, M. E., Pfeiffer, M. R., & McVeigh, K. H. (2012). School-age outcomes of late preterm infants in New York city. *American Journal of Obstetrics and Gynecology, 206*(3), 222.e1-222.e6. doi: 10.1016/j.ajog.2012.01.007

Lott, J. W. (2006). State of the science: Neonatal bacterial infection in the early 21st century. *The Journal of Perinatal & Neonatal Nursing, 20*(1), 62-70.

Ludwig, S. M. (2007). Oral feeding and the late preterm infant. *Newborn and Infant Nursing Reviews, 7*(2), 72-75. doi: 10.1053/j.nainr.2007.05.005

Maisels, M. J., & Kring, E. (1998). Length of stay, jaundice, and hospital readmission. *Pediatrics, 101*(6), 995-998. doi: 10.1542/peds.101.6.995

Mally, P. V., Hendricks-Muñoz, K. D., & Bailey, S. (2013). Incidence and etiology of late preterm admissions to the neonatal intensive care unit and its associated respiratory morbidities when compared to term infants. *American journal of perinatology*, *30*(05), 425-432.

Martin, J. A., Hamilton, B. E., Ventura, S. J., Osterman, M. J. K., Wilson, E. C., & Mathews, T. J. (2012). Births: Final data for 2010. *National Vital Statistics Reports: From the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System, 61*(1), 1.

Mathews, T. J., & Hamilton, B. E. (2002). Mean age of mother, 1970-2000. *National Vital Statistics Reports: From the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System, 51*(1), 1.

Mathews, T. J., & MacDorman, M. F. (2007). Infant mortality statistics from the 2004 period linked birth/infant death data set. *National Vital Statistics Reports: From the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System, 55*(14), 1.

McCormick, M. C., Litt, J. S., Smith, V. C., & Zupancic, J. A. F. (2011). Prematurity: An overview and public health implications. *Annual Review of Public Health, 32*(1), 367-379. doi: 10.1146/annurev-publhealth-090810-182459

McCourt, C., Weaver, J., Statham, H., Beake, S., Gamble, J., & Creedy, D. K. (2007). Elective cesarean section and decision making: A critical review of the literature. *Birth, 34*(1), 65-79. doi: 10.1111/j.1523-536X.2006.00147.x

McDonald, S. W., Benzies, K. M., Gallant, J. E., McNeil, D. A., Dolan, S. M., & Tough, S. C. (2013). A comparison between late preterm and term infants on breastfeeding and maternal mental health. *Maternal and Child Health Journal, 17*(8), 1468-1477. doi: 10.1007/s10995-012-1153-1

McGowan, J. E., Alderdice, F. A., Holmes, V. A., & Johnston, L. (2011). Early childhood development of late-preterm infants: A systematic review. *Pediatrics, 127*(6), 1111-1124. doi: 10.1542/peds.2010-2257

McIntire, D. D., & Leveno, K. J. (2008). Neonatal mortality and morbidity rates in late preterm births compared with births at term. *Obstetrics and Gynecology, 111*(1), 35-41. doi :10.1097/01.AOG.0000297311.33046.73

McLaurin, K. K., Hall, C. B., Jackson, E. A., Owens, O. V., & Mahadevia, P. J. (2009). Persistence of morbidity and cost differences between late-preterm and term infants during the first year of life. *Pediatrics*, *123*(2), 653-659. doi: 10.1542/peds.2008-1439

Meier, P. P., Furman, L. M., & Degenhardt, M. (2007). Increased lactation risk for late preterm infants and mothers: Evidence and management strategies to protect breastfeeding. *Journal of Midwifery and Women's Health, 52*(6), 579-587. doi: 10.1016/j.jmwh.2007.08.003

Miesnik, S. R., & Reale, B. J. (2007). A review of issues surrounding medically elective cesarean delivery. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 36*(6), 605-615. doi: 10.1111/j.1552-6909.2007.00196.x

Morse, S. B., Zheng, H., Tang, Y., & Roth, J. (2009). Early school-age outcomes of late preterm infants. *Pediatrics, 123*(4), e622-e629. doi: 10.1542/peds.2008-1405

Moster, D., Lie, R. T., & Markestad, T. (2008). Long-term medical and social consequences of preterm birth. *The New England Journal of Medicine, 359*(3), 262-273. doi: 10.1056/NEJMoa0706475

Mughal, M. K., Ginn, C. S., Magill-Evans, J., & Benzies, K. M. (2017). Parenting stress and development of late preterm infants at 4 months corrected age. *Research in Nursing & Health, 40*(5), 414-423. doi:10.1002/nur.21809

Munakata, S., Okada, T., Okahashi, A., Yoshikawa, K., Usukura, Y., Makimoto, M., . . . Okuhata, Y. (2013). Gray matter volumetric MRI differences late-preterm and term infants.*Brain & Development, 35*(1), 10-16. doi: 10.1016/j.braindev.2011.12.011

Murray, L., Fiori-Cowley, A., Hooper, R., & Cooper, P. (1996). The impact of postnatal depression and associated adversity on early mother-infant interactions and later infant outcome. *Child Development, 67*(5), 2512-2526. doi: 10.1111/j.1467-8624.1996.tb01871.x

Murray, L., & Cooper, P. J. (1997). *Postpartum depression and child development*. New York: Guilford Press.

National Center for Health Statistics. (2008). *Births: preliminary data for 2008*. Centers for Disease Control and Prevention. Available at: www.cdc.gov/nchs/data/nvsr/nvsr58/nvsr58_16.pdf. Last Accessed: March 13th, 2018.

Newman, T. B., Escobar, G. J., Gonzales, V. M., Armstrong, M. A., Gardner, M. N., & Folck, B. F. (1999). Frequency of neonatal bilirubin testing and hyperbilirubinemia in a large health maintenance organization. *Pediatrics*, *104*(5 Pt 2), 1198.

Odd, D. E., Lingam, R., Emond, A., & Whitelaw, A. (2013). Movement outcomes of infants born moderate and late preterm. *Acta Paediatrica*, *102*(9), 876-882. doi: 10.1111/apa.12320

Olafsen, K. S., Rønning, J. A., Bredrup Dahl, L., Ulvund, S. E., Handegård, B. H., & Kaaresen, P. I. (2007). Infant responsiveness and maternal confidence in the neonatal period. *Scandinavian Journal of Psychology*, *48*(6), 499-509. doi: 10.1111/j.1467-9450.2007.00619.x

Pados, B. F. (2007). Safe transition to home: Preparing the near-term infant for discharge. *Newborn and Infant Nursing Reviews*, 7(2), 106-113. doi: 10.1053/j.nainr.2007.03.002

Petrini, J. (2009). Increased risk of adverse neurological development for late preterm infants. *Journal of Pediatrics*, *154*(2), 169-176.e3. doi: 10.1016/j.jpeds.2008.08.020

Perinatal Services BC. (2015). *Perinatal Services BC: Standards for Obstetrical Ultrasound Assessment*s.

Available at: http://www.perinatalservicesbc.ca/Documents/Guidelines-Standards/Standards/Ultrasound/PSBCUltrasoundAssessmentStandards.pdf
Last Accessed: March 13th, 2018.

Power, G. G., Blood, A. B., & Hunter, C. J. (2004). Perinatal thermal physiology. In *Fetal and Neonatal Physiology* (3rd ed.) (pp. 541-548). Philadelphia, PA: Elsevier.

Premji, S. S., Currie, G., Reilly, S., Dosani, A., Oliver, L. M., Lodha, A. K., & Young, M. (2017). A qualitative study: Mothers of late preterm infants relate their experiences of community-based care. *PLoS One, 12*(3), e0174419. doi: 10.1371/journal.pone.0174419

Public Health Agency of Canada, & Canadian Perinatal Surveillance System. (2013). *Perinatal health indicators for Canada 2013: A report from the Canadian perinatal surveillance system*. Ottawa: Public Health Agency of Canada = Agence de la santé publique du Canada.

Pulver, L. S., Denney, J. M., Silver, R. M., & Young, P. C. (2010). Morbidity and discharge timing of late preterm newborns. *Clinical Pediatrics, 49*(11), 1061-1067. doi: 10.1177/0009922810376821

Quigley, M. A., Poulsen, G., Boyle, E., Wolke, D., Field, D., Alfirevic, Z., & Kurinczuk, J. J. (2012). Early term and late preterm birth are associated with poorer school performance at age 5 years: A cohort study. *Archives of Disease in Childhood. Fetal and Neonatal Edition, 97*(3), F167-F173. doi: 10.1136/archdischild-2011-300888

Quinn, J. M., Sparks, M., & Gephart, S. M. (2017). Discharge criteria for the late preterm infant: A review of the literature. *Advances in Neonatal Care, 17*(5), 362-371. doi: 10.1097/ANC.0000000000000406

Raju, T. N. K. (2006). Epidemiology of late preterm (near-term) births. *Clinics in Perinatology, 33*(4), 751.

Raju, T. N. K., Higgins, R. D., Stark, A. R., & Leveno, K. J. (2006). Optimizing care and outcome for late-preterm (near-term) infants: A summary of the workshop sponsored by the national institute of child health and human development. *Pediatrics, 118*(3), 1207-1214. doi: 10.1542/peds.2006-0018

Ramachandrappa, A., & Jain, L. (2008). Elective cesarean section: Its impact on neonatal respiratory outcome. *Clinics in Perinatology, 35*(2), 373-393. doi: 10.1016/j.clp.2008.03.006

Ramachandrappa, A., & Jain, L. (2009). Health issues of the late preterm infant. *The Pediatric Clinics of North America, 56*(3), 565-577. doi: 10.1016/j.pcl.2009.03.009

Radtke, J. V. (2011). The paradox of Breastfeeding-Associated morbidity among late preterm infants. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*, *40*(1), 9-24. doi: 10.1111/j.1552-6909.2010.01211.x

Roth-Kleiner, M., Wagner, B. P., Bachmann, D., & Pfenninger, J. (2003). Respiratory distress syndrome in near-term babies after caesarean section. *Swiss Medical Weekly, 133*(19-20), 283.

Samra, H. A., McGrath, J. M., & Wehbe, M. (2011). An integrated review of developmental outcomes and late-preterm birth. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*, *40*(4), 399-411.

Sarici, S. Ü., Serdar, M. A., Korkmaz, A., Erdem, G., Oran, O., Tekinalp, G., ... & Yigit, S. (2004). Incidence, course, and prediction of hyperbilirubinemia in near-term and term newborns. *Pediatrics*, *113*(4), 775-780. doi: 10.1542/peds.113.4.775

Shapiro-Mendoza, C. K., Tomashek, K. M., Kotelchuck, M., Barfield, W., Weiss, J., & Evans, S. (2006). Risk factors for neonatal morbidity and mortality among "healthy," late preterm newborns. *Seminars in Perinatology, 30*(2), 54. doi: 10.1053/j.semperi.2006.02.002

Shapiro-Mendoza, C. K., Tomashek, K. M., Kotelchuck, M., Barfield, W., Nannini, A., Weiss, J., & Declercq, E. (2008). Effect of late-preterm birth and maternal medical conditions on newborn morbidity risk. *Pediatrics, 121*(2), e223-e232. doi:10.1542/peds.2006-3629

Shapiro-Mendoza, C. K. (2009). Infants Born Late Preterm: Epidemiology, Trends, and Morbidity Risk. *NeoReviews*, *10*(6), e287-e294.

Shapiro-Mendoza, C., Kotelchuck, M., Barfield, W., Davin, C. A., Diop, H., Silver, M., & Manning, S. E. (2013). Enrollment in early intervention programs among infants born late preterm, early term, and term. *Pediatrics, 132*(1), e61-e69. doi: 10.1542/peds.2012-3121

Singer, L. T., Fulton, S., Davillier, M., Koshy, D., Salvator, A., & Baley, J. E. (2003). Effects of infant risk status and maternal psychological distress on maternal-infant interactions during the first year of life. *Journal of Developmental and Behavioral Pediatrics, 24*(4), 233-241. doi :10.1097/00004703-200308000-00003

Smith, D. E., Otulakowski, G., Yeger, H., Post, M., Cutz, E., & O'Brodovich, H. M. (2000). Epithelial Na+ channel (ENaC) expression in the developing normal and abnormal human perinatal lung. *American journal of respiratory and critical care medicine*, *161*(4), 1322-1331.

Stoltz, J. E., Straughn, S., & Kupsick, C. (2011). Development of a late preterm infant initiative on the postpartum unit. *Journal of Obstetric, Gynecologic & Neonatal Nursing, 40*, S29-S29. doi: 10.1111/j.1552-6909.2011.01242_40.x

Sutcliffe, A. G., Barnes, J., Belsky, J., Gardiner, J., & Melhuish, E. (2012). The health and development of children born to older mothers in the United Kingdom: Observational study using longitudinal cohort data. *British Medical Journal, 345*(7876), 18-18. doi: 10.1136/bmj.e5116

Talge, N. M., Holzman, C., Wang, J., Lucia, V., Gardiner, J., & Breslau, N. (2010). Late-preterm birth and its association with cognitive and socioemotional outcomes at 6 years of age. *Pediatrics, 126*(6), 1124-1131. doi: 10.1542/peds.2010-1536

Tomashek, K. M., Shapiro-Mendoza, C. K., Weiss, J., Kotelchuck, M., Barfield, W., Evans, S., & Declercq, E. (2006). Early discharge among late preterm and term newborns and risk of neonatal morbidity. *Seminars in Perinatology, 30*(2), 61-68. doi: 10.1053/j.semperi.2006.02.003

Treyvaud, K. (2014). Parent and family outcomes following very preterm or very low birth weight birth: A review. *Seminars in Fetal & Neonatal Medicine, 19*(2), 131. doi: 10.1016/j.siny.2013.10.008

Tu, M. T., Grunau, R. E., Petrie-Thomas, J., Haley, D. W., Weinberg, J., & Whitfield, M. F. (2007). Maternal stress and behavior modulate relationships between neonatal stress, attention, and basal cortisol at 8 months in preterm infants. *Developmental Psychobiology, 49*(2), 150-164. doi: 10.1002/dev.20204

Ventolini, G., Neiger, R., Mathews, L., Adragna, N., & Belcastro, M. (2008). Incidence of respiratory disorders in neonates born between 34 and 36 weeks of gestation following exposure to antenatal corticosteroids between 24 and 34 weeks of gestation. *American Journal of Perinatolog, 25*(2), 079-083. doi: 10.1055/s-2007-1022470

Voegtline, K. M., & Stifter, C. A. (2010). Late-preterm birth, maternal symptomatology, and infant negativity. *Infant Behavior and Development, 33*(4), 545-554. doi: 10.1016/j.infbeh.2010.07.006

Walker, M. (2008). Breastfeeding the late preterm infant. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 37*(6), 692-701. doi: 10.1111/j.1552-6909.2008.00293.x

Wang, M. L., Dorer, D. J., Fleming, M. P., & Catlin, E. A. (2004). Clinical outcomes of near-term infants. *Pediatrics*, *114*(2), 372-376. doi: 10.1542/peds.114.2.372

Watchko, J. F. (2006). Hyperbilirubinemia and bilirubin toxicity in the late preterm infant. *Clinics in Perinatology*, *33*(4), 839.

Whyte, R., & Fetus Newborn Comm. (2010). Safe discharge of the late preterm infant. *Paediatrics & Child Health, 15*(10), 655-660. doi: 10.1093/pch/15.10.655

Young, P. C., Glasgow, T. S., Li, X., Guest-Warnick, G., & Stoddard, G. (2007). Mortality of late-preterm (near-term) newborns in Utah. *Pediatrics, 119*(3), e659-e665. doi:10.1542/peds.2006-2486

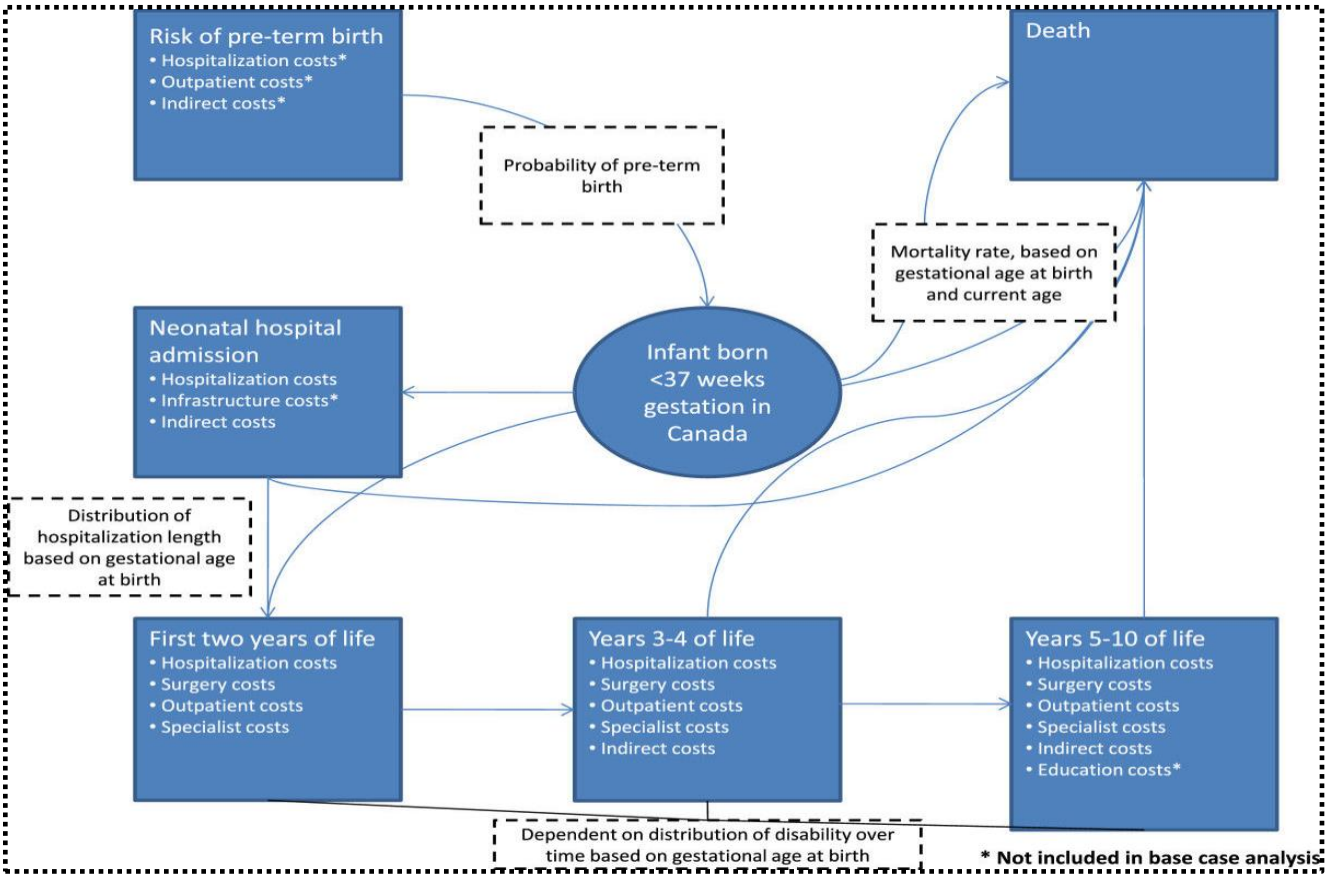
Young, P. C., Korgenski, K., & Buchi, K. F. (2013). Early readmission of newborns in a large health care system. *Pediatrics, 131*(5), e1538-e1544. doi: 10.1542/peds.2012-2634

Zanardo, V., Gambina, I., Begley, C., Litta, P., Cosmi, E., Giustardi, A., & Trevisanuto, D. (2011). Psychological distress and early lactation performance in mothers of late preterm infants. *Early Human Development, 87*(4), 321-323. doi: 10.1016/j.earlhumdev.2011.01.035

Appendix A

Schematic of Markov model structure for estimating economic burden of prematurity in Canada.

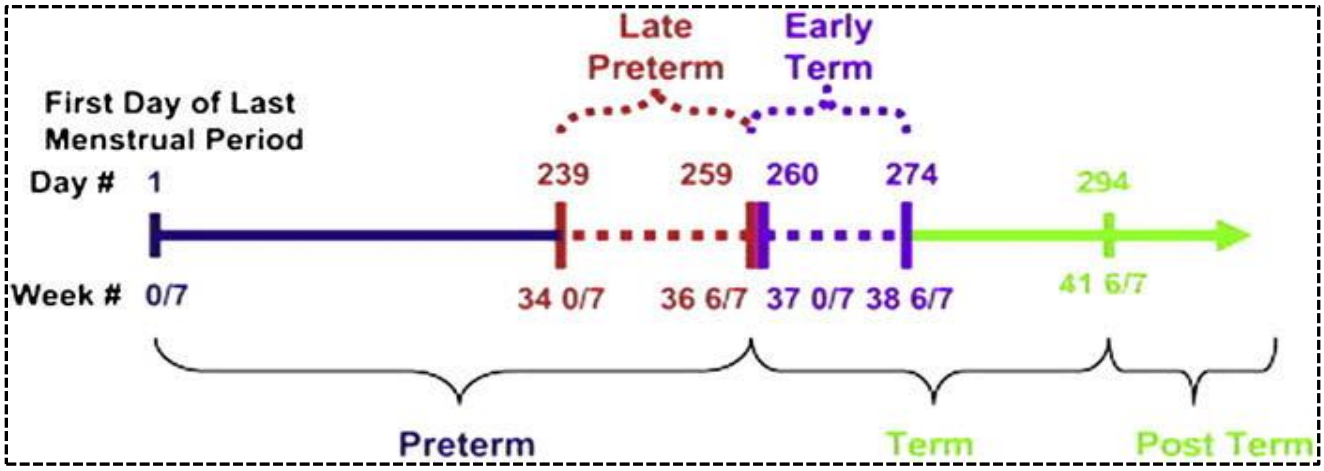
(Johnston et al., 2014)



Appendix B

Definition of ‘late-preterm’ and ‘early term’.

(Engle et al., 2007).



Appendix C

Family Nurse Practitioner Scope of Practice

College of Registered Nurses of British Columbia (2017)

The family nurse practitioner can:

- provide comprehensive health assessments and perform check-ups.
- diagnose health conditions.
- treat and manage acute and chronic illness.
- treat and manage simple and complex health issues.
- order and interpret screening and diagnostic tests.
- order procedures.
- prescribe treatment and medications.
- refer clients to other healthcare professionals and specialists.
- treat, transfer, and may discharge in-patients, and community out-patients from hospitals.
- provide counselling and education.

Appendix D

Table A1

Morbidities in Late-preterm Versus Term Infants

Morbidity	Wang et al. (2004) Frequency		Leone et al. (2012) Frequency	
	Late Pre-Term	Full Term	Late Pre-Term	Full Term
Temperature Instability	10.0%	0%	2.5%	0.6%
Hypoglycemia	15.6%	5.3%	14.3%	0.6%
Respiratory Distress	28.9%	5.3%	34.7%	4.6%
Apnea/Bradycardia	4.4%	0%	n/a	n/a
Jaundice/Hyperbilirubinemia	54.4%	37.9%	47.7%	3.4%
Sepsis evaluation	36.7%	12.6%	n/a	n/a
Poor feeding	76.0%	28.6%	n/a	n/a
Intravenous Infusions	26.7%	5.3%	n/a	n/a

Table B2

Potential Postnatal Risks to Late-Preterm Infants and the Primary Care Interventions

Adapted from Association of Women's Health, Obstetric, and Neonatal Nurses (AWHONN), 2010.

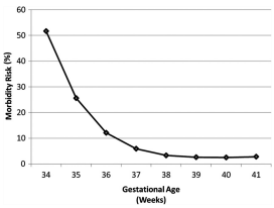
Postnatal Risk	Primary Care Intervention
General Recommendations	Evaluate late-preterm infants 24 to 48 hours post-discharge. Evaluate late-preterm infants at 2 weeks and 4 weeks of life.
Hyperbilirubinemia	Evaluate maternal and birth history for indications of increased risk for jaundice. Determine ABO compatibility. Monitor urine and stool output. Assess for jaundice and monitor direct and indirect serum bilirubin levels if assessment warrants intervention.
Respiratory Compromise	Monitor for respiratory difficulties. Educate parents on the signs of increased work of breathing and when to call the primary healthcare provider.
Poor Feeding/ Hypoglycemia	Monitor weight gain and feeding practices closely. Offer lactation support, if appropriate. Educate parents on feeding cues and proper feeding techniques and anticipated intake at each feeding. Monitor and review with parents the signs of dehydration and hypoglycemia.
Primary Caesarean Delivery	The most common indications for primary cesarean delivery included, in order of frequency, labor dystocia, abnormal or indeterminate (formerly, nonreassuring) fetal heart rate tracing, fetal malpresentation, multiple gestation, and suspected fetal macrosomia
Temperature Instability	Educate parents on proper dressing of infant for temperature regulation. Educate parents on proper technique of taking a temperature. Review signs of cold stress with parent.
Infection	Educate parents to call if temperature above 38.6° Celsius (100.4° Fahrenheit) or below 36.1° Celsius (97° Fahrenheit). Evaluate maternal and infant risk factors for infection. Monitor for and review with parents the signs of infection and home infection control.

Primary Care Management of the Late-Preterm Infant for the Family Nurse Practitioner

Simon-Matthew Bate, RN
School of Nursing: Family Nurse Practitioner Program

BACKGROUND

It can be said the family nurse practitioner (FNP) may feel stressed and overwhelmed when caring for older adults with complex health needs in the primary care setting; whilst there is no direct evidence, it is likely this is also the case when managing a late-preterm infant (LPI) too. The LPI appears deceivingly innocent (Darcy, 2009), as they are often the size and weight of a full-term infant (FTI) and because of this, they are quickly discharged into the primary care setting; are then treated by parents and the FNP as though they are developmentally mature and at low risk of morbidity.



Neonatal morbidity versus gestational age. (Data from Shapiro-Mendoza, C. K., et al. (2008). Effect of late-preterm birth and maternal medical conditions on newborn morbidity risk. *Pediatrics, 121*(2), e223-e232. doi:10.1542/peds.2006-3629

PURPOSE

FNPs involved in managing the LPI would benefit from a clear understanding of the potential differences in risks faced by these LPIs when compared with their FTI counterparts. This will allow the FNP to build their confidence and competence, whilst enabling them to safely manage this vulnerable yet resilient population.

WHAT IS A FNP?

A FNP is an advanced practice nurse (APN) that is licensed by the College of Registered Nurses of British Columbia (CRNBC). FNPs provide comprehensive clinical care including the diagnosis and management of disease/illness, prescribing medications, ordering/interpreting laboratory/diagnostic tests, and initiating referrals to specialists. NP practice does not require physician supervision.

WHAT IS A LPI?

Preterm infants born between the gestational age of 34 0/7 weeks through 36 6/7 weeks are considered 'late-preterm'.

EPIDEMIOLOGY

In Canada, 7.7 percent of infants are born preterm (Public Health Agency of Canada & Canadian Perinatal Surveillance System, 2013) and 75% of these are born late-preterm (Engle et al., 2007).

CAUSATIVE FACTORS

1. Artificial Reproductive Technology
2. Caesarian Sections
3. Maternal Risk Factors
4. Multiple Gestations
5. Obstetrical Management

CLINICAL PRESENTATION

FEEDING DIFFICULTIES

↓ suck-swallow-breathe ↓ stimulation *which leads to* ↓ emptying of the breast ↓ growth and development.

↑ parent education ↑ resource utilization *which leads to* ↑ adequate hydration ↑ steady weight gain.

NEONATAL HYPOGLYCEMIA

↓activity, ↑lethargy, ↑hypotonia, ↓crying, ↑poor feeding, ↑jitteriness, ↑apnea, ↑grunting, ↑sweating. *Which leads to*, ↑neuronal cell death, and ↑neurological deficit(s).

However, hypoglycemic infants may not always be symptomatic.

HYPERBILIRUBINEMIA

↑fatigue ↑lethargy ↓sucking and/or feeding ↑jaundice ↓wet diapers ↑pale stools ↑irritability ↓weight gain.

Which leads to, kernicterus, a devastating chronic condition in which bilirubin-mediated irreversible brain damage results in cerebral palsy and loss of hearing.

TEMPERATURE INSTABILITY

↑cool or mottled skin, ↓heart rate, ↑respiratory rate, ↑restlessness, shallow and irregular respirations, ↓activity, ↑lethargy, ↑hypotonia, ↓crying, ↑poor feeding, ↓weight gain and seizures.

Temperature instability leads to ↑morbidity.

NEONATAL SEPSIS

↑temperature instability, ↑restlessness, shallow and irregular respirations, ↑diarrhoea or ↓bowel movements, ↓blood sugar, ↑lethargy, ↑hypotonia, ↓sucking and/or feeding, ↑seizures, ↑ or ↓heart rate and ↑vomiting.

Neonatal sepsis leads to ↑morbidity.

PRIMARY CARE INTERVENTIONS

GENERAL RECOMMENDATIONS

1. Evaluate late-preterm infants 24 to 48 hours post-discharge.
2. Evaluate late-preterm infants at 2 weeks and 4 weeks of life.

FEEDING DIFFICULTIES AND HYPOGLYCEMIA

1. Monitor weight gain and feeding practices closely.
2. Offer lactation support, if appropriate.
3. Educate parents on feeding cues and proper feeding techniques and anticipated intake at each feeding.
4. Monitor and review with parents the signs of dehydration and hypoglycemia.

HYPERBILIRUBINEMIA

1. Evaluate maternal and birth history for indications of increased risk for jaundice.
2. Monitor urine and stool output.

TEMPERATURE INSTABILITY

1. Educate parents on proper dressing of infant for temperature regulation.
2. Educate parents on proper technique of taking a temperature.
3. Review signs of cold stress with parent.

NEONATAL SEPSIS

1. Educate parents to call if temperature above 38.6 Celsius or below 36.1 Celsius.
2. Evaluate maternal and infant risk factors for infection.
3. Monitor for and review with parents the signs of infection and home infection control.

REFERENCES

Association of Women's Health, Obstetric, and Neonatal Nurses (AWHONN). (2010). Assessment and Care of the Late Preterm Infant Evidence-Based Clinical Practice Guidelines. Washington, DC: AWHONN.

Darcy, A. E. (2009). Complications of the late preterm infant. The Journal of Perinatal & Neonatal Nursing, 23(1), 78-86. doi:10.1097/JPN.0b013e3181968516.

Engle,W. A., Tomashek, K. M.,Wallman, C.,American Academy of Pediatrics, & and the Committee on Fetus and Newborn. (2007). "late-preterm" infants:A population at risk. Pediatrics, 120(6), 1390-1401. doi:10.1542/peds.2007-2952

Public Health Agency of Canada, & Canadian Perinatal Surveillance System. (2013). Perinatal health indicators for Canada 2013: A report from the Canadian perinatal surveillance system. Ottawa: Public Health Agency of Canada.

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