Late Preterm Birth:
A Review of the Literature and Retrospective Review
Of Readmissions in the Cincinnati Area, 2009

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A Master’s Paper submitted to the faculty of the
University of North Carolina at Chapel Hill
in partial fulfillment of the requirements for the degree of
Master of Public Health
in the Public Health Leadership Program.

August 2011

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ABSTRACT

The preterm birth rate has risen by more than 20% in the last 20 years with late preterm births accounting for more than 70% of all preterm births in the United States (U.S.). There has been continued focus of this problem of late preterm birth in the U.S. Late preterm birth has been shown to increase morbidity and mortality risk when compared to term infants. Greater morbidities translate to increased use of intensive care units, increased length of stay, and higher hospital costs. The late preterm infant has a higher rate of hospital readmission during the neonatal period. In order to decrease the rate of hospital readmissions in the Cincinnati area, the rate and reasons for readmission for the late preterm infant must be determined.

The purpose of the study was to determine the rate of readmission for late preterm infants in the Cincinnati area as well as determine the reasons for readmission. The charts of infants were examined through retrospective chart review. All late preterm infants (defined as infants born at 34 0/7 through 36 6/7 weeks) who were readmitted January 1, 2009 – December 31, 2009 to the hospital up to twenty-eight days of age were included in the selection process.

The late preterm readmission rate for the study was 3.7% (range 1.96-6.86%). There was wide variation of readmission based on birth hospital site. The most frequent readmission diagnoses included hyperbilirubinemia (75%), feeding problems (32%), and infection (25%). Reasons for late preterm birth and readmission are multifactorial and complex. To change the outcome surrounding late preterm birth, healthcare providers must focus their efforts on the specific categories of prevention, standardization, and quality improvement efforts.

Key words: Late preterm infant, prematurity, literature review
ACKNOWLEDGEMENTS

I would like to express my gratitude to all those who helped make this work possible. The research conducted for this paper would not have been possible without the guidance and support of my readers Susan Randolph and Dr. James Greenberg. I am also very grateful to Dr. Andrew South, Dr. Laura Ward, Dr. Scott Wexelblatt, and Christina Rust for their help in development and collection of this research, as well as to Dr. Eric Hall for his help with statistical analysis. I would like to thank Andrea Allen from the Hamilton County Public Health office for providing aggregate birth certificate data used for this study.
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CHAPTER I

INTRODUCTION

Late preterm births account for more than 70% of all preterm births in the U.S.\textsuperscript{1-7} While the rate of all preterm births is increasing, the rate of late preterm birth has increased faster than the overall rate of preterm birth in the U.S.\textsuperscript{1,3,4} Late preterm birth increases mortality risk when compared to term infants, with a range of two to six times the rate of death.\textsuperscript{1,5,7-18} From 2000 to 2002, there were 68,697 singleton infant deaths in the U.S., 6,840 (10\%) were late-preterm infants, and 23,956 (34.9\%) were term infants. The cause-specific infant mortality rates were 1.8 to 4.5 times higher in late-preterm infants than term infants during the three year time period.\textsuperscript{10} There are multiple maternal and fetal risk factors associated with late preterm birth. Assisted reproductive technologies, multi-fetal pregnancies, delayed childbearing, obstetrical surveillance and interventions, maternal obesity, and maternal medical and obstetrical complications associated with premature delivery such as premature rupture of membranes, preeclampsia, and diabetes contribute to the increasing numbers of preterm deliveries.\textsuperscript{1-4,6,7,9,13,19,22} Fetal factors such as intrauterine growth restriction and congenital anomalies often require delivery before 37 weeks, and therefore also contribute to late preterm births.\textsuperscript{20} Research and clinical interventions have failed to stem the increase in preterm birth rates over the last 20 years. The majority of preterm infants fall into the late preterm designation (gestational age 34 – 36 weeks).\textsuperscript{1-4,6,7} Because these infants are often the size of term infants, many parents and medical professionals believe that risk for morbidities is low. However, the preponderance of published evidence for the last several years has proven otherwise. Late preterm birth increases morbidity and mortality risk compared to term births, and compromises
long-term neurodevelopmental outcomes,\textsuperscript{1-5,7} which have a significant negative impact upon children, their families, and society.

The purpose of this paper is to provide a review of the literature of the epidemiology and morbidities associated with late preterm birth as well as provide a review of local data. One significant problem with the late preterm population is the increased need for readmission. Readmission increases costs, time, and is an increased burden to the medical system as well as the families of the infant who is born late preterm. Currently, there is a gap in knowledge as to how to decrease readmission rates in the late preterm population because there have been few studies looking at prevention strategies. The current problem has to be defined so intervention strategies can be identified for the late preterm infant. Then, data driven targets for improvement can be determined.
CHAPTER II
LITERATURE REVIEW

Definition of Late Preterm Birth

Late preterm birth has defined as an infant born between 34 0/7 weeks and 36 6/7 weeks of gestation.\textsuperscript{1,2,23} This gestational age was selected by an expert panel assembled by the National Institute of Child Health and Human Development (NICHD) of the National Institutes of Health (NIH). It was chosen as acknowledgement that the 34\textsuperscript{th} week of gestation represents a key gestational age used for obstetric decision-making, and infants born at these gestational ages have excess mortality and morbidity risks when compared to term infants.\textsuperscript{1-3} The definition of late preterm also communicates that this group of neonates is still premature, and not “almost” term, as the “near-term” definition implies.\textsuperscript{4,23} Therefore, healthcare providers should use the phrase “late preterm” instead of “near-term” to avoid underestimating the inherent risks experienced by these infants.\textsuperscript{3}

Late Preterm Birth Rates

Late preterm births account for more than 70\% of all preterm births in the U.S.\textsuperscript{1-7} While the rate of all preterm births is increasing, the rate of late preterm birth has increased faster than the overall rate of preterm birth in the U.S.\textsuperscript{1,3,4} Reviews of population data document a trend toward earlier delivery in all births, with the gestational age distribution shifting from 40 weeks (25\% of births) in 1992 to 39 weeks (25.9\%) in 2002.\textsuperscript{4,6} Data from the National Center for Vital Statistics and additional studies report that non-Hispanic blacks have the highest percentage of live births delivered late preterm.\textsuperscript{1,6,7} However, due to a larger population size, non-Hispanic
white late preterm infants contribute more than any other racial or ethnic group to the rising trend of late preterm births in the U.S.\textsuperscript{1,6,7}

In 2006-2009, a 5% decrease in the late preterm birth rate was noted, from 9.1 to 8.66\%.\textsuperscript{24-26} Furthermore, because late preterm births comprise a substantial portion of all preterm births, the overall preterm rate has decreased to 12.18\% for 2009, and marked the first sustained (more than 2 consecutive years) decline in this rate since 1981, when national gestational age data first became available.\textsuperscript{26} The overall rate for preterm births in Ohio has decreased in parallel with national trends, with a rate of 12.3\% in 2009 from 12.6\% in 2008.\textsuperscript{26} Prematurity campaigns and improvement collaboratives targeting elective delivery before 39 weeks gestation may be responsible for this national trend and will be discussed later in the paper.

**Risk Factors for Late Preterm Birth**

Multiple risk factors are associated with late preterm birth. These factors include maternal as well as fetal factors that have been shown to be associated with late preterm birth. The rate of late preterm birth has been linked to assisted reproductive technologies (ART), multifetal pregnancies, delayed childbearing, obstetrical surveillance, maternal obesity, and maternal medical and obstetrical complications associated with premature delivery such as premature rupture of membranes, preeclampsia, and diabetes.\textsuperscript{1-4,6,7,9,13,19-22} Factors affecting pregnancy, such as fetal anomalies, amniotic fluid abnormalities, and fetal growth restriction often require delivery before 37 weeks, and therefore also contribute to late preterm births.\textsuperscript{20}

Multiple maternal demographic factors such as age and race have also been associated with increased risk of late preterm birth, but studies differ on which factors are reported to be associated with increased risk.\textsuperscript{6,7,9,14,27} In a review of the 2001 U.S. birth cohort, there was an association between late preterm birth and higher maternal age and non-Hispanic white
In another large cohort study, there was an increase in the prevalence of late preterm birth among non-Hispanic black mothers. Additionally, in several studies, the prevalence of late preterm births decreased with increasing maternal age with the highest rates seen in the youngest mothers. Authors have also reported that mothers at both ends of the age spectrum are at increased risk for late preterm birth.

Multiple Gestation and Assisted Reproduction Technology

Since the 1990s, the incidence of multiple births in the U.S. has increased rapidly. Between 1990 and 2005, the number of twin births increased by 42% from 22.6 to 32.2 per 1,000 live births. The rate of higher-order births (triplets and higher) increased by 122% from 72.8 to 161.8 per 1,000,000 live births. Women who have a multi-fetal pregnancy are at increased risk of preterm labor as well as pregnancy complications that result in late preterm delivery. When compared with singleton births, multiple births in the U.S. are about five to six times more likely to be born late preterm.

An increase in multiple gestation births noted over the last several decades can be attributed largely to two factors: delayed childbearing and the rise in use of infertility therapies such as ART. Since 1996, there has been a three-fold increase in the incidence of women successfully delivering a viable baby following infertility treatment. With this success, ART is associated with an increased likelihood of multiple gestations. National ART surveillance data statistics show that 32% of all live multiple births were conceived with assisted conception. From 1999 through 2008, the percentage of twin births from ART was 32%; and the percentage of triplet-or-more births was 2% in 2008. While ART overall has been decreasing the number of multiple births, and increasing its single birth rate, it is an independent risk factor for preterm birth, even as a singleton pregnancy.
Maternal Medical Complications

Women delivering late preterm have significantly more medical complications, including hypertension, obesity, preexisting diabetes, and kidney disease. Observed rates of late preterm birth range from 4-6% among women who have gestational hypertension and 10% to 11% among women who have preeclampsia. Studies have shown that obesity is a risk factor for preterm delivery and the epidemic of obesity among women of reproductive age may be contributing to an overall increase in U.S. preterm births. Because obesity significantly increases the likelihood of developing diabetes, preeclampsia, fetal growth abnormalities, and requiring cesarean delivery, it will also significantly increase the risk for the delivery of a late preterm infant.

In addition to the risk for late preterm delivery, pregnancies associated with a maternal medical condition have an increased rate of infant morbidities. The proportion of offspring with newborn morbidity increased with the number of maternal morbidities reported. Among late-preterm infants with newborn morbidity, 28.7% had at least one maternal condition reported, and 36.6% had two maternal conditions reported. Shapiro-Mendoza et al (2008) reported that there was a greater than additive effect of morbidity to the late preterm infant for each maternal condition.

Obstetrical Contribution to Late Preterm Birth

Previous analyses have revealed that recent increases in the U.S. late preterm birth rate were associated with a parallel increase in medically indicated preterm births. The rate of births involving obstetrical intervention has doubled since 1990 with almost 25% of deliveries occurring through induction of labor, with the greatest rate of increase seen in the late preterm population. Obstetric surveillance is hypothesized to increase late preterm birth because
abnormalities that predict a non-reassuring fetal status are identified and acted upon by clinicians. However, the positive predictive value of surveillance monitoring is low for predicting poor outcomes, and by increasing surveillance, the medical community may create an iatrogenic increase in the late preterm birth rate. In addition, fetal conditions such as abnormal placentation, premature rupture of membranes without labor, and intrauterine growth restriction may require delivery between 34 and 36 weeks.

According to the practice guidelines published by American Congress of Obstetricians and Gynecologists (ACOG), the management of preterm labor should not include the use of tocolysis and glucocorticoids beyond 34 weeks of gestation. Antenatal steroids are recommended only for preterm delivery before 34 weeks of gestation because it does not reduce lung disease or neonatal death after this time unless there is evidence of fetal lung immaturity. By not recommending a trial of tocolysis to arrest preterm labor or administering antenatal steroids, healthcare providers may passively have contributed to the increasing rate of late preterm births. The ACOG guidelines state that to avoid iatrogenic prematurity delivery before 39 weeks of gestation, induction of delivery should only be undertaken when there is an accepted medical or obstetric complication or if fetal lung maturity has been documented. Despite this guideline, increases in obstetric interventions appear to be shifting gestational ages earlier.

**Increased Rate of Cesarean Delivery**

The rates of cesarean deliveries and inductions of labor in the U.S. rose to 32.9% in 2009, an increase of 2% from the prior year and a record high, making cesarean section the most common major surgical procedure for women. The percentage of births delivered by cesarean has been rising steadily for over a decade and is up nearly 60% since 1996, and contributes to the increasing rate of preterm birth in the U.S. Maternal risks in subsequent pregnancies after a
cesarean section delivery include uterine rupture, placenta previa, placenta accreta, and hysterectomy. Between 1989 and 1995, there were reports of complications associated with vaginal birth after cesarean (VBAC) delivery and this led to increasing concerns about safety. This is seen as a major contributor to increasing the cesarean section rate since 1996.\textsuperscript{36}

Notably, for late preterm births, there was no increase in the proportion of births delivered vaginally, but a marked increase in the proportion of births delivered by cesarean section. Overall, the increase in the preterm birth rate, especially for late preterm births, occurred primarily among cesarean section deliveries.\textsuperscript{36} National statistics data showed a 41\% increase in late preterm birth cesarean delivery rates from 1996 to 2004, and those rates have only continued to increase.\textsuperscript{20,36} This reflects an increase in primary cesarean section rates, which influence future pregnancies and sustain the increase, considering that women who have a primary cesarean section are likely to be delivered by repeat cesarean section.\textsuperscript{36} Additionally, as the rate of cesarean delivery has increased, the rates of abnormal placentation have also increased,\textsuperscript{1,20} thereby increasing the rate of late preterm birth. Finally, published reports estimate that cesarean delivery by mother’s request has increased from 2.5\% to 18\% of all cesarean deliveries in the U.S.\textsuperscript{8,10,19,40} Unfortunately, U.S. birth certificate data do not differentiate between cesarean deliveries performed electively at maternal request and low-risk cesarean sections performed for unspecified indications.\textsuperscript{40} With this lack of specificity, it is unknown how this contributes to the overall late preterm birth rate or simply to the increased cesarean section rate overall.

**Reductions in Stillbirth**

The increase in late preterm birth has been coupled with reductions in stillbirths and perinatal mortality.\textsuperscript{3,20} With increased obstetrical surveillance and intervention and increase in late preterm birth, the U.S. has seen significant reductions in stillbirths, perinatal mortality, and
births beyond 40 weeks’ gestation.\textsuperscript{3, 7, 21, 28, 36, 37} Goldenberg et al. (2004) reported that the reduction in stillbirth in recent decades is secondary to elimination of risk factors (such as isoimmunization and labor induction for post-date pregnancies), intrapartum fetal monitoring, and the implementation of technology (such as ultrasound and genetic screening) which has allowed the detection of significant congenital anomalies that are often electively terminated whereas previously many would have resulted in a stillbirth.\textsuperscript{37, 42} There is evidence showing that medically indicated deliveries of late preterm infant may improve rates of perinatal survival. Between 1995 and 2004, the rate of fetal deaths declined from 7.5 to 6.2 per 1,000 live births.\textsuperscript{43} During a similar time period, infant mortality rates declined from 7.6 to 6.75 per 1,000 live births from 1995 to 2007.\textsuperscript{44}

These findings imply that to prevent stillbirths, timed obstetrical interventions for at-risk infants are needed, and an increase in late preterm birth rates may be the result. More work is necessary, however, to determine the causal association between increasing obstetric interventions and decreasing stillbirths, and the combined role in increasing the late preterm birth rates.\textsuperscript{1} If the trends toward delivery at early gestations around term continue, then the rate of late preterm births would be predicted to grow without a clear understanding of the impact on neonatal health.\textsuperscript{6, 36}

\textbf{Mortality Rates}

Late preterm birth increases mortality risk, with a range of two to six times the rate of death for infants born at term.\textsuperscript{1-5, 7-18} From 2000 to 2002, there were 68,697 singleton infant deaths in the U.S., of which 6,840 (10%) were late-preterm infants and 23,956 (34.9%) were term infants.\textsuperscript{10} The cause-specific infant mortality rates were 1.8 to 4.5 times higher in late-preterm infants compared to term infants during the three year time period.\textsuperscript{10} In a U.S.
population-based study from 1995 to 2002, there was a three-fold higher rate of infant mortality among late preterm infants compared with term infants (7.3/1,000 live births among late preterm infants versus 2.4/1,000 live births among term infants). This disparity was greatest in the neonatal period, and even more pronounced in the first week after birth.\textsuperscript{10} During infancy, late preterm infants were four times more likely to die of congenital malformations, bacterial sepsis, and placental or cord complications when compared to term infants.\textsuperscript{10,19} Because late preterm infants represent more than 70\% of the total number of preterm infants, their deaths comprise a much larger percentage of neonatal mortality than do those who are more premature.\textsuperscript{4} Mortality rates for late-preterm newborns remained significantly higher even after excluding those who died of birth defects. Each week increase of estimated gestational age was associated with a decreased risk of death.\textsuperscript{8} Infant mortality has been shown to be greater in late preterm infants for each of the leading 10 causes of death, indicating that all-cause mortality is higher in this population, not simply those disease processes related to preterm birth.\textsuperscript{13}

**Risk of Clinical Morbidities**

As with mortality, the rates of morbidity in the late preterm population are well established. Late-preterm infants are physiologically immature and, as a result, have a higher probability than term infants of developing medical complications that result in higher rates of morbidity during the birth hospitalization.\textsuperscript{3,5,35} Morbidity rates decrease with increasing gestational age from 34 to 39 weeks.\textsuperscript{7,45,46} Using a 1998 to 2003 population-based study of infants born in Massachusetts, Shapiro-Mendoza et al. (2008) found that the risk for newborn morbidity increases twofold as each week of gestation decreases, beginning from 38 weeks’ gestation to 34 weeks’ gestation.\textsuperscript{35} The infants born at 34 weeks’ gestation had 20 times the risk for morbidity compared with the infants born at 40 weeks’ gestation; those born at 35 and 36
weeks’ gestation had 10 times and 5 times the risk for morbidity, respectively.\textsuperscript{35} Similarly, Bastek et al. (2008) found a 23\% decrease in adverse outcomes with each week of advancing gestational age between 32 and 39 completed weeks.\textsuperscript{47}

Late preterm infants are more likely to be diagnosed with morbidities such as respiratory distress, hyperbilirubinemia, feeding difficulties, temperature instability, and sepsis as well as increased rates of admission to neonatal intensive care units when compared to term infants.\textsuperscript{2, 3, 5-7}

Late preterm infants required some type of resuscitation at birth more frequently than term infants.\textsuperscript{9, 46, 51} Late preterm infants are more likely to have one or more clinical problems when compared to term infants.\textsuperscript{3, 13, 18, 52}

\textbf{Admissions to Neonatal Intensive Care Unit (NICU) and Length of Stay}

Infants born late preterm are more likely to be admitted to the intensive care unit following delivery compared with term infants.\textsuperscript{13, 53, 54} It is estimated that almost 50\% of infants born at 34 weeks gestation receive neonatal intensive care.\textsuperscript{4, 55} Using infant and obstetric records from a large tertiary teaching hospital in Massachusetts, Wang et al. (2004) reported that at 34 weeks’ gestation, 88\% of infants are admitted to the NICU, whereas at 35, 36, and 38 to 40 weeks’ gestation, NICU admissions are at 54\%, 25\%, and 3\%, respectively.\textsuperscript{18} In a large U.S. retrospective review of 35,000 infants, length of hospital stay was noted to be significantly longer for late preterm infants when compared to term births,\textsuperscript{18, 49, 50, 52} with the average length of stay being six days longer for infants born late preterm (8.8 vs. 2.2 days) when compared to term infants.\textsuperscript{56}
Specific Morbidities of the Late Preterm Infant

Respiratory Complications

The late preterm infant has an increased risk for respiratory complications compared to the term infant. All forms of respiratory morbidity, including pulmonary hypertension, respiratory distress syndrome, pneumonia, and transient tachypnea of the newborn occur at higher rates in the late preterm infants than term infants, with an additional increased risk if labor has not preceded cesarean delivery or if the delivery occurs before 39 weeks. In recent studies, 23-33% of late preterm infants require respiratory support, and approximately 3% of these infants require mechanical ventilation. An observational study of 5,600 infants showed that late preterm infants were eight times more likely to be diagnosed with respiratory distress syndrome, nine times more likely to be placed on nasal continuous positive pressure ventilation, five times more likely to be placed on a ventilator, and 42 times more likely to require surfactant supplementation when compared with term neonates who were admitted to the NICU during the study period. This may be explained by the fact that total lung volumes at 34 weeks are only 47% of the final volume at maturity due to decreased alveolarization. This has direct implications on lung function and plays a key role in respiratory complications of the late preterm infant.

Hyperbilirubinemia

For infants of any gestational age, hyperbilirubinemia is the most common clinical condition requiring treatment in the newborn with late preterm infants being two to five times as likely to have significantly elevated bilirubin concentrations compared to term infants. Associations have been made between decreasing gestational age and increased risk for significant hyperbilirubinemia due to decreased hepatic bilirubin conjugation capacity, decreased
hepatic uridine diphosphate glucoronyltransferase (UGT) enzymatic activity, and increased enterohepatic circulation secondary to immature gastrointestinal function and activity.\textsuperscript{2,60,66,68,69}

The incidence of kernicterus, the permanent sequelae of hyperbilirubinemia, has been rising over the last decade, with increased and over-representation of late preterm infants.\textsuperscript{11,66,68,69} Furthermore, the U.S. Kernicterus Registry demonstrates that late preterm neonates have evidence of bilirubin neurotoxicity at an earlier postnatal age than term newborns, suggesting a greater vulnerability to bilirubin-induced brain injury in the late preterm population.\textsuperscript{68}

The risks for hyperbilirubinemia are further increased by feeding problems in the late preterm infant. Coupled with the increased emphasis on breastfeeding, the late preterm infant has multiple hurdles to overcome. Feeding difficulties in the late preterm infant are related to an immature suck and swallow reflex that leads to difficulties with the proper latching for breastfeeding as well as insufficient intake in those infants who are feeding by breast or bottle.\textsuperscript{4,18,19,66,68,70-73} Feeding problems are also the most common reason for admission to the NICU and delay in hospital discharges for this cohort of the newborn population.\textsuperscript{62,71}

\textit{Infection}

Although the overall mortality rate from infection is low in the late preterm infant,\textsuperscript{4} many clinical findings seen in late preterm infants are also common initiating signs of neonatal sepsis. Consequently, late preterm infants are more likely to undergo evaluations for sepsis and receive antibiotic therapy, prolonging the length of hospitalization and increasing costs.\textsuperscript{4,18,74}

\textit{Neurodevelopmental Disability}

There is increasing interest in the school age neurodevelopmental outcome of the late preterm infant. The cortical volume at 34 weeks is 53\% of term volume, with dramatic increases in the white matter myelination between 35 and 41 weeks' gestation.\textsuperscript{67,75,76} The immaturity of
the late preterm brain may contribute to neurodevelopmental problems because infants born late preterm are more likely to develop learning, speech, and other developmental delays compared with term infants. \(^{67,75-77}\) There is a relationship between decreasing gestational age and increasing risk of adverse outcomes such as neurodevelopmental disabilities and poor academic performance. \(^{76,78}\) The risk for suspension in kindergarten was 19% higher for late preterm infants. They were also more likely to have problems with school readiness. \(^{67,77}\) Chyi et al. (2008), using the Early Childhood Longitudinal Study-Kindergarten Cohort that followed late preterm infants from kindergarten through fifth grade, report that late preterm infants scored lower in reading and math and had twice the risk for special education at all grade levels. \(^{19,79}\)

**Costs of Late Preterm Birth**

Increased morbidities translate to increased use of intensive care units, length of stay, and readmissions that produce higher overall medical costs when compared to the term population. \(^{5,6}\) \(^{18,19,48,56}\) McLaurin et al. (2009) found that the cost of the hospitalization at birth was more than ten times higher for late preterm infants than term infants. \(^{56}\) Although the cost for treating an individual extremely premature infant is higher, because the numbers of late preterm infants born in the U.S. are higher, the aggregate cost for the population of late preterm infants is collectively higher to society. Using a population-based dataset for 1996 from California, Gilbert et al. (2003) reviewed the total costs for each gestational age group. The average cost for treating infants at 25 weeks gestation was 38.9 million dollars and for 35 weeks gestation was 41.1 million dollars. \(^{19,80}\) Using the same dataset, they concluded that preventing non-medically indicated births between 34 and 37 weeks of gestation could have saved 49.9 million dollars. \(^{1,80}\) It is expected as medical costs and the percentages of late preterm births have increased, that this
number is only larger today. Consequently, even a modest reduction in late preterm birth rate will reduce the burden of disease and can lead to considerable cost savings in the U.S.

**Readmission of the Late Preterm Infant**

It is well established in the medical literature that late preterm infants have higher rates of hospital readmission. Depending on the study, late preterm infants were 1.5 to 3 times more likely to be readmitted than term infants with the overall rehospitalization rate increasing as gestational age decreases.

Several factors contribute to an increased risk of hospital readmission and many differ depending on the study or review. Some of these factors include being the first born child, male gender, maternal delivery complications, never being admitted to intensive care unit, being breastfed, being of Asian/Pacific Island descent, being a recipient of public insurance, and early discharge. Oddie et al. (2005) studied five large maternity centers in the United Kingdom and found that readmission rates varied significantly by hospital of birth and was the most important factor in determining risk for readmission. The reported rates of readmission of late preterm infants vary by study, ranging from 2.8-6.1%. Several factors contribute to an increased risk of hospital readmission and many differ depending on the study or review. Some of these factors include being the first born child, male gender, maternal delivery complications, never being admitted to intensive care unit, being breastfed, being of Asian/Pacific Island descent, being a recipient of public insurance, and early discharge. Oddie et al. (2005) studied five large maternity centers in the United Kingdom and found that readmission rates varied significantly by hospital of birth and was the most important factor in determining risk for readmission. The reported rates of readmission of late preterm infants vary by study, ranging from 2.8-6.1%. Numerous studies find that the most common reason for readmission is hyperbilirubinemia. This may be explained because concentrations of bilirubin do not peak until four to seven days after birth when the infant has usually been discharged. Since late preterm infants are at higher risk for kernicterus, this has implications on the long-term neurologic sequelae of this patient population. Of those late preterm infants diagnosed with kernicterus before rehospitalization, nearly all infants were breastfed with little or no lactation support, suboptimal milk intake, and had been scheduled for a
2-week first follow-up appointment. The majority of readmissions occur before seven days of age, with most occurring between 3 to 5 days of age.

Some strategies have been examined to prevent readmission of the late preterm infant such as discharge criteria for the late preterm infant, home visits, or outpatient appointments scheduled within 72 hours of discharge. However, few studies exist that show a significant decrease in these rates. Since hospital protocols vary widely for the late preterm population, specialized minimum criteria for discharge should be established.

Without new developments in the prevention and management of preterm birth, it is important to focus on improving the care of the late preterm infant and prevent readmission to the hospital. The data to support targeted intervention to reduce readmission rates in the late preterm population are limited, and increased analyses of successful interventions to prevent readmission in the late preterm population are needed within the literature to help guide the practicing healthcare provider.
CHAPTER III

METHODS

Study Design

A retrospective chart review was conducted of all infants 34 0/7 weeks to 36 6/7 weeks gestation who were readmitted from January 1, 2009 to December 31, 2009. The study was designed to:

1. determine the rate of readmission for late preterm infants in the greater Cincinnati region, and
2. determine the reasons for readmission.

Setting

The setting for this study was 8 study hospitals: 5 hospitals with Level I and II nurseries, 2 hospitals with Level I, II, and IIIb nurseries, and 1 hospital with a free standing Level IIIc NICU in Cincinnati, OH. These hospitals were selected because they have almost all deliveries and admissions of infants in the Cincinnati area.

Sample

The target population was all late preterm infants readmitted to hospitals within twenty-eight days after birth. The accessible population was all late preterm infants admitted to these eight hospitals who were readmitted from January 1, 2009 to December 31, 2009 by obtaining information from Medical Records and the Information Systems Department. Only infants less than 34 weeks or greater than 36 completed weeks were excluded. All patients who met condition eligibility criteria (as infants born at 34 0/7 through 36 6/7 weeks) were included and no patients were excluded from review.
Data Collection

A data collection tool (Appendix A) was created by researchers at Cincinnati Children’s Hospital based on known factors and information available from the literature. Birth records, readmission records, and the records of the mothers were obtained to gather all relevant data. Gestational age was determined by documentation from maternal medical record when the mother was admitted for delivery.

The data collected included:

- birth hospital,
- maternal age,
- race,
- type of insurance,
- marital status,
- gravida,
- para,
- infant gestational age at time of delivery,
- type of delivery,
- pregnancy complications,
- maternal and infant blood type,
- infant sex,
- infant birth weight,
- delivery complications,
- breast or bottle feeding,
- feeding supplementation,
- lactation consultation,
- total bilirubin levels,
- length of hospital stay,
- scheduled follow-up appointments,
- readmission and discharge dates,
- discharge and readmission weight,
- referral made to neonatology outpatient nurse coordinator,
- readmission admitting diagnosis, and
- readmission bilirubin levels if applicable.

The rate of late preterm birth and readmission occurring in the eight study hospitals was determined by reviewing Vital Statistics birth certificate data provided by Hamilton County Public Health Department.

**Human Subjects Protection**

Institutional human subjects review board approval was obtained from Cincinnati Children’s Hospital (Appendix B) as well as the University of North Carolina at Chapel Hill prior to data collection (Appendix C). The study posed minimal risk to the participants. Only the researchers had access to the names of subjects and the names were stored in a password protected file with unidentified information stored in a password protected electronic database. All data were reported as aggregate data only. Subjects did not receive payment or other reimbursement for participation in this study.

**Data Management and Analysis**

Descriptive analysis was completed and included means and/or median, standard deviation, and ranges from the data collected using data collection tool.
CHAPTER IV
FINDINGS

Results

There were 32,230 total births in the eight participating hospitals during the study period. Of those births, 1,840 were born late preterm for a rate of 5.7%. Sixty-eight late preterm infants were readmitted within twenty-eight days of birth, resulting in a late preterm readmission rate of 3.7% (range 1.96-6.86%). Infant characteristics are listed in Table 4.1. There were more male than female infants readmitted. Seventy-eight percent of readmissions were singleton deliveries and 75% were born vaginally. Most mothers received prenatal care, were non-Hispanic White, 22 to 34 years old, multiparous, and had private insurance (Table 4.2). With respect to maternal medical complications, 46% had no medical condition documented, 37% had one medical complication, and 17% had two or more medical complications recorded at the time of delivery. Types of maternal medical conditions were hypertensive complications (19%), diabetes (12%), and 15% of the mothers had 2 or more medical conditions recorded (Table 4.3). Birth hospital characteristics are listed in Table 4.4. Sixty-two percent of late preterm infants were initially admitted to the regular newborn nursery. During the initial admission at the birth hospital, 33% of the infants were exclusively breastfed with equal thirds bottle feeding and doing a combination of breast and bottle feeding. Most late preterm infants had a bilirubin check completed, and had a lactation consult prior to the initial hospital discharge, but home nursing visits and having a scheduled pediatrician appointment were uncommon.

The reasons for readmission are listed in Table 4.5 and included hyperbilirubinemia (75%), feeding problems (32%), and infection (25%). Data regarding infant readmission
TABLE 4.1
INFANT CHARACTERISTICS
(n=68)

<table>
<thead>
<tr>
<th>Infant Characteristics</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of total readmissions</td>
<td>68 (100%)</td>
</tr>
</tbody>
</table>

Birth Weight

- Mean weight (g*), ± SD: 2710 ± 520
- Median weight (g): 2680
- Weight range (g): 1520-3830

Type of Birth

- Singleton: 53 (78%)
- Multiple: 15 (22%)

Delivery Type

- Cesarean delivery: 17 (25%)
- Vaginal delivery: 51 (75%)

Gender

- Male: 40 (59%)
- Female: 28 (41%)

* g = grams
## TABLE 4.2

MATERNAL DEMOGRAPHIC DETAILS

(n=68)

<table>
<thead>
<tr>
<th>Maternal Demographic Details</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother’s age at delivery, mean ± SD (years)</td>
<td>28.2 ± 6.1</td>
</tr>
<tr>
<td>Gravidity, mean ± SD</td>
<td>2.34 ± 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Hispanic White</td>
<td>56 (82%)</td>
</tr>
<tr>
<td>Black</td>
<td>8 (12%)</td>
</tr>
<tr>
<td>Other</td>
<td>4 (06%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insurance Type</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Private insurance</td>
<td>45 (66%)</td>
</tr>
<tr>
<td>Public insurance</td>
<td>22 (32%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Received prenatal care</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>66 (97%)</td>
</tr>
<tr>
<td>No</td>
<td>2 (03%)</td>
</tr>
</tbody>
</table>
TABLE 4.3

MATERNAL MEDICAL CONDITIONS

(n=68)

<table>
<thead>
<tr>
<th>Maternal Medical Conditions</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Medical Conditions Recorded</strong></td>
<td></td>
</tr>
<tr>
<td>• None</td>
<td>31 (46%)</td>
</tr>
<tr>
<td>• One</td>
<td>25 (37%)</td>
</tr>
<tr>
<td>• Two or more</td>
<td>12 (17%)</td>
</tr>
<tr>
<td><strong>Types of Medical Conditions</strong></td>
<td></td>
</tr>
<tr>
<td>• Hypertension</td>
<td>13 (19%)</td>
</tr>
<tr>
<td>• Diabetes</td>
<td>8 (12%)</td>
</tr>
<tr>
<td>• Premature labor or rupture of membranes</td>
<td>46 (68%)</td>
</tr>
<tr>
<td>• Fetal growth restriction</td>
<td>6 (09%)</td>
</tr>
</tbody>
</table>
### TABLE 4.4

**BIRTH HOSPITAL CHARACTERISTICS**

(n=68)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (%)</td>
<td>No. (%)</td>
</tr>
<tr>
<td>Admitted to newborn nursery</td>
<td>42 (62%)</td>
<td>26 (38%)</td>
</tr>
<tr>
<td>Admitted to NICU/Special Care Nursery</td>
<td>26 (38%)</td>
<td>42 (62%)</td>
</tr>
<tr>
<td>Lactation consult</td>
<td>38 (56%)</td>
<td>30 (44%)</td>
</tr>
<tr>
<td>Type of Feeding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Exclusive Breastfeeding</td>
<td>22 (32%)</td>
<td>46 (68%)</td>
</tr>
<tr>
<td>• Exclusive Bottle feeding</td>
<td>23 (34%)</td>
<td>45 (66%)</td>
</tr>
<tr>
<td>• Both breast and bottle feeding</td>
<td>23 (34%)</td>
<td>45 (66%)</td>
</tr>
<tr>
<td>Visits Scheduled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Home nursing visit</td>
<td>32 (47%)</td>
<td>36 (53%)</td>
</tr>
<tr>
<td>• Pediatrician visit</td>
<td>23 (34%)</td>
<td>45 (66%)</td>
</tr>
<tr>
<td>Discharge bilirubin completed</td>
<td>50 (74%)</td>
<td>18 (26%)</td>
</tr>
</tbody>
</table>
TABLE 4.5
REASONS FOR READMISSION
(n=68)

<table>
<thead>
<tr>
<th>Reasons for Readmission</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperbilirubinemia</td>
<td>51 (75%)</td>
</tr>
<tr>
<td>Feeding problems</td>
<td>22 (32%)</td>
</tr>
<tr>
<td>Hypothermia</td>
<td>8 (12%)</td>
</tr>
<tr>
<td>Infection</td>
<td>17 (25%)</td>
</tr>
</tbody>
</table>
characteristics are listed in Table 4.6. Readmitted late preterm infants were discharged prior to their fourth day of life with average length of stay for initial admission of 3.8 ± 3.7 days. The average age at admission was 7 days ± 6.2 days, but the median was 4 days (range 3-24 days) (not presented in table). The day of admission varied by the infant’s medical condition. For example, infants with hyperbilirubinemia were admitted to the hospital on day 4 of life on average, whereas those admitted for infection were admitted on average at 12.5 days. Of those readmitted, the average length of stay was 2.4 ± 2.4 days.

**Discussion**

The readmission rate in the first 28 days was 3.7%, which is similar to prior studies in the literature.3 82 84 86 There was a wide variation in rates of readmission between birth hospitals from 1.96-6.86%, which is similar to what was reported by Oddie et al. (2005) who stated that birth hospital was the most important factor in determining risk of readmission.86 This study showed an association between readmission and never being admitted to a neonatal intensive care unit, with 62% of the readmitted population never being admitted. Escobar et al. (2005) also reported that late preterm infants who were never admitted to a neonatal intensive care unit were more likely than term infants to be readmitted.84 Interestingly, in this study, the birth hospital that had standardized orders and routinely admits all late preterm care infants to the intensive care unit had the lowest rates of readmission.

In this study, there were a higher percentage of mothers who were multiparous, received prenatal care, had private insurance, and had a medical condition at the time of delivery. Infants were more likely to be male, singleton birth delivered vaginally. Male gender has been associated as a risk factor for late preterm readmission.2 61 81 83 84 In this study, hyperbilirubinemia and infection were the most common diagnoses on readmission. Those
TABLE 4.6
INFANT READMISSION CHARACTERISTICS
(n=68)

<table>
<thead>
<tr>
<th>Readmission Characteristics</th>
<th>No. Days Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at discharge</td>
<td>3.8 ± 3.7</td>
</tr>
<tr>
<td>Age at readmission</td>
<td>7.2 ± 6.2</td>
</tr>
<tr>
<td>Age at readmission for hyperbilirubinemia</td>
<td>4.4 ± 2.2</td>
</tr>
<tr>
<td>Age at readmission for infection</td>
<td>12.5 ± 7.5</td>
</tr>
<tr>
<td>Length of stay for readmission</td>
<td>2.4 ± 2.4</td>
</tr>
</tbody>
</table>
infants readmitted with hyperbilirubinemia presented earlier than those readmitted with infection, which is consistent with the published literature on reasons for readmission.\textsuperscript{56, 82-84}

**Limitations**

The study had several limitations. First, only the results of those late preterm infants who were readmitted to the hospital were reported and not those characteristics of all late preterm infants. Conclusions based on risk factors can only be made as an association for those infants who were readmitted. This information cannot be used to assess the risk for readmission to all late preterm infants. Second, records of all late preterm infants were not reviewed, only those who were readmitted. Therefore, the results for the readmitted population are discussed. This makes targeted interventions more difficult because the information from late preterm infants who were not readmitted is unknown. Third, because of the small numbers of readmitted infants, separating data by individual hospital is not meaningful and would risk making conclusions based on the characteristics of very few babies. Finally, data from medical charts and vital statistics may not always be accurate or may have missing data. For example, a pediatrician appointment may have been made for an infant, but if it was not noted in the inpatient record, then it was recorded that no appointment was made. However, this study is the first to review the readmission rates for late preterm birth in the Cincinnati area and can provide key information to target local level improvement.
CHAPTER V
CONCLUSIONS/RECOMMENDATIONS

While conclusions regarding risk for late preterm infants cannot be drawn from the reported data, interventions that were applied to those infants who were readmitted can be reviewed which provide potential areas to focus improvement efforts. To change the outcomes surrounding late preterm birth, efforts must be placed on specific categories: prevention, standardization, and quality improvement efforts.

Currently, few opportunities exist for the prevention of preterm birth because of limited knowledge of the basic etiologies surrounding preterm delivery.\textsuperscript{36} However, eliminating preventable late preterm births should be a priority not only for the medical community, but also because it is a public health issue. One approach includes reduction of multiple births secondary to ART\textsuperscript{91} as it increases the risk of multiple births which increases the risk for late preterm delivery.\textsuperscript{4,30,31} More research is essential to identify the etiology of late preterm birth as well as the use of 34 weeks gestation as an endpoint for pregnancy for specific conditions.\textsuperscript{10,20,36} In addition, the identification of screening tools to identify risk factors and avoid potential medical complications of late-preterm births is needed to make significant improvements in morbidity.\textsuperscript{3}

Standardization of care has been shown to reduce differences in complication rates and improve clinical outcomes in the medical setting.\textsuperscript{91-99} Delaying deliveries of those infants who would be born late preterm may be influenced by following established guidelines regarding labor inductions and scheduled cesarean deliveries. Hospital guidelines and protocols in labor and delivery should also emphasize education for clinicians and patients regarding the morbidity and mortality associated with late preterm births.\textsuperscript{2,3,20} Using a standard approach in the
management of the late preterm infant could provide the best option for prevention of readmission. There are several published discharge criteria for the late preterm infant,\textsuperscript{1-3,19} and there should be practice guideline endorsed by the American Academy of Pediatrics to standardize care of the late preterm infant.

One way to implement these guidelines and prevention strategies is through quality improvement efforts. Quality improvement efforts, including statewide collaboratives have had varied success in improving clinical outcomes.\textsuperscript{91,98,100-102} By using a collaborative rather than a single center, the potential impact on population statistics is greater and the potential improvement interventions reach an audience much larger than in a single medical center. The Ohio Perinatal Quality Collaborative focused on decreasing the rates of scheduled births in member hospitals between 36 0/7-38 6/7 weeks that lacked documentation of a medical or obstetric indication. Through their improvement efforts, the rate declined from 25% in July 2008 to less than 5% in August 2009.\textsuperscript{103} This project is being replicated in other states as well and offers a great potential to decrease late preterm birth.

While there are serious morbidities affecting those infants born late preterm, there is cause for hope in this arena. Strategic efforts are being made to improve outcomes through standardized care and statewide quality collaboratives. Obstetricians, neonatologists, and public health officials have all raised concerns that this is a national epidemic and there is increased awareness of this problem. It is only through these joint efforts of the medical and public health communities that efforts to reduce late preterm birth and the sequelae that follow can be successful.
REFERENCES


APPENDICES

A. Data Collection Tool .......................................................................................................................................40

B. IRB Approval Letter: Cincinnati Children’s Hospital Medical Center ..................................41

C. IRB Approval Letter: University of North Carolina.................................................................42
# APPENDIX A

## DATA COLLECTION TOOL

<table>
<thead>
<tr>
<th>Patient ID #</th>
<th>Maternal Age (DOB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth Hospital:</td>
<td></td>
</tr>
<tr>
<td>Maternal Marital Status:</td>
<td>Single Married Divorced Other</td>
</tr>
<tr>
<td>Race:</td>
<td>Cau AA Hisp Asian Other</td>
</tr>
<tr>
<td>Type of Insurance:</td>
<td>Private Self-Pay Medicaid Military</td>
</tr>
<tr>
<td>Prenatal Care:</td>
<td>Yes No</td>
</tr>
<tr>
<td>Gestational Age</td>
<td></td>
</tr>
</tbody>
</table>

### Pregnancy Complications:
1. Pre-eclampsia (Eclampsia)
2. PIH (pregnancy induce hypertension)
3. Chronic hypertension
4. Diabetes (Gestational or Pregestational)
5. Premature Rupture of Membranes
6. Preterm Labor
7. IUGR
8. Mental Health
9. Other (Specify)

<table>
<thead>
<tr>
<th>Type of Delivery:</th>
<th>Vaginal C-Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Weight</td>
</tr>
<tr>
<td>Birth number:</td>
<td>Singleton Twin A Twin B</td>
</tr>
<tr>
<td>Resuscitative measures:</td>
<td>Blow by O2 CPAP PPV Intubation Compressions Epi</td>
</tr>
<tr>
<td>Admit to:</td>
<td>SCN NNB</td>
</tr>
<tr>
<td>Feeding:</td>
<td>Breast Bottle Both</td>
</tr>
<tr>
<td>Supplementing at Discharge:</td>
<td>Yes No With: Cup Bottle</td>
</tr>
<tr>
<td>Baby’s blood type:</td>
<td>O A B AB Pos Neg Coombs: Pos Neg</td>
</tr>
<tr>
<td>Peak Bilirubin level</td>
<td>Hours since birth Discharge Bilirubin level</td>
</tr>
<tr>
<td>Seen by hospitalist (NCA):</td>
<td>Yes No</td>
</tr>
<tr>
<td>Discharge- # days of age at time of D/C:</td>
<td></td>
</tr>
<tr>
<td>Discharge Hospital:</td>
<td></td>
</tr>
<tr>
<td>Discharge wt.:</td>
<td></td>
</tr>
<tr>
<td>Discharge with bili blanket:</td>
<td>Yes No</td>
</tr>
<tr>
<td>Lactation Visit:</td>
<td>Yes No</td>
</tr>
<tr>
<td>Home Visit:</td>
<td>Yes No</td>
</tr>
<tr>
<td>Pediatrician Visit:</td>
<td>Yes No</td>
</tr>
<tr>
<td>Synagis prior to discharge:</td>
<td>Yes No</td>
</tr>
<tr>
<td>Referral to outpatient nurse coordinator:</td>
<td>Yes No</td>
</tr>
<tr>
<td>Referral to social work (DFS):</td>
<td>Yes No</td>
</tr>
<tr>
<td>Readmission - # days post delivery:</td>
<td></td>
</tr>
<tr>
<td>Readmission diagnosis:</td>
<td></td>
</tr>
<tr>
<td>Readmission weight:</td>
<td></td>
</tr>
</tbody>
</table>

If Hyperbilirubinemia, Maternal Blood type: O A B AB Pos Neg

<table>
<thead>
<tr>
<th>Bilirubin level</th>
<th>Days of life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of stay for readmission:</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX B

IRB APPROVAL LETTER: CINCINNATI CHILDREN’S HOSPITAL MEDICAL CENTER

From: IRB Committee
To: Principal Investigator: Laurel Bookman
Division: Neonatology

Re: Study ID: 2010-0509
Study Title: Late Preterm Birth Readmissions in the Cincinnati Area

The above referenced protocol and all applicable additional documentation provided to the CCHMC IRB were reviewed and APPROVED using an EXPEDITED review procedure in accordance with 45 CFR 46.110(b)(1)(see below) on 4/14/2010.

This study will be due for continuing review at least 30 days before: 4/13/2011.

The following documents were reviewed and approved:
Appendix A.doc
Late Preterm Birth Readmissions Protocol.doc

Please note the following requirements:

Per 45 CFR 46.116 the CCHMC IRB has waived the requirement to obtain informed consent for all adult participants.

Per 45 CFR 46.116 the CCHMC IRB has waived the requirement to obtain parental permission from the parent(s) (or guardian) of all child participants. NOTE: If your research is subject to FDA regulations it is not eligible for this waiver of parental permission.

Per 45 CFR 46.116 the CCHMC IRB has waived the requirement to obtain assent from all child participants. NOTE: If your research is subject to FDA regulations it is not eligible for this waiver of assent.

Per 45 CFR 164.512 the CCHMC IRB has granted a waiver from the requirement to obtain an authorization for the use and/or disclosure of protected health information (PHI).

OTHER APPROVALS: Principal investigators are responsible for assuring final approval from other applicable review committees and performance sites prior to study initiation. This includes, but is not limited to, Divisional Scientific Review committee, General Clinical Research Center (GCRC), Radiation Safety, Institutional Biosafety Committee (IBC), Conflict of Interest (COI) Committee, and any sites (i.e. schools, hospitals) where the research may be conducted. Principal investigators are also responsible for obtaining final approval from the FDA and a valid contract between the sponsor and CCHMC, as applicable. If any of these entities require changes to the IRB-approved protocol and/or informed consent/assent document(s), the changes must be submitted to and approved by the IRB prior to implementation.
APPENDIX C
IRB APPROVAL LETTER: UNIVERSITY OF NORTH CAROLINA

To: Laurel Bookman
School of Public Health
Cincinnati Children's Hospital Medical Center MLC 7009, 3333 Burnet Avenue Cincinnati, OH
45229-3099

From: Public Health Nursing IRB

Approval Date: 8/08/2011
Expiration Date of Approval: 8/08/2011

IRB Notice of IRB Approval by Expedited Review (under 45 CFR 46.110)
Submission Type: Initial
 Expedited Category: 5. Existing or non-research data
 Study #: 10-1426
 Study Title: Late Preterm Birth Readmissions in the Cincinnati Area

This submission has been approved by the above IRB for the period indicated. It has been
determined that the risk involved in this research is no more than minimal.

Study Description:

Purpose: The purpose of the study is to determine the rate of readmission for late preterm infants in
the Cincinnati area as well as determine the reasons for readmission. Participants: All late preterm
infants (defined as infants born at 34 0/7 through 36 6/7 weeks) who were admitted January 1,
2009 - December 31, 2009 to the seven area Cincinnati hospitals (listed below) up to twenty-eight
days of age will be included in the selection process. Only infants less than 34 weeks or greater than
36 completed weeks will be excluded. Procedures (methods): The charts of infants will be examined
through retrospective chart review. All late preterm infants (defined as infants born at 34 0/7
through 36 6/7 weeks) who were admitted January 1, 2009 - December 31, 2009 to the hospital
up to twenty-eight days of age will be included in the selection process. Data analysis will primarily
be descriptive with means and/or medians, standard deviation, and interquartile range (IQR) reported.
In addition, risk factors proposed to be associated with readmission will be determined using
parametric correlation or Spearman rank correlation. Study findings will be generalized to other
neonatal units and intend to devise intervention strategies based on the data obtained from the chart
review.

Individual IRB approval is being sought at the following hospitals: Cincinnati Children's Hospital
Medical Center, St. Elizabeth's Hospitall - Edgewood, Good Samaritan Hospital, University of
Cincinnati Medical Center, Bethesda North Hospital, The Christ Hospital, Mercy Anderson Hospital
and Mercy Fairfield Hospital.