Academy of Breastfeeding Medicine
Annotated Bibliography:

Breastfeeding the Late preterm Infant (34 $^{0/7}$- 36 $^{6/7}$ Weeks Gestation)

INTRODUCTION:

There has been an explosion of literature regarding the late preterm infant in the five years since the first protocol and annotated bibliography were written. The" Late Preterm" designation was adopted by a panel of experts assembled by NICHHD in July of 2005 to emphasize the fact these infants are really "preterm" and not "almost term." The panel lowered the age for inclusion in the Late Preterm category by one week to included the infant born $34^{0/7}$- $34^{6/7}$ weeks in the LPI category. Much of the new literature documents the increased vulnerability of these infants. There is little strong evidence for managing the late preterm infant, therefore, we have occasionally drawn on studies using more preterm infants or even full term infants in the management section. The obstetrical literature has had a number of articles examining the increasing incidence of late preterm births and current obstetrical practice. We have therefore included some of these articles.

The annotated bibliography is divided into two general sections, the first is "Background Evidence Defining the Problems", and the second is "Evidence Regarding Management." In a few cases the same article is included in both sections when it has important information applicable to both areas that the reader could miss it if only looking in one section. Each of these larger sections is subdivided into subsections.

Contents

Hyperbilrubinemia (37)

Background Evidence Defining the Problems

Physiologic Vulnerabilities		
	Content	**Level of Evidence***
Definition		
Engle, W. A. (2006). "A recommendation for the definition of "late preterm" (near-term) and the birth weight-gestational age classification system." Semin Perinatol **30**(1): 2-7.	Rationale for change in categorization from "*near-term*" (35 0/7-36 6/7 wks GA) to "*late preterm*" (34 0/7 to 36 6/7 wks GA) in order to reflect risks associated with physiologic and developmental immaturity.	**III**
Physiologic Maturation		
Hunt, C. E. (2006). "Ontogeny of autonomic regulation in late preterm infants born at 34-37 weeks postmenstrual age." Semin Perinatol **30**(2): 73-76.	Reviews the results of the Collaborative Home Infant Monitoring Evaluation (CHIME) study comparing incidence of apnea, ALTE, SIDS in preterm (≤ 33 wks GA), late preterm (34-36 wks GA) and term (≥37 wks GA) infants. The incidence of severe apnea was 10%,	**II-2**
Mizuno, K. and A. Ueda (2003). "The maturation and coordination of sucking, swallowing, and respiration in preterm infants." J Pediatr **142**(1): 36-40.	Twenty-six preterm infants born before 32 wks gestation were studied weekly during bottle feeding from 32 to 36 weeks post-conception to establish normative maturational data for feeding behavior. Maturational changes included significant, progressive improvement in sucking efficiency, pressure, frequency in near-term infants between 35 and 36 wks gestation. Swallowing pattern was mature after 35 wks. A mature respiratory pattern during feeding was still not fully established at 36 wks.	**II-2**
Bu'Lock, F., M. W. Woolridge, et al. (1990). "Development of co-ordination of sucking, swallowing and breathing: ultrasound study of term and preterm infants." Dev Med Child Neurol 32(8): 669-678.	Cross-sectional, descriptive ,observational study comparing nutritive and non-nutritive feeding movements using real-time ultrasound exam on the fourth day after birth in 14 healthy, bottle feeding preterm (33-34 wks); near-term (35-36 wks) and term (≥ 37 wks) infants. Compared to term infants, near-term infants had more abnormal and obstructive tongue movements, a higher suck/swallow ratio, more breathing abnormalities, and a less well-coordinated suck/swallow/breathing pattern.	**II-2**
Gewolb, I. H. and F. L. Vice (2006). "Maturational changes in the rhythms, patterning, and coordination of respiration and swallow during feeding in preterm and term infants." Dev Med Child Neurol **48**(7): 589-594.	Observational study of feeding patterns in a convenience sample of 16 term compared to 20 low-risk preterm infants (26-33 weeks PMA) beginning after initiation of 1st bottle feed at 32-34 weeks PMA. Improvement in sucking rate, rhythm and suck/swallow coordination correlated well with PMA, not with postnatal age, implying that development of suck, swallow and respiratory coordination are maturational rather than learned phenomena.	**II-3**

Barlow, S. M. (2009). "Oral and respiratory control for preterm feeding." Curr Opin Otolaryngol Head Neck Surg **17**(3): 179-186.	Reviews studies of the physiologic, neural, and mechanical bases for the transition from non-nutritive sucking to mature suck-swallow-respiration pattern in the preterm infant. Discusses the changes in sucking, swallowing and respiratory dynamics and sensory input required. Provides the physiologic rationale for immature feeding patterns seen in the LPI.	**III**
Darnall, R. A., R. L. Ariagno, et al. (2006). "The late preterm infant and the control of breathing, sleep, and brainstem development: a review." Clin Perinatol **33**(4): 883-914	In depth review of developmental progression of brainstem and autonomic control of cardiorespiratory function, airway stability and sleep in the late preterm infant (34-37 wks GA). Discussion includes feeding related bradycardia and desaturation and the neurologic basis for the development of coordinated sucking, swallowing and breathing.	**III**
Miller, M. J. and P. Kiatchoosakun (2004). "Relationship between respiratory control and feeding in the developing infant." Semin Neonatol **9**(3): 221-227.	Review of development of buccophayngeal function necessary for coordinating breathing and swallowing and of maturation of esophageal and gastroesophageal spincter tone.	**III**
Mortality		
Donovan, E. F., J. Besl, et al. (2010). "Infant death among Ohio resident infants born at 32 to 41 weeks of gestation." Am J Obstet Gynecol.203:58.e1-5	Retrospective, observational, population-based, state-wide, cohort study of gestational age specific mortality included 411,560 infants between 32-41 weeks gestation with linked birth-death certificates who were born from 2003-2005 in Ohio. Adjusted IMR for LPI at 34,35 and 36 wks gestation were respectively 4X, 3X and 2X term IMR. LPI were more likely to die in the neonatal period.	**II-2**
Mathews, T. J. and M. F. MacDorman (2010). "Infant mortality statistics from the 2006 period linked birth/infant death data set." Natl Vital Stat Rep **58**(17): 1-31.	Retrospective, national (US) cohort study using the NCHS dataset linking 2006 infant birth and death certificates. Late preterm IMR was 3X the term IMR (7.08/1000 LB vs. 2.39/1000 LB) and was essentially unchanged since 2000.	**II-2**
Pulver, L. S., G. Guest-Warnick, et al. (2009). "Weight for gestational age affects the mortality of late preterm infants." Pediatrics **123**(6): e1072-1077.	Retrospective, observational, population-based, statewide (Utah) cohort study of the association between weight-for-gestation (SGA, AGA, LGA) and mortality (NMR,IMR) for 343,322 infants born at ≥34 wks gestation from 1999-2005 using linked birth-death certificates. Compared to term AGA infants, SGA (BW < 10^{th} %) LPI were ~50 X more likely to die in the neonatal period. Excluding congenital abnormalities, LPI were still ~15X more likely to die in the neonatal period and ~3.5X more likely to die during infancy.	**II-2**
Reddy, U. M., C. W. Ko, et al. (2009). "Delivery indications at late-preterm gestations and infant mortality rates in the United States." Pediatrics **124**(1): 234-240.	Retrospective, observational, population-based, national (US) cohort study of gestational age and delivery indication specific NMR and IMR for 3,483,496 singleton infants born at 34-41 wks gestation in 2001 using NCHS linked birth/death certificates. Compared to term infants, LPI at 34,35 and 36 wks had increased RR of neonatal mortality (9.5, 6.4, 2.8) and of infant mortality of (11.8, 8.6 , 5.7) respectively. Mothers of the 23% of LPI deliveries with no maternal, obstetrical or fetal indications for	**II-2**

	delivery recorded were more likely to be white, better educated and to live outside the Northeast raising the question of whether patient preference and/or provider convenience are contributing to the increasing rate of LPI delivery.	
Swamy, G. K., T. Ostbye, et al. (2008). "Association of preterm birth with long-term survival, reproduction, and next-generation preterm birth." JAMA **299**(12): 1429-1436.	Retrospective, observational, population-based, national (Norway), cohort study to determine the long-term effect of singleton preterm birth on survival, reproduction and next-generation preterm birth using a national registry data of births from 1976-1976 with longitudinal follow-up through 2004. Infants born at 33-36 wks were at significantly increased risk of death during fetal (a RR 12-13), infant (Adjusted RR 5-6) and early childhood at1-5.9 years (a RR 1.5-1.6) periods. Both male and female LPI were less likely to have reproduced (aRR 0.95-0.97) and more likely to have had preterm offspring (aRR 1.4).	**II-2**
Tomashek, K. M., C. K. Shapiro-Mendoza, et al. (2007). "Differences in mortality between late-preterm and term singleton infants in the United States, 1995-2002." J Pediatr **151**(5): 450-456, 456 e451.	Retrospective, observational, population-based, national (US), cohort study to determine differences in early neonatal, late neonatal, post-neonatal and infant mortality between singleton LPI and term infants born between 2000-2002 in the US using data derived from national linked birth-death records. Compared to all cause mortality of term infants (37-41 wks gestation, N=11,719,205), LPI (34-36 wks gestation, N=871,608) were 6X more likely to die in the early neonatal period, 3X more likely to die in the late neonatal period, and 2X more likely to die in the post-neonatal period. In the post-neonatal period LPI were 3X more likely to die of congenital malformation, respiratory infection or sepsis, 2X as likely to die from SIDS and 1.8X as likely to die accidentally. Overall, LPI had 3X higher infant mortality rate compared term infants to throughout infancy (9.5-7.6/1000 LB vs 3.0-2.4/1000 LB).	**II-2**
Young, P. C., T. S. Glasgow, et al. (2007). "Mortality of late-preterm (near-term) newborns in Utah." Pediatrics **119**(3): e659-665.	Retrospective, observational, population-based, regional (Utah), cohort study to determine the relative risk of LPI for neonatal and infant mortality. Data derived from linked birth-death certificates in 1999-2004. Compared to term infants (N=262,869), LPI (N=21,106) born at 34-36 weeks had significantly higher risk of early neonatal (1-7 days), neonatal (1-28 days) and infant (birth -12 months) death (Adjusted RR 25.5-5.3). Infant mortality rates for LPI were 12.5/1000 LB, 8.7/1000 LB and 6.3/1000 LB for 34, 5 and 36 weeks gestation respectively compared to 1.4/1000LB for term, 40 weeks gestation infants.	**II-2**
Kramer, M. S., K. Demissie, et al. (2000). "The contribution of mild and moderate preterm birth to infant mortality. Fetal and Infant Health Study Group of the Canadian Perinatal Surveillance System." JAMA **284**(7): 843-849.	Retrospective, observational, population-based, multinational (US, Canada) cohort study to assess the quantitative contribution of singleton preterm birth to early neonatal, late neonatal, post-neonatal and overall infant mortality. Data derived from linked birth-infant death databases [US (1985, N= 3,619,650) and 1995, N=3,866,513,); Canada (1985-1987,N= 692,579 and1992-1994, N=726,435)]. During all mortality time periods, LPI (34-36 weeks gestation) had significantly higher adjusted risk for all cause mortality (Adjusted RR 2.1-7.9), asphyxia-related mortality (Adjusted RR 2.6-3.6), and infection-related mortality (Adjusted RR 2.2-12.6). The risk of SIDS for LPI was significantly higher (Adjusted RR 1.7-1.9). The etiologic fraction of LPI birth for all cause infant death was 6.3-8.0).	**II-2**
Osrin, D. (2010). "The implications of late-preterm birth for global child survival." Int J Epidemiol **39**(3): 645-649.	Commentary on the global impact of late preterm birth. In developing, low income countries without access to newborn care, late preterm birth is likely to have a very significant impact upon neonatal mortality. Preterm birth accounts for approximately 30% of neonatal mortality in developing countries. The majority of preterm infants are likely to be late preterm. The etiologic fraction of global mortality	**III**

	contributed by late preterm birth is estimated to be 16%-22% which accounts for a very substantial proportion (10-15%) of all global neonatal deaths. The need to focus efforts on low intensity, home management of low birthweight infants in developing countries (e.g., hygienic delivery, skin to skin care, early and exclusive breastfeeding, early treatment of illness) is emphasized.	

Morbidity-General		
Bird, T. M., J. M. Bronstein, et al. (2010). "Late preterm infants: birth outcomes and health care utilization in the first year." Pediatrics **126**(2): e311-319.	Retrospective, observational, regional, statewide, case-control study to determine the incidence of neonatal complications of LPI (34-36 wks) born from 2001-1005 in Arkansas. Singelton, LPI (N=5188) were matched with term infants (N=15303) by linking Medicaid claims records with birth certificate and maternal/infant hospital records. Popensity scoring was used to reduce selection bias. Outcomes were adjusted for multiple demographic, maternal and delivery variables.LPI were at increased risk for respiratory distress (aOR 3.84), TTN (aOR 1.87), mechanical ventilation (aOR 1.31, apnea (aOR 2.33), sepsis (aOR 2.06), jaundice (aOR 1.88), hypoglycemia (aOR 1.60),temperature instability (aOR 1.80), feeding problems (aOR 2.34), rehospitalization in the first year (aOR 1.11), and hospital cost > $ 25,000 in the first year (aOR 2.04). Mortality was not increased.	**II-2**
Dimitriou, G., S. Fouzas, et al. (2010). "Determinants of morbidity in late preterm infants." Early Hum Dev **86**(9): 587-591.	Prospective, observational, cohort study to assess the effect of maternal medical conditions on neonatal morbidity of LPI (34-36 wks gestation) born at in a single, urban center (Greece). Thirty percent of LPI cohort (N=548) had neonatal medical complications including respiratory disease (25%), temperature instability (6%), hypoglycemia (9%), jaundice (25%), feeding intolerance (15%). Twenty-seven percent were admitted to the NICU. Overall morbidity increased 3.5X between 36 and 34 weeks gestation being 16.8% at 36 weeks, 38.2% at 35 weeks and 59.7% at 34 wks gestation.	**II-2**
Picone, S. and P. Paolillo (2010). "Neonatal outcomes in a population of late-preterm infants." J Matern Fetal Neonatal Med.	Retrospective, observational, cohort study to determine neonatal outcomes of all preterm infants born in a single, urban center at 33-36 wks gestation in 2008-2010 (Italy). Twenty four percent of LPI (N=417, 34-36 wks gestation) required respiratory support in the delivery room, 20% had respiratory disease (i.e., RDS, TTN, pneumonia, air leak, apnea); 41% had metabolic abnormalities (i.e., hypocalcemia, hypoglycemia, hypopmagnesemia, hypo/hypernatremia, dehydration), 29% required phototherapy for jaundice, 16% had infection, and 24% had evidence of Grade 1 IVH . The risk of most abnormalities increased with decreasing gestational age. However, dehydration and Na abnormalities were more likely at 36 wks gestation compared to 34 and 35 wks gestation.	**II-2**
Cohen-Wolkowiez, M., C. Moran, et al. (2009). "Early and late onset sepsis in late preterm infants." Pediatr Infect Dis J **28**(12): 1052-1056.	Retrospective, observational, cohort study of sepsis risk, derived from prospectively collected database, including 106,142 infants born at 34-36 wks gestation between1997-2007 and cared for in all 248 NICUs managed by a single US medical group (Pediatrix). There were 531 episodes of early onset sepsis (4.4/1000 NICU admissions) and 803 episodes of late onset sepsis (6.3/1000 NICU admissions). Most episodes were caused by gram positive organisms. Young maternal age and low Apgar scores were independently associated with increased risk or sepsis. Mortality was 1.3% in the early and 0.4% in the late sepsis groups. Death was more likely with gram negative sepsis.	**II-2**

Dani, C., I. Corsini, et al. (2009). "Neonatal morbidity in late preterm and term infants in the nursery of a tertiary hospital." Acta Paediatr **98**(11): 1841-1843.	Retrospective observational, chart review to determine the risk of problems in a cohort of all healthy infants born in 2008 at ≥ 34 wks gestation with birthweight > 2000 g who were routinely admitted after delivery to the normal nursery in a single, tertiary level, university hospital (Italy). Compared to term infants (N=2708), healthy LPI (N=137) were at higher unadjusted risk for C-section delivery (RR 2.04), hypocalcemia (RR 13.2), hyperbilirubinemia (RR 2.97), respiratory distress (RR 7.53),poor feeding (RR2.7), supplemental formula feeding (RR 2.20), exclusive formula feeding (RR 3.29), hypoglycemia (RR 12.4), NICU admission (RR 19.8), and prolonged hospitalization (RR 3.53). Excessive weight loss (> 10%) was less common in the LPI due to frequent formula supplementation to prevent/treat hypoglycemia and dehydration.	**II-2**
Ishiguro, A., Y. Namai, et al. (2009). "Managing "healthy" late preterm infants." Pediatr Int **51**(5): 720-725.	Retrospective, observational, chart review examined postnatal risk factors for NICU admission of 210 infants born at 34-36 wks gestation over 3 years (1998-2000) at a single, city hospital (Japan) who were admitted to the NICU. Overall, 56% of all LPI born at 35 weeks gestation (17.8% at birth, 37.8% from the normal nursery) and 30.5% of all LPI born at 36 weeks gestation (12.4% at birth and 18% from the normal nursery) were admitted to the NICU. Sixty-seven percent of LPI born at 34 wks gestation and 48% of LPI < 2000g born at 35-36 wks gestation who were admitted immediately after delivery required medical intervention, primarily for respiratory distress. Most (≥80%) of the post-delivery NICU admissions were due to apnea (10.8% at 35 wks, 5.4% at 36 wks) or hypoglycemia (24.3% at 35 wks, 14.1% at 36 wks).	**II-2**
Kitsommart, R., M. Janes, et al. (2009). "Outcomes of late-preterm infants: a retrospective, single-center, Canadian study." Clin Pediatr (Phila) **48**(8): 844-850.	Retrospective, observational, chart review examined major morbidities and mortality of 1436 LPI born at 34-36 wks gestation over 4 years (2008-2008) who were admitted to a single, tertiary, regional medial center (Canada). Compared to 8666 term newborns, LPI were more likely to have respiratory distress (31.1%), TTN (14.6%) or RDS (11.6%), require positive pressure ventilation (25%; CPAP or mechanical ventilation), and had 12X the risk of death. Magnitude of respiratory support needed decreased with each week of increasing gestation.	**II-2**
Lubow, J. M., H. Y. How, et al. (2009). "Indications for delivery and short-term neonatal outcomes in late preterm as compared with term births." Am J Obstet Gynecol **200**(5): e30-33.	Retrospective, observational, single site, cohort study of delivery indications and short-term outcomes of sequentially selected LPI born at 34 to ≥39 wks gestation (N=50/week gestation) at a single US, tertiary level, academic medical center over 2 years (2005-2006). The most common indications for LPI delivery were spontaneous preterm labor (83%) and/or PPROM (50%). Compared to term infants (≥ 37 wks gestation, N=150), LPI (34-36 wks gestation, N=149) were significantly more likely to be admitted to the NICU, had a longer length of stay (5.0 vs. 2,4 days), have feeding problems (36% vs. 5%), hyperbilirubinemia (25% vs. 3%), RDS (6% vs. 0.7%), TTN (13% vs. 3%), need CPAP (11% vs. 3%), have sepsis (4% vs. 0%). The risk of NICU admission, feeding problems, hyperbilirubinemia, sepsis, and respiratory complications significantly increased with decreasing gestation from 36 to 34 weeks.	**II-2**
Melamed, N., G. Klinger, et al. (2009). "Short-term neonatal outcome in low-risk, spontaneous, singleton, late preterm deliveries." Obstet Gynecol **114**(2 Pt 1): 253-260.	Retrospective, cohort study of neonatal morbidity and risk factors derived from prospectively collected computerized discharge records of all low risk, singleton, spontaneously delivered LPI (34-36 wks gestation) born between1997-2006 in a single, university affiliated tertiary medical center (Israel). Compared to term infants N=7,434), the adjusted ORs at each week of gestation in the LPI group (N=2,478) were significantly higher for NICU admission, hospitalization > 7 days, , composite morbidity, respiratory morbidity, infectious morbidity, and hypoglycemia. The risk for these morbidities	**II-2**

	was increased ≥ 10X for those at 34 and 35 wks gestation. Composite morbidity decreased sharply from 34 to 37 wks gestation, reaching a nadir at 39 wks gestation. Lower gestational age, male gender, C-section delivery, and multiparity were each independently associated with increased adverse outcome. The number of LPI deliveries needed to result in one adverse event (i.e. ,number needed to harm) was 2.9 for composite outcome, 5.9 for NICU admission, 6.5 for jaundice and 7.9 for respiratory morbidity.	
Santos, I. S., A. Matijasevich, et al. (2009). "Late preterm birth is a risk factor for growth faltering in early childhood: a cohort study." BMC Pediatr **9**: 71.	Prospective, observational, cohort study of growth outcomes at 12 and 24 months of age in singleton LPI born at 34-36 weeks gestation and recruited at birth in 2004 from ~ 99% of all deliveries in a single, urban center (Brazil). Follow-up rates at 12 and 24 months were 94.3% and 93.5% respectively. Compared to term infants (N=2,914), LPI (N=371) at 12 months were significantly more likely to be underweight, stunted and wasted (aOR 2.57, 2.35, 3.98) respectively. At 24 months, LPI continued to be at higher risk for underweight (aOR 3.36) and stunting (aOR 2.3), but not for wasting.	**II-2**
Bastek, J. A., M. D. Sammel, et al. (2008). "Adverse neonatal outcomes: examining the risks between preterm, late preterm, and term infants." Am J Obstet Gynecol **199**(4): 367 e361-368.	Retrospective, observational, single center, cohort study to assess differences in adverse outcomes between singleton, preterm (32-33 weeks gestation), LPI (34-36 weeks gestation) and term (≥ 37 weeks gestation) infants born between 2002-2005 whose mothers were admitted with preterm labor before 34 weeks gestation to an urban tertiary care hospital. Maternal and neonatal data obtained by chart review. Compared to those delivered at term infants (N=134), LPI (N=69) were significantly more likely to have respiratory insufficiency (19% vs 2%), hypoglycemia (35% vs 6%), apnea/bradycardia (13% vs 0%), hyperbilirubinemia (41% vs 10%), and feeding difficulties (20% vs 1%). Controlling for confounders, risk of adverse outcome decreased 23% per week between 32 and 39 weeks gestation.	**II-2**
McIntire, D. D. and K. J. Leveno (2008). "Neonatal mortality and morbidity rates in late preterm births compared with births at term." Obstet Gynecol **111**(1): 35-41.	Retrospective, observational cohort study to compare mortality and morbidity of LPI (N= 21,771, 34-36 wks gestation) to term (N=84,747, 39 wks gestation) infants born from 1988-2005 at a single, large, urban, teritary center (US). Maternal and neonatal outcomes were routinely recorded in an electronic maternal/infant database. Significant neonatal morbidity (i.e., respiratory disease , IVH, sepsis, phototherapy, NEC, Apgar score <3 at 5 minutes, intubation at delivery) occurred in 34% at 34 wks, 24% at 35 weeks, and 17% at 36 wks compared to 14% at 39 wks gestation. Intensive care was required by 5% at 34 wks, 2% at 35 wks, 1.1% at 36 wks and 0.5% at 39 wks. Cost of hospitalization billed per infant was $6,094 at 34 wks, $3,519 at 35 wks, $2,019 at 36 wks compared to $1,258 at 39 wks.	**II-2**
Santos, I. S., A. Matijasevich, et al. (2008). "Associated factors and consequences of late preterm births: results from the 2004 Pelotas birth cohort." Paediatr Perinat Epidemiol **22**(4): 350-359.	Prospective, observational, citywide, birth- based cohort study to determine maternal characteristics associated with singleton LPI birth and consequences of LPI (34-36 weeks gestation) birth on LPI health from birth to 3 months in 2004 using various methods of direct health surveillance in Pelotas, Brazil. LPI infants (N=447) were at increased risk of neonatal (aRR 5.1) and infant (aRR 2.1) mortality with a neonatal mortality rate of 15.7/1000LB, post-neonatal mortality rate of 6.7/1000LB and overall infant mortality rate of 22.4/1000LB. Compared to term infants, LPI infants were significantly more likely to have low Apgar scores, require feeding supplementation, to have neonatal morbidity, require intensive care and were less likely to be breastfed. At 3 months of age LPI were significantly less likely to be exclusively breastfeeding (aRR 0.8).	**II-2**

Shapiro-Mendoza, C. K., K. M. Tomashek, et al. (2008). "Effect of late-preterm birth and maternal medical conditions on newborn morbidity risk." Pediatrics **121**(2): e223-232.	Retrospective, observational, regional, statewide (Massachusetts, US), cohort study to determine incidence of neonatal morbidity in LPI (34-36 wks gestation) born in 1998-2003 using a statewide databases linking infant and maternal discharge records with birth and deaths certificates. Compared with term infants (N=377,638), LPI (N=26,170) were more likely to experience newborn morbidity (22% vs. 3%, aOR 6.9) which doubled for each week < 38 wks gestation and to have mother with maternal complications, especially antepatrum hemorrhage and hypertensive disorders . Among LPI with neonatal morbidity, 29% had mothers with 1 complication and 37% had mothers with ≥ 2 complications.	**II-2**
Wang, M. L., D. J. Dorer, et al. (2004). "Clinical outcomes of near-term infants." Pediatrics **114**(2): 372-376.	Retrospective, observational, single site, case-control chart review of 90 randomly selected near-term (35-36 wk) and 95 full-term infants born in Boston, Massachusetts in 1997-2000 to determine the risk of neonatal complications. Compared to term newborns, near-term infants were more likely to have clinically significant temperature instability (10% vs. 0%), hypoglycemia (16% vs. 5%), receive iv infusions (27% vs. 5%), have respiratory distress (29% vs. 4%), be clinically jaundiced (54% vs. 38%), to have apnea/bradycardia (4% vs.0%), to be evaluated for sepsis (37% vs. 13%), and to have ≥2 diagnoses (50% vs. 21%). Near-term infants were more likely to have discharge home delayed due to respiratory distress, poor feeding, and jaundice.	**II-2**
Robertson, P. A., S. H. Sniderman, et al. (1992). "Neonatal morbidity according to gestational age and birth weight from five tertiary care centers in the United States, 1983 through 1986." Am J Obstet Gynecol **166**(6 Pt 1): 1629-1641; discussion 1641-1625.	Prospective, observational, data collection for 20,680 consecutive, singleton deliveries between 1983-1986 at 5 US tertiary centers to determine the incidence of clinically significant neonatal problems (RDS, IVH, NEC,PDA, sepsis, hypoglycemia, hyperbilirubinemia) by gestational age (23-44 weeks) and birthweight (500->4000 g) . Compared to term newborns, the risk of neonatal problems substantially increased with each week of decreasing gestational age below 37 weeks. At 35, 36 and 37wks gestation respectively, RDS occurred in 6.4%, 3.3% and 0.4%; sepsis in 2.3%, 1.3%, and 0.3%; hypoglycemia in 4.4%, 1.1% and 0.9%; need for phototherapy in 16%, 9% and 3.5% and admission to a Level II or III nursery was required in 42%, 24% and 10%.	**II-2**
Ortigosa Rocha, C., R. E. Bittar, et al. (2010). "Neonatal outcomes of late-preterm birth associated or not with intrauterine growth restriction." Obstet Gynecol Int **2010**: 231842.	Retrospective, observational, convenience sample of 50 singleton IUGR (BW<10th%) LPI compared to 36 AGA LPI born at 34-36 weeks gestation in 2005-2007 at a single center in Brazil. IUGR LPI were more likely to be delivered by C-section (92% vs 25%), required more days of phototherapy (6 vs. 3 days), were more likely to be hypoglycemic (24% vs. 6%), and were hospitalized longer (16 vs.5 days).	**II-3**
Loftin, R. W., M. Habli, et al. (2010). "Late preterm birth." Rev Obstet Gynecol **3**(1): 10-19.	Comprehensive review of LPI epidemiology, neonatal risk, long-term morbidity, and cost in the US. Includes summary risk of RDS, IVH, sepsis, NEC, PDA, NICU admission by week of gestation from 34-36 wks gestation based on multiple published studies. The authors calculate that a delay in delivery from 34 to 35 weeks decreases neonatal cost by 42%, a delay from 35 to 36 weeks results in a further 38% decrease in neonatal costs.	**III**
Mally, P. V., S. Bailey, et al. (2010). "Clinical issues in the management of late preterm infants." Curr Probl Pediatr Adolesc Health	Comprehensive review of the LPI including discussion of definition, etiology, epidemiology, labor and delivery complications, physiologic vulnerabilities, neonatal , post-discharge , neurodevelopment, cost, and potential impact of school outcome on the educational system.	**III**

Care **40**(9): 218-233.		
Ramachandrappa, A. and L. Jain (2009). "Health issues of the late preterm infant." Pediatr Clin North Am **56**(3): 565-577.	Comprehensive review of LPI including definition, epidemiology, etiology, pathophysiology, short-term and long-term health consequences and management.	**III**
Engle, W. A., K. M. Tomashek, et al. (2007). ""Late-preterm" infants: a population at risk." Pediatrics 120(6): 1390-1401.	Expert opinion of authors and the AAP Committee on Fetus and Newborn reviewing LPI morbidity including feeding difficulties, hypoglycemia, jaundice, temperature instability, mechanical ventilation and risk factors for readmission.	**III**
LOS and Readmission		
Lim, J. J., V. M. Allen, et al. (2010). "Late preterm delivery in women with preterm prelabour rupture of membranes." J Obstet Gynaecol Can **32**(6): 555-560.	Retrospective, observational, population-based, cohort study to determine maternal and neonatal outcomes of mothers (N=2180) with preterm, prelabor rupture of membranes (PPROM) who had obstetrically indicated delivery of singleton LPI (34-36 weeks gestation) in Nova Scotia, Canada between1988-2006. Data derived from the province-wide Atlee Perinatal Database. LPI delivered at 36 weeks gestation (N=458) had significantly fewer complications including RDS (aOR 0.17), neonatal depression (aOR 0.22) and composite perinatal morbidity/mortality (aOR 0.39) compared to LPI delivered at 34-35 weeks gestation (N=240) suggesting that delaying delivery after PPROM may be advantageous if spontaneous labor has not occurred .	**II-2**
Pulver, L. S., J. M. Denny, et al. (2010). "Morbidity and Discharge Timing of Late Preterm Newborns." Clin Pediatr (Phila).	Retrospective, observational, cohort study to determine the proportion of LPI (N=235, 34-36 wks gestation) with prolonged hospitalization for ≥ 1 day after their mother's discharge who were born at a single, tertiary center in 2002-2007 (Utah, US). Sixty-two percent of LPI had conditions which required at ≥ 1 intervention (i.e., need for supplemental oxygen, phototherapy, IV antibiotics, incubator for hypothermia, NG feeding, respiratory support with CPAP or assisted ventilation), 63% of whom had prolonged hospitalizations. At least one intervention was required by 83% of LPI at 34 wks, 75% at 35 wks and 48% at 36 wks gestation. Mean length of stay for LPI was 12.6 days at 34 wks, 6.1 days at 35 wks, and 3.8 days at 36 wks gestation. Prolonged hospitalization after their mother's discharge occurred in 75% of LPI at 34 wks, 49% at 35 wks and 25% at 36 wks.	
Shapiro-Mendoza, C. K., Tomashek,K.M, et al. (2006). "Risk factors for neonatal morbidity and mortality among "healthy," late preterm newborns." Semin Perinatol **30**(2): 54-60.	Retrospective, observational, regional, statewide, cohort study to determine incidence of neonatal morbidity, readmission, and mortality during the first month in healthy, singleton, LPI (34-36 wks gestation) born in Massachusetts between 1998-2002 using a statewide database linking birth and deaths. Healthy LPI were defined as vaginally delivered, discharged home after < 4 night stay, BW ≥ 2000g, and having had no significant health problems or procedures before discharge. Healthy LPI (N=9522) had a 4.8% readmission rate. Jaundice was the most common reason for admission overall (63%) and was most likely at < 7 days. Infection accounted for 13% of readmissions, mostly after 14 days of age. The strongest overall risk factor for neonatal morbidity was breastfeeding at initial discharge (aRR 1.65): 89% of readmissions for jaundice were breastfed. The risk of neonatal morbidity was also increased by primiparity (aRR 1.44) and complications of labor and delivery (aRR	**II-2**

	1.25).	
Escobar, G. J., J. D. Greene, et al. (2005). "Rehospitalisation after birth hospitalisation: patterns among infants of all gestations." Arch Dis Child **90**(2): 125-131.	Retrospective, observational, multisite, cohort study to examine factors related to hospital readmission of all 33,276 infants born between1998-2000 at 7 Northern California Kaiser Permanente hospitals. The 2153 LPI born at 34-36 wks gestation were at increased risk for readmission compared to term infants (4.4% vs. 2%). Healthy LPI who were never in the NICU were at the highest risk for readmission (OR 3.1). Jaundice was the most common reason for readmission, followed by feeding difficulties.	**II-2**
Martens, P. J., S. Derksen, et al. (2004). "Predictors of hospital readmission of Manitoba newborns within six weeks postbirth discharge: a population-based study." Pediatrics **114**(3): 708-713.	Retrospective, observational, population-based study of predictors of readmission within 6 weeks of discharge for all 68,681 infants born in Manitoba, Canada in 1997-2001. Preterm infants ≤ 36 wks gestation were almost twice as likely to be readmitted (OR 1.8) within six weeks post-birth.	**II-2**
Escobar, G. J., V. M. Gonzales, et al. (2002). "Rehospitalization for neonatal dehydration: a nested case-control study." Arch Pediatr Adolesc Med **156**(2): 155-161.	Retrospective, observational, multisite, nested case-control population-based study to determine the incidence of readmission due to dehydration of 51,383 infants ≥36 wks and ≥2000 g born in 1995-1996 at 11 Northern California Kaiser Permanente hospitals. Gestational age ≤ 38 wks (OR 2.0) and exclusive breastfeeding at discharge (OR 11.2) were significant predictors of readmission for dehydration, usually within the first week after discharge.	**II-2**
Edmonson, M. B., J. J. Stoddard, et al. (1997). "Hospital readmission with feeding-related problems after early postpartum discharge of normal newborns." JAMA **278**(4): 299-303.	Retrospective, observational, population-based, nested case-control study of risk for feeding related readmission after early discharge in 120,290 normal newborns born in 1991-1994 in Wisconsin. Delivery at ≤37 wks was associated with 16% of all feeding-related readmissions. Risk factors by multivariate analyses included breastfeeding (OR 2.6) and gestational age ≤37 wks (OR 2.3).	**II-2**
Liu, L. L., C. J. Clemens, et al. (1997). "The safety of newborn early discharge. The Washington State experience." JAMA **278**(4): 293-298.	Retrospective, observational, population-based, regional, case/control study of the risk of readmission after early discharge in the first month after birth for 310,578 infants ≥ 36 wks gestation born in 1991-1994 in Washington State. Data was obtained by linking hospital discharge abstracts and birth certificates. Near-term infants born at 36 wks gestation comprised 3.1% of the entire cohort, had a 3.6X higher risk for readmission compared to term infants and accounted for 7.5% of all readmissions. For all infants, jaundice was the most common reason for readmission within the first week.	**II-2**
Lewis, D. F., S. Futayyeh, et al. (1996). "Preterm delivery from 34 to 37 weeks of gestation: is respiratory distress syndrome a problem?" Am J Obstet Gynecol **174**(2): 525-528.	Retrospective, single site, chart review to determine the incidence of RDS and other neonatal morbidity in a cohort of 416 near-term, singleton, mostly African-American infants born between 1990-1992 in Louisiana at 34-37 weeks gestation after an uncomplicated pregnancy. At 35-36 weeks gestation, 23% of mothers presented with premature rupture of membranes, 67% had preterm labor and 11% were delivered by cesarean section. Although RDS was infrequent (<1.0%) at 35-36 weeks gestation, the LOS was ≥ 7 in 12% and 6% of near-term infants born at 35 and 36 weeks gestation	**II-2**

	respectively.	
Soskolne, E. I., R. Schumacher, et al. (1996). "The effect of early discharge and other factors on readmission rates of newborns." Arch Pediatr Adolesc Med **150**(4): 373-379.	Retrospective, observational single site, case-control study of 117 hospital readmissions within the first 3 weeks after birth for newborns ≥ 34 wks gestation discharged from the normal nursery. Jaundice was the most common reason for readmission. The shorter the gestation, the more likely the readmission, especially for infants ≤37 wks gestation who represented 19% of those readmitted. Authors recommended delaying newborn discharge until after 72 hours of age and a re-evaluation within 1-2 days for all preterm infants.	**II-2**

Respiratory		
Abe, K., C. K. Shapiro-Mendoza, et al. (2010). "Late preterm birth and risk of developing asthma." J Pediatr **157**(1): 74-78.	Retrospective, population-based, cohort study using NCHS/NHANES III (1988-1994) US database with birth certificates for 6187 singleton children ages 2-83 months to determine whether late preterm birth (34-36 wks gestation, N=537) was a risk factor for physician-diagnosed asthma. LPI were slightly more likely to develop asthma (Hazard ratio 1.3, 95% CI 0.8-2.0) but this difference was not statistically significant.	**II-2**
Bastek, J. A., M. D. Sammel, et al. (2010). "The effects of a preterm labor episode prior to 34 weeks are evident in late preterm outcomes, despite the administration of betamethasone." Am J Obstet Gynecol **203**(2): 140 e141-147.	Retrospective, observational, single center, cohort, chart review of 700 singleton, mother-infant pairs delivered between 34-36 wks gestation in a single, large, urban, tertiary care center to assess whether giving antenatal steroids (ANS) for preterm labor (PTL) or PPROM prior to 34 weeks reduced the incidence of adverse outcome in spontaneous deliveries delayed until between 34-36 weeks gestation. After adjusting for maternal and neonatal demographic and medical confounders, LPI born at 36 weeks who had been exposed to ANS for PTL (N=148) before 34 weeks were at significantly increased risk for respiratory distress (IRR 2.73), NICU admission (IRR 2.01), and need for CPAP (IRR 3.87) compared to 36 week LPI (N=552) whose mothers had never received ANS. Clinical chorioamnionitis was independently associated with adverse respiratory outcome (IRR 2.46). The authors hypothesized that intrauterine inflammation associated with earlier PTL for which the mothers received ANS contributed to the adverse respiratory outcome at later spontaneous delivery.	**II-2**
Colin, A. A., C. McEvoy, et al. (2010). "Respiratory morbidity and lung function in preterm infants of 32 to 36 weeks' gestational age." Pediatrics **126**(1): 115-128.	Comprehensive survey of 24 published studies of respiratory morbidity in LPI (34-36 wks gestation). Reviews the impact of late preterm birth on lung development and discusses the implications for longterm lung function.	**II-2**
Derbent, A., M. M. Tatli, et al. (2010). "Transient tachypnea of the newborn: effects of labor and delivery type in term and preterm pregnancies." Arch Gynecol Obstet.	Retrospective, observational, single center, case-control (1:4) study of infants born between 2006-2009 to determine how timing or type of delivery affects the incidence of transient tachpnea of the newborn (TTN) in a university-based, tertiary medical center in Turkey. Infants with TTN (N=85) were significantly less mature (mean GA 36.0 vs 38.9 wks gestation) and had lower mean birthweight (2810 vs 3265 gm) compared to infants without TTN (N=340). Compared to vaginal delivery, elective C-section at ≤37 weeks was associated with a 7X increased risk of TTN. After adjustment, male gender, CS delivery, absence of PROM and younger gestational age were independently associated with TTN.	**II-2**

Dimitriou, G., S. Fouzas, et al. (2010). "Prediction of respiratory failure in late-preterm infants with respiratory distress at birth." Eur J Pediatr.	Prospective, observational, cohort study of all LPI (34-36 wks gestation) born in 2006-2008 who were admitted to the NICU in a single, university hospital (Greece) with respiratory distress to determine which indices of respiratory function best predicted respiratory failure. Fifty-five percent of all LPIs were admitted to the NICU for respiratory distress. Thirty five percent (55/155) developed respiratory failure and required assisted ventilation of whom 71% had RDS, 13% had sepsis, 7% had pneumonia, 5% had meconium aspiration and 9% developed PPHN. An alveolar-arterial oxygen gradient (A-aDO2) of > 200 mmHg was the best index for predicting respiratory failure with a sensitivity of 98%, specificity of 96%, positive predictive value of 93%, negative predictive value of 99% and a positive Likelihood Ratio of 24.5.	**II-2**
Gouyon, J. B., A. Vintejoux, et al. (2010). "Neonatal outcome associated with singleton birth at 34-41 weeks of gestation." Int J Epidemiol **39**(3): 769-776.	Retrospective, population-based, regional (Burgundy,France), observational, cohort study using a government database linking maternal and neonatal outcomes to assess neonatal outcome in 150,426 singleton neonates born at 34-41 wks gestation in 2000-2008. Severe respiratory disorders occurred in 8.3% of the LPI group (34-36 wks gestation) vs 0.28% of the term group (39-41 wks gestation). Compared to term infants, at 34, 35 and 36 wks respectively the aRRs for death or severe neurologic condition were 6.8, 3.0 and 3.1 and the aRRs for severe respiratory disorders requiring mechanical ventilation or CPAP were 61.0,31.0, and 14.2. Between 34 and 38 wks, each additional week decreased the risk for severe respiratory disorder by a factor of 2-3. LPI had a greater risk of poor prognosis associated with severe respiratory disorders compared to term infants (6.8% vs 0.1%). Poor prognosis and severe respiratory disorders were associated with antepartum hemorrhage and maternal hypertensive disorders.	**II-2**
Gunville, C. F., M. K. Sontag, et al. (2010). "Scope and Impact of Early and Late Preterm Infants Admitted to the PICU with Respiratory Illness." J Pediatr.	Retrospective, chart review of all admissions < 2 years of age for LRI at a single tertiary level PICU (Denver, Colorado) over a two year period (2006-2007). Median length of stay (LOS) in PICU, LOS in hospital and charges were compared for early preterm < 32 weeks gestation, later preterm (32-35 weeks gestation) and term (≥ 36 weeks gestation) admissions. Later preterm accounted for 12% of all patients admitted to the PICU for respiratory illness; 48% of LRIs in the later preterm group were due to RSV. Compared to term infants, later preterm were had significantly longer PICU (7.1 vs 3.7 days) stays, hospital (13.8 vs 7.1 days) stays, and correspondingly higher total charges ($83,576 vs $55,122). Twenty four percent of later preterm required discharge home on newly prescribed oxygen.	**II-2**
Hibbard, J. U., I. Wilkins, et al. for The Consortium on Safe Labor. (2010). "Respiratory morbidity in late preterm births." JAMA **304**(4): 419-425.	Retrospective, observational, multicenter study to assess neonatal respiratory morbidity in LPI (34-36 weeks gestation) born between 2002-2008 in 12 institutions across the US. Data were collected from electronic medical records and by chart review. Compared to term infants (N=165,993), LPI (N=19,344) born at 34-36 wks gestation were significantly more likely to require delivery room resuscitation, be admitted to a NICU, and have respiratory failure. Compared to term infants born at 39-40 wk gestation infants, LPI born at 36 wk gestation had aOR 9.1 for RDS, 6.1 for TTN, 3.6 for pneumonia, and 6.2 for respiratory failure. Compared to 36 weeks gestation, most risks at least doubled and the risk of RDS more than quadrupled at 34 wks gestation.	**II-2**
Paramore, L. C., P. J. Mahadevia, et al. (2010). "Outpatient RSV lower respiratory	Survey of published literature to identify the frequency of outpatient visits for RSV and LRI in high risk infants, including LPI in of population-based studies (i.e., national, regional, HMO). Supplemented by retrospective cohort data in 2004-2006 from a commercial US database (MedStat MarketScan). Rates	**II-2**

infections among high-risk infants and other pediatric populations." Pediatr Pulmonol **45**(6): 578-584.	for LPI (33-36 wks gestation) were 183-246/1000 compared to 129-171/1000 for term infants. LPI had similar to rates as those of preterm infants ≤ 32 wks gestation.	
Yoder, B. A., M. C. Gordon, et al. (2008). "Late-preterm birth: does the changing obstetric paradigm alter the epidemiology of respiratory complications?" Obstet Gynecol **111**(4): 814-822.	Retrospective cohort study to analyze effect of gestational age, delivery mode and maternal-fetal risk factor on respiratory morbidity of infants born after 34 wks gestation at a single tertiary, US, medical center over a 9 year period (1990-1998).Neonatal data was collected from a prospectively recorded database. LPI were much more likely to be delivered by C-section. LPI neonatal death rates were 22%, 8.5% and 3.9% for 34, 35, and 36 wks respectively. Clinically significant respiratory morbidity occurred in 4.9% of LPI .The unadjusted risk of respiratory morbidity increased from a RR 5.3 at 35-36 wks to a 35.1 at 34 weeks compared to a RR 1.6 at 37 wks gestation.	**II-2**
Escobar, G. J., R. H. Clark, et al. (2006). "Short-term outcomes of infants born at 35 and 36 weeks gestation: we need to ask more questions." Semin Perinatol **30**(1): 28-33.	Review of worldwide published literature to describe outcome of cohorts of LPI (35-36 wks gestation) including death, neonatal respiratory support and re-hospitalization. The authors also retrospectively analyzed data from a cohort of 47,495 newborns, born from 2002-2004, and enrolled in a Northern California, Kaiser HMO. The aORs for requiring assisted ventilation were 19.8, 9.0 and 5.2 for 34, 35, 36 wks respectively; 8% of LPI (35-36 wks gestation) required supplemental oxygen for ≥ 1 hour. LPI infants were more likely to be rehospitalized: 9.1 % at 34 wks, 6.8% at 35 wks and 7.3% at 36 wks gestation compared to 4.4% at 38-40 wks gestation. Independent predictors for rehospitalization included gestational age of 36 wks, male gender and need for assisted ventilation as a neonate.	**II-2**
Merchant, J. R., C. Worwa, et al. (2001). "Respiratory instability of term and near-term healthy newborn infants in car safety seats." Pediatrics 108(3): 647-652.	Pre-discharge, observational study comparing the cardiorespiratory stability in car seats of 50 healthy near-term newborns (35-36 wks gestation) to that of 50 healthy term newborns. While seated in car seats, near-term newborns were more likely to have significant apnea or bradycardia compared to term newborns (12% vs 0%). Half of the near-term events required intervention.	**II-2**
Rubaltelli, F. F., L. Bonafe, et al. (1998). "Epidemiology of neonatal acute respiratory disorders. A multicenter study on incidence and fatality rates of neonatal acute respiratory disorders according to gestational age, maternal age, pregnancy complications and type of delivery. Italian Group of Neonatal Pneumology." Biol Neonate **74**(1): 7-15.	Prospective, regional, 3-month survey to determine the incidence of respiratory disorders in a cohort of 17,192 infants born in 65 sites in Italy. For near-term infants born at 35-36 wks gestation, the combined incidence of all respiratory disorders was 11.5% including RDS (2.0%), transient tachypnea (6.5%) and all other respiratory diagnoses (3.0%).	**II-2**
Lanari, M., M. Silvestri, et al. (2009). "Respiratory syncytial virus risk factors in late preterm infants." J Matern Fetal Neonatal Med **22 Suppl 3**: 102-107.	Review of studies in Canada, Italy and Spain describing factors associated with RSV-related hospitalization rates in the LPI (34-36 wks gestation). LPI hospitalization rates due to RSV are similar to those of more prematurely born infants and were increased by lower birth weight (<2500 g), male gender, birth order (≥ 1 sibling), child-care attendance, household crowding, school age siblings, exposure to tobacco smoke, shorter duration of breastfeeding, family history of wheezing, and younger chronologic age at the beginning of the RSV season. The rationale for maximizing	**II-3**

	effectiveness of RSV prophylaxis in the LPI (younger than 3 months at start of the RSV season, child-care attendance, sibling < 5 years of age) is discussed.	

Jaundice		
Jangaard, K. A., D. B. Fell, et al. (2008). "Outcomes in a population of healthy term and near-term infants with serum bilirubin levels of >or=325 micromol/L (>or=19 mg/dL) who were born in Nova Scotia, Canada, between 1994 and 2000." Pediatrics **122**(1): 119-124.	Retrospective, observational, population-based, regional, cohort study to determine the incidence of kernicterus and it's sequelae in infants ≥ 35 wks gestation (N=56,019), who were born between 1994-2000 and had total serum bilirubin (TSB) ≥13.5 mg/dl (≥ 230 μm) using prospectively gathered maternal and neonatal data in a regional, perinatal database (Nova Scotia, Canada) linked with insurance and Canadian hospital admission databases. Factors independently associated with moderate hyperbilirubinemia (TSB ≥ 13.5 mg/dl) included being breastfed, male, 35-36 weeks gestation, and mothers who were nulliparous, non-smoking, and/or ≥ 35 years of age. A significantly increased risk of developmental delay was associated with TSB between 13.5-19.0 mg/dl (aOR 1.6); ADHD was significantly increased with TSB ≥ 19 mg/dl (aOR 1.9). No cases of kernicterus were identified.	
Sarici, S. U., M. A. Serdar, et al. (2004). "Incidence, course, and prediction of hyperbilirubinemia in near-term and term newborns." Pediatrics **113**(4): 775-780.	Prospective, observational, single site, cohort study of daily serum bilirubin levels over the first week post-birth to determine the incidence of significant hyperbilirubinemia in all 146, healthy, singleton, near-term (35-36 wks) compared to 219 healthy term infants (38-42 wks) born over a 7-month period (2001-2002) in Turkey. Near-term infants were more 2.4X more likely to require phototherapy and had persistently higher bilirubin levels on post-natal days 5-7.	**II-2**
Newman, T. B., P. Liljestrand, et al. (2003). "Infants with bilirubin levels of 30 mg/dL or more in a large managed care organization." Pediatrics **111**(6 Pt 1): 1303-1311.	Retrospective, observational, multisite, population-based case series of infants born between1995-1998 in 11 Northern California Kaiser Permanente hospitals describes incidence, etiology, treatment and outcome of newborns with severe hyperbilirubinemia (≥ 30 mg/dL). Near-term infants born at 35-36 wk gestation were disproportionately represented among cases of severe hyperbilirubinemia (36%, 4/11 cases). The near-term birthweights were ≥ 2900 g; 2 of the 4 near term infants were exclusively breastfeeding.	**III**
Watson, D., J. Rowan, et al. (2003). "Admissions to neonatal intensive care unit following pregnancies complicated by gestational or type 2 diabetes." Aust N Z J Obstet Gynaecol **43**(6): 429-432.	Retrospective, observational, single site, 2-year chart review describes neonatal morbidity in infants born to Type 2 and gestational diabetic mothers. Forty-six percent were preterm and 40% were delivered by emergency C-section. Forty percent of infants born to Type 2 diabetic mothers and 29% of IGDM were admitted to the NICU, most often for hypoglycemia (51%) and respiratory distress (40%).	**II-2**
Newman, T. B., B. Xiong, et al. (2000). "Prediction and prevention of extreme neonatal hyperbilirubinemia in a mature health maintenance organization." Arch Pediatr Adolesc Med **154**(11): 1140-1147.	Retrospective, observational, multisite, nested case-control population-based study of 51,383 infants ≥36 wks and ≥2000 g born at 11 N. Ca Kaiser Permanente hospitals to determine predictors of severe hyperbilirubinemia (> 25 mg/dl). Gestational age 36-37 weeks (OR 5.7) was significantly associated with extreme hyperbilirubinemia. Multivariate analysis demonstrated a decreased risk of extreme hyperbilirubinemia with each advancing week of gestational age (OR 0.6) and an increased risk associated with exclusive breastfeeding at discharge (OR 6.9).	**II-2**

Brown, A. K., K. Damus, et al. (1999). "Factors relating to readmission of term and near-term neonates in the first two weeks of life. Early Discharge Survey Group of the Health Professional Advisory Board of the Greater New York Chapter of the March of Dimes." J Perinat Med **27**(4): 263-275.	Retrospective, observational study of readmissions in first 14 days after birth for a multisite cohort of term and near-term (35-36 wks) infants born in 9 New York City hospitals in 1995. Near-term, breastfeeding infants, born at 35-37 wks gestation, were at significantly higher risk of readmission due to hyperbilirubinemia in the first week after birth.	**II-2**
Grupp-Phelan, J., J. A. Taylor, et al. (1999). "Early newborn hospital discharge and readmission for mild and severe jaundice." Arch Pediatr Adolesc Med **153**(12): 1283-1288.	Retrospective, observational, population-based, case/control cohort study of the risk of readmission after early discharge for jaundice in 3,942 infants ≥ 36 wks gestation born from 1991-1994 in Washington State. Stratified and multivariate analyses of data ascertained by linking hospital discharge abstracts and birth certificates. Near-term infants born at 36 wks gestation were at higher risk for readmission for jaundice.	**II-2**
Newman, T. B., G. J. Escobar, et al. (1999). "Frequency of neonatal bilirubin testing and hyperbilirubinemia in a large health maintenance organization." Pediatrics **104**(5 Pt 2): 1198-1203.	Retrospective, observational, cohort study of the incidence of hyperbilirubinemia in 51,387 infants ≥ 36 wks gestation and > 2000g, born between 1995-1996 and cared for by a large HMO (Kaiser). Compared to infants born at 39-40 wks gestation, those born at 36-37 wks gestation had a 4X greater risk readmission for total serum bilirubin > 20 or 25 mg/dl.	**II-2**
Maisels, M. J. and E. Kring (1998). "Length of stay, jaundice, and hospital readmission." Pediatrics **101**(6): 995-998.	Retrospective, observational, case-control, chart review conducted in a single community hospital for infants born over a 6 year period (1988-1994) to evaluate relationship between age at discharge from the well-baby nursery (N=29,934) and readmission in the first 14 days (N=247). Factors independently associated with readmission for jaundice included gestational age < 36 wks (OR 13.2) and 361/7-36 6/7 wks(OR 7.7); breastfeeding (OR 1.8), length of stay < 48 hours(OR 2.4), length of stay >48 but < 72 hours(OR 3.2) and male gender (OR 2.9).	**II-2**
Bhutani, V. K. and L. Johnson (2006). "Kernicterus in late preterm infants cared for as term healthy infants." Semin Perinatol **30**(2): 89-97.	Retrospective, observational, study of a convenience sample including term and preterm infants (≤36 weeks gestation) who were cared for as term infants, developed acute bilirubin encephalopathy and kernicterus, and were voluntarily reported from 1992-2003 to the Pilot Kernicterus Registry. Late preterm infants were disproportionately represented in the registry and developed more frequent and severe post-icteric sequelae.	**III**

Feeding		
Geraghty, S. R., S. M. Pinney, et al. (2004). "Breast milk feeding rates of mothers of multiples compared to mothers of singletons." Ambul Pediatr **4**(3): 226-231.	Retrospective, stratified, random sampling in a regional, Midwestern cohort of 346 preterm and term, singleton and multiple gestation infants whose mothers were given self-administered questionnaire and phone interview used to ascertain feeding status during the first 6 months. Preterm multiples had lower breastfeeding rates, less exclusivity and shorter duration of breastfeeding.	**II-2**

As-Sanie, S., B. Mercer, et al. (2003). "The association between respiratory distress and nonpulmonary morbidity at 34 to 36 weeks' gestation." Am J Obstet Gynecol **189**(4): 1053-1057.	Retrospective, single site, matched, case-control, chart review to evaluate the association of non-pulmonary, neonatal morbidity with RDS in infants born at 34-36 weeks gestation in 1996-2000 in Cleveland, Ohio. In 75 control infants at 35 and 36 wks gestation, admission to the NICU occurred in 29% and 0%, and feeding difficulties in 24% and 8% respectively.	**II-2**
Metaj, M., N. Laroia, et al. (2003). "Comparison of breast- and formula-fed normal newborns in time to first stool and urine." J Perinatol **23**(8): 624-628.	Retrospective, observational, single site, chart review of 1000 consecutive infants ≥ 34 wks admitted to the normal nursery over a 5 month period in 2000. By multivariate analyses, only gestational age significantly predicted time to the first stool with 27% being delayed beyond 17 hours.	**II-2**

Developmental Outcome		
Vohr, B. R., B. B. Poindexter, et al. (2007). "Persistent beneficial effects of breast milk ingested in the neonatal intensive care unit on outcomes of extremely low birth weight infants at 30 months of age." Pediatrics **120**(4): e953-959.	Retrospective, observational, multicenter, secondary analysis of a RCT to evaluate the neurodevelopmental benefits of MBM at 30 months adjusted age in a cohort of 773 high risk, Extremely Low Birth Weight (<1000 gm) infants born in 1999-2001 who participated in a NICHD Neonatal Network RCT of glutamine supplementation. BSID II Mental Developmental Index (MDI) and Psychomotor Developmental Index (PDI) were both significantly higher at 30 months for children who received MBM vs those who received no MBM. After adjustment, for every10 mL/kg/day increase in MBM ingestion, the MDI increased 0.59 points and the PDI increased 0.56 points.	**II-1**
Vohr, B. R., B. B. Poindexter, et al. (2006). "Beneficial effects of breast milk in the neonatal intensive care unit on the developmental outcome of extremely low birth weight infants at 18 months of age." Pediatrics **118**(1): e115-123.	Retrospective, observational, multicenter, secondary analysis of a RCT to evaluate the neurodevelopmental benefits of MBM at 18-22 months adjusted age in a cohort of 1035 high risk, Extremely Low Birth Weight (<1000 gm) infants born in 1999-2001 who participated in a NICHD Neonatal Network RCT of glutamine supplementation. After adjustment, for every10 mL/kg/day increase in MBM ingestion, the BSID II Mental Developmental Index (MDI) increased 0.53 points and the Psychomotor Developmental Index (PDI) increased 0.63 points. An intake of 80% MBM per day prior to NICU discharge would be associated with a 5 point increase in developmental scores for these ELBW infants.	**II-1**
Lucas, A., R. Morley, et al. (1992). "Breast milk and subsequent intelligence quotient in children born preterm." Lancet **339**(8788): 261-264.	Prospective, observational, cohort study conducted in 1982-1984 to determine the effect of infant feeding type (term formula, preterm formula, MBM or donor milk) on long-term developmental outcome of preterm infants with birthweight < 1850 gm. The authors had previously reported significantly better developmental outcome at 18 months for those children who received MBM prior to discharge. At 7-8 years, 96% of the survivors (N=313) were followed and assessed with standardized psychometry (WISC-R). After adjustment including maternal education, gender, GA, BW, days of ventilation and social class, children who received MBM had an 8.3 point IQ advantage over those who received no MBM whether or not the mother had chosen to breastfeed. Receipt of breastmilk was the most significant predictive factor identified. In addition, a dose response was noted between proportion of MBM received and subsequent IQ.	**II-1**

Barros,C.M.,Mitsuhiro,S., et al. (2011). “Neurobehavior of late preterm infants of adolescent mothers.”Neonatology **99**:133-139.	Prospective, observational study compared neonatal neurobehavior in healthy late preterm (34-36 wks gestation) and term (40 wks gestation) infants delivered by adolescent mothers at a single center in Brazil in 2001-2002. Neurobehavioral skills were evaluated between 24-72 hours after birth using the Neonatal Intensive Care Unit Network Neurobehavioral Scale (NNNS) which assessed habituation, attention, arousal, regulation, handling, quality of movement, excitability, lethargy, non-optimal reflexes, asymmetry, hypertonicity and stress/abstinence signals. Compared with healthly term infants (N=96), LPI (N=36) had significantly lower scores for attention, arousal, regulation, quality of movements, and significantly higher scores for non-optimal reflexes and hypotonicity.	**II-2**
Gurka, M. J., J. LoCasale-Crouch, et al. (2010). "Long-term cognition, achievement, socioemotional, and behavioral development of healthy late-preterm infants." Arch Pediatr Adolesc Med **164**(6): 525-532.	Prospective, observational, population-based, multicenter, national (US) study to compare the cognitive, socioemotional and behavioral outcomes of 1056 healthy, singleton infants born at 34-36 wks gestation 1991 with an uncomplicated neonatal course who were discharged from the hospital within 7 days and followed through 15 years of age. A standardized battery of tests was used to assess outcome. Participating families were more likely to have higher incomes and to be better educated than those who choose not to participate in long-term follow-up. Compared to term infants, healthy LPI (N=53) had no significant differences in IQ, achievement, socioemotional development or behavior at 15 years of age.	**II-2**
Romeo, D. M., A. Di Stefano, et al. (2010). "Neurodevelopmental outcome at 12 and 18 months in late preterm infants." Eur J Paediatr Neurol.	Prospective, observational, case-control, subgroup of a large cohort study (Italy) of early cognitive outcome of low risk, infants born at 33-36 wks gestation over a two year period in 2005-2006 and evaluated at 12 and 18 months chronologic age using the Bayley II (BSID II). Compared to 60 low risk term infants, 61 LPI had lower MDI scores at 12 months (92 vs. 100) and 18 months (88 vs. 98) *chronologic* age. However, MDI scores at 12 and 18 months were similar for term and LPI infants after adjusting for prematurity. Male LPI scored significantly lower than female LPI at both 12 and 18 months.	**II-2**
Samra, H. A., J. M. McGrath, et al. (2010). "Are former late-preterm children at risk for child vulnerability and overprotection?" Early Hum Dev **86**(9): 557-562.	Prospective, observational, small, community-based, convenience sample to examine the relationship of parent perception of child vulnerability to healthcare utilization in LPI (34-36 wks gestation .The sample was recruited at 3-8 years of age; most had uncomplicated neonatal courses. Compared to term children (N=41), the authors did not find a relationship between late preterm birth (N=14), increased healthcare utilization, maternal sense of vulnerability or maternal overprotection in this healthy, primarily Caucasian sample.	**II-2**
van Soelen, I. L., R. M. Brouwer, et al. (2010). "Effects of gestational age and birth weight on brain volumes in healthy 9 year-old children." J Pediatr **156**(6): 896-901.	Prospective, observational, population-based (Netherlands) study of brain development in a twin cohort born at 32-40 weeks (N= 192, mean BW 2615 gm, GA 36.8 weeks) . Brain volume and IQ were determined by MRI and the WISC-III administered at 9 years of age, respectively. After adjusting for BW, sex, age, and total intracranial volume, gestational age was directly related to cerebellar volume. After adjusting for GA, sex and age, higher birthweight was associated with higher IC volume which was in turn associated with higher IQ scores. These results suggested a disadvantage in regional brain growth associated with late preterm birth and an advantage of higher birthweight at each week of gestation for long-term cognitive outcome.	**II-2**

Voegtline, K. M. and C. A. Stifter (2010). "Late-preterm birth, maternal symptomatology, and infant negativity." Infant Behav Dev.	Prospective, case-control (1:1), observational, study to examine infant temperamental negativity, maternal depression and anxiety, and maternal perception of infant negativity at 2 and 6 months of age. This was a sub-sample analysis of the longitudinal, cohort Family Life Project study conducted in a rural, low income areas of Appalachia and the Black South (US). Low risk preterm infants (32-37 wks gestation, mean 35.6 wks gestation) were matched with term infants for race, income and maternal age. Compared to mothers of term (N=66) infants, mothers of LPI (N=66) were 3X more likely to have symptoms of depression and anxiety at 6 months post-delivery. Symptoms of anxiety and depression in LPI mothers were associated with maternal perception of their infant negativity at 6 months of age. In contrast, impartial observers did not observe differences in infant negativity between LPI and term infants suggesting that maternal symptomatology was mediating the negative maternal perception of their infant's behavior.	**II-2**
Baron, I. S., K. Erickson, et al. (2009). "Visuospatial and verbal fluency relative deficits in 'complicated' late-preterm preschool children." Early Hum Dev **85**(12): 751-754.	Retrospective, observational, single center, cohort study to compare cognition, attention/working memory, language, coordination/motor dexterity, visuomotor, visuospatial and executive function in LPI (34-36 wks gestation) vs term (> 37 wks gestation) US preschoolers born in 2004-2005. Compared to term infants (N=35), LPI (N=60) had relative deficits in visuomotor, visuospatial and verbal aspects of executive function but not in attention/working memory, receptive/expressive language, non-verbal reasoning or coordination/motor dexterity.	**II-2**
Morse, S. B., H. Zheng, et al. (2009). "Early school-age outcomes of late preterm infants." Pediatrics **123**(4): e622-629.	Retrospective, observational, population based, statewide cohort (Florida) of healthy, singleton infants born in 1996-1997 at 34-41 wks gestation derived from linked birth certificate, Early Intervention and public school Dept of Education databases. After adjustment for confounders, compared to term children (N=152,661), LPI born at 34-36 wks gestation (N=7152) were 36% more likely to have developmental delay or disability, were at 19% greater risk for kindergarten suspension and had a 10-13% increased risk of kindergarten retention or need for special education, and were less likely to complete high school.	**II-2**
Petrini, J. R., T. Dias, et al. (2009). "Increased risk of adverse neurological development for late preterm infants." J Pediatr **154**(2): 169-176.	Retrospective, observational, regional (California Kaiser Permanente HMO) cohort of 141,321 surviving infants born from 30 wks to term gestation.LPI (N=8166) were born at 34-36 weeks gestation between 2000-2004 and were followed for 12-60 months. Compared to term infants, LPI infants had increased unadjusted risks for cerebral palsy (Hazard ratio 3.4) and developmental delay (Hazard ratio 1.25).	**II-2**
Quigley, M.A. C. Hockley, et al (2009)."Breastfeeding is associated with improved child cognitive development: Evidence from the UK Millennium Cohort Study." J. Epidemiol Community Health **63**(Suppl II):A1-A36. (Abstract)	Prospective, population based, observational, cohort study of singleton, white children (N=11,801) born in 2000-2002 between 28-42 wks gestation in the UK which examined the relationship between breastfeeding duration and exclusivity and scores on the standardized British Ability Scales administered at 5 years of age. After adjustment for social and demographic confounders, any breastfeeding was significantly associated with better cognitive outcome. A stronger benefit was noted in the 684 moderately preterm (33-36 weeks gestation) infants. A dose/response effect was present with higher vocabulary, pattern construction and picture similarities scores for each additional month of breastfeeding. Further analysis is needed to determine whether the benefit of breastfeeding is	**II-2**

	mediated through parenting and/or childcare practices.	
Chyi, L. J., H. C. Lee, et al. (2008). "School outcomes of late preterm infants: special needs and challenges for infants born at 32 to 36 weeks gestation." J Pediatr **153**(1): 25-31.	Retrospective, observational, national (US) cohort of 13,671 term and 767 LPI (34-36 wks gestation) children identified by the US Dept of Education ECLS-K longitudinal dataset. School outcomes from Kindergarten through the 8th grade for children enrolled in 1998-99 were examined and adjusted for confounders. Compared to term controls, LPI children had lower reading scores, lower teacher evaluation scores, performed less well on academic rating scales, and had a higher risk of needing special education particularly in the early grades.	**II-2**
Kramer, M. S., F. Aboud, et al. (2008). "Breastfeeding and child cognitive development: new evidence from a large randomized trial." Arch Gen Psychiatry **65**(5): 578-584.	Secondary, non-blinded, analysis of the cluster-randomized PROBIT trial including 13,889/17,046 healthy newborns born in Belarus from 1996-97. Children in the experimental group, which was associated with longer duration and exclusivity of breastfeeding, had significantly higher verbal WASI IQ at 6.5 years of age.	**II-2**
Moster D, Lie RT, Markestad T. (2008). Long-term medical and social consequences of preterm birth. NEJM **359**:262-273.	Retrospective, observational, population –based, country-wide (Norway) cohort of 867,692 liveborn infants derived from compulsory national databases born from 23weeks to term gestation between 1967-1983 who were followed until between 20-36 years of age. Compared to those born at ≥ 37 weeks gestation, LPI (31,169), born at 34-36 weeks gestation, were significantly more likely to have CP (RR 2.7), mental retardation (RR1.6), emotional/behavioral disorders (RR 1.5), other major disabilities (RR1.5) and to have any medical disability affecting working capacity (RR1.4).	**II-2**
Feldman, R. and A. I. Eidelman (2003). "Direct and indirect effects of breast milk on the neurobehavioral and cognitive development of premature infants." Dev Psychobiol **43**(2): 109-119.	Prospective, observational study of breast milk consumption and developmental outcome in 86 preterm infants < 33 wks gestation born from 1996-1999 in Israel to well-educated, middle class families. Substantial (75%) breast milk consumption was associated with improved neurobehavioral profiles, less maternal depression, and more maternal affectionate touch at 6 month adjusted age.	**II-2**
Arpino, C., E. Compagnone, et al. (2010). "Preterm birth and neurodevelopmental outcome: a review." Childs Nerv Syst.	Literature review includes discussion of critical brain development occurring from 34 to 40 weeks gestation which increases the risk of CNS injury in the LPI. Factors include rapid brain growth with a 40% increase in brain size in the last 6 weeks of gestation, persistence of subplate neurons reflecting incompletely developed axonal connections between the thalamus and cerebral cortex, very active myelination, increased vulnerability to white matter injury in the presence of immature oligodendrocytes, and gestational age related susceptibility of developing neurons and astrocytes to bilirubin-induced brain injury. In the LPI, the incidence of CP is 3X and the incidence of developmental delay is 1.3-2 X that found in fullterm infants. Although the incidence of brain injury is much lower in the LPI compared to more immature preterm infants, LPI comprise 75% of all preterm births, thereby contributing significantly to the prevalence of adverse neurodevelopmental outcome	**III**

	associated with prematurity.	
Michaelsen, K. F., L. Lauritzen, et al. (2009). "Effects of breast-feeding on cognitive function." Adv Exp Med Biol **639**: 199-215.	Review of studies of the effect of breast-feeding on cognitive development, adult IQ, visual development, brain growth concluding that the majority of studies found consistent results among different populations with a similar magnitude of advantage and a dose response effect in developmental outcome associated with breast-feeding even after adjustment for multiple confounders.	**III**
Kinney C. (2006). The near-term(late preterm) human brain and risk for periventricular leukomalacia:A review. Semin Perinatol **30**(2): 81-88.	Comprehensive review of brain and white matter development in the third trimester, focusing on the pathogenesis of periventricular leukomalacia and the maturational vulnerability of the late preterm infant.	**III**

Evidence Regarding Management

Obstetrical Practice and the Late Preterm Infant		
Bastek, J. A., M. D. Sammel, et al. (2010). "The effects of a preterm labor episode prior to 34 weeks are evident in late preterm outcomes, despite the administration of betamethasone." Am J Obstet Gynecol.	Retrospective cohort chart review of 700 mother infant pairs delivering at 34-36$^{6/7}$ wks EGA at a US tertiary-care urban hospital in Pennsylvania from 2003-2008. Aim: To assess whether betamethasone administered at < 34 wks reduces adverse outcomes in infants who go on to deliver in the late preterm period. Study included singleton LPIs and their mothers with spontaneous preterm labor and or preterm premature rupture of membranes without pre-eclampsia. Multivariant, adjusted analysis of neonatal outcomes was done by grouping respiratory and nonrespiratory morbidities. Unexpectedly the group who received betamethasone antenatally had worse outcomes than the group who did not. 1) There was a statistically insignificant (p=0.17) increased risk for respiratory morbidity in the betamethasone group. 2) There was a statistically significant risk for composite neonatal morbidities with and without respiratory morbidity (p=0,001 for both). 3) Infants born at 36 weeks who received betamethasone were at increased risk of respiratory morbidity (IRR=-2.73). The authors suggest a large RCT needs to be done to answer this question.	**II-2**
Derbent, A., M. M. Tatli, et al. (2010). "Transient tachypnea of the newborn: effects of labor and delivery type in term and preterm pregnancies." Arch Gynecol Obstet.	Retrospective case control study of infants ≥ 34 wks EGA delivered at a single hospital in Turkey with transient tachypnea of the newborn (TTN) from Jan 2006 to March 2009. Aim: To determine whether time or type of delivery affects incidence of TTN in preterm and term infants. In this hospital CD accounted for 60% all deliveries during the study period. Four control newborns not transferred to the NICU were randomly selected for each of the 85 infants with TTN. Cesarean delivery, lower GA and absence of rupture of membranes prior to delivery were risk factors for TTN. At all gestational ages infants delivered vaginally had reduced TTN compared to CD with or without labor.	**II-2**

Lim, J. J., V. M. Allen, et al. (2010). "Late preterm delivery in women with preterm prelabour rupture of membranes." J Obstet Gynaecol Can **32**(6): 555-560.	Retrospective, population-based, cohort study to determine maternal and neonatal outcomes of mothers (N=2180) with preterm, prelabor rupture of membranes (PPROM) who had obstetrically indicated delivery of singleton LPI (34-36 wks gestation) in Canada between1988-2006. Data was derived from the province-wide Nova Scotia Atlee Perinatal Database. LPIs delivered at 36 wks (N=458) had significantly fewer complications including RDS (aOR 0.17), neonatal depression (aOR 0.22) and composite perinatal morbidity/mortality (aOR 0.39) compared to LPI delivered at 34-35 weeks (N=240) suggesting that delaying delivery after PPROM may be advantageous if spontaneous labor has not occurred .	**II-2**
Mateus, J., K. Fox, et al. (2010). "Preterm premature rupture of membranes: clinical outcomes of late-preterm infants." Clin Pediatr (Phila) **49**(1): 60-65.	Retrospective chart review of infants born to women delivered electively due to PPROM between $34^{0/7}$ – $36^{6/7}$ wks EGA in two US hospitals, one community-based tertiary hospital in Pennsylvania and one tertiary hospital in Texas. Study included 192 singleton infants with complete medical records for mother and infant. Antenatal steroid use was similar in each group ($34^{0/7}$- $34^{6/7}$, $35^{0/7}$- $35^{6/7}$, $36^{0/7}$-$36^{6/7}$ weeks). Compared to neonates born at $35^{0/7}$- $35^{6/7}$ and $36^{0/7}$-$36^{6/7}$ weeks, infants in the $34^{0/7}$- $34^{6/7}$ had a 3 and 9 fold increased for RDS, respectively. Similarly there was 3 and 4 fold risk of NICU admission between groups and length of hospital stay was significantly longer for the younger group. Morbidity did not differ significantly between the two groups in the $35^{0/7}$ - $36^{6/7}$ week range. There were no cases of IVH, NEC, sepsis, or death. The authors question classifying infants born $34^{0/7}$- $34^{6/7}$weeks as late preterm considering the significant increase in morbidity as compared to infants delivered at $35^{0/7}$ - $36^{6/7}$. In addition, the authors state that current obstetrical practices that expedite delivery in pregnancies that have reached $34^{0/7}$ weeks with PROM deserve further investigation.	**II-2**
Malloy, M. H. (2009). "Impact of cesarean section on intermediate and late preterm births: United States, 2000-2003." Birth **36**(1): 26-33.	Retrospective, multivariate analysis of US Linked Birth and Infant Death Certificate files for 2000-2003 to determine whether primary CD offered any advantages for infants delivered 32-36 wks gestation. Sixty percent of 422,001 available live births were reviewed. Forty percent were trimmed due to inconsistencies between reported birth weight and gestational age. White, older, primagravida, multiple pregnancy, medical and labor complications including breech were more likely to have CD. Adjusted odds ratios for neonatal mortality for primary CD vs.VD was 1.79 @ 34 wks; 2.31 @35 wks; 1.98 @36 wks. Adjusted OR for mechanical ventilation for primary CD vs. VD was 1.28 @ 34 wks; 1.42 for 35 wks; 1.63 @ 36 wks. Adjusted OR for hyaline membrane disease for primary CD vs. VD was 1.46 @34 wks; 1.49 @ 35 wks; 1.68 @ 36 wks. Authors conclude that infants born between 32-36 weeks EGA and delivered via CD are at increased risk of mortality and morbidity compared to those delivered vaginally at comparable gestational ages. A limitation noted by the authors is the potential for underreporting of medical, pregnancy and labor complications leading to CD and having an adverse effect on the infant.	**II-2**
De Luca, R., M. Boulvain, et al. (2009). "Incidence of early neonatal mortality and morbidity after late-preterm and term cesarean delivery." Pediatrics **123**(6): e1064-1071.	Secondary analysis of a prospective, cohort study of data collected over a twenty year period from 1982-2004 at single university affiliated hospital in Switzerland. Multivariate analysis of 56,549 live-born deliveries ≥ 34 weeks EGA comparing mortality and morbidity between infants delivering via elective CD vs planned VD (included emergency CD) stratifying by GA was done. CD rate increased from <10% to ≥ 20 % over the study period. Elective CD rate was approximately 35%. Study confirmed a strong inverse relationship between neonatal mortality and morbidity and EGA in this cohort. Infants in the elective CD group had significantly increased rates of mortality and respiratory morbidity at all gestational ages. Elective CD vs emergent CD is associated with less respiratory depression at birth (5 minute Apgar <7) in infants > 38 weeks but not in the LPI infants. The authors conclude that elective CD should not be performed before term.	**II-2**

Lewis, D. F., J. McCann, et al. (2009). "Hospitalized late preterm mild preeclamptic patients with mature lung testing: what are the risks of delivery?" J Perinatol **29**(6): 413-415.	Retrospective case control study of mothers delivering 34-37 weeks gestation in two US hospitals in Louisiana. Aim: To compare outcomes of 51 infants born to mothers with mild pre-eclampsia delivering at 34-37 wks EGA after amniocentesis documented fetal lung maturity to 51 control infants who had a spontaneous preterm delivery or were delivered preterm for obstetrical indications. Sixteen (31.4%) in the study group and 21 (41.2%) controls were admitted to the NICU and five infants (9.8%) in each group developed respiratory distress syndrome. The unexpected morbidity in the study group who were delivered electively after fetal lung assessment raises questions about the current practice of delivering mothers with PROM if they are ≥ 34 weeks gestation. The study is limited due to retrospective design and limited number of cases.	**II-2**
Aziz, K., M. Chadwick, et al. (2008). "Ante- and intra-partum factors that predict increased need for neonatal resuscitation." Resuscitation **79**(3): 444-452.	Prospective cohort single site study conducted in a tertiary perinatal center in Canada over a 30 month period (February 2002 – August 2004). Aim: To evaluate relative importance of antenatal and intra-partum risk factors in determining need for resuscitation. Of 5691 deliveries, 3796 (66.7%) required neonatal resuscitation team attendance; data was available for 3564 (94%). Analysis of 761 CD describes as elective revealed 82 (10.8%) occurred at 35-37 wks and were significantly more likely to result in positive pressure ventilation and/or endotrachial entubation (OR 3.5) or NICU admission (OR 12) than those at ≥ 38 wks.	
Bastek, J. A., M. D. Sammel, et al. (2008). "Adverse neonatal outcomes: examining the risks between preterm, late preterm, and term infants." Am J Obstet Gynecol **199**(4): 367 e361-368.	Retrospective chart review of singleton infants born to a cohort of mothers presenting in uncomplicated preterm labor (e.g., without cervical insufficiency, pre-eclampsia, preterm rupture of membranes, placental abruption or fetal demise) to a large, tertiary care, US hospital in Pennsylvania from 2002 -2005. Aim: To assess the risk of adverse neonatal outcomes in three groups of infants ($32^{0/7}$ – $33^{6/7}$ wks; $34^{0/7}$- $36^{6/7}$ wks; ≥ 37 wks). Ninety-eight percent of the 264 mothers (23% delivering < 34 weeks, 26.1% LPI, and 50.7% full term) received antenatal betamethasone. LPIs had significantly increased risk of adverse outcomes compared with term infants. Adjusted and unadjusted risk ratios for adverse events were calculated for infants' gestational age in weeks and "unexpectedly found the risks for infants delivered at 34 weeks comparable to infants born in the $32^{/7}$ – $33^{6/7}$ week age range." The authors conclude that further investigation regarding obstetrical management and long-term outcomes is warranted for mothers presenting in preterm labor.	**II-2**
Bettegowda, V. R., T. Dias, et al. (2008). "The relationship between cesarean delivery and gestational age among US singleton births." Clin Perinatol **35**(2): 309-323, v-vi.	Retrospective, stratified review of US natality files from 1996 – 2004 to determine changes in CD and gestational age over time. Singleton live births between 23 – 44 weeks EGA and > 500 grams were included. The overall preterm birth rate increased from 9.7% to 10.7%. The vaginal birth rate in this cohort decreased from 7.2% to 6.9% while the proportion of CD increased from 2.5% to 3.8%. The increase of infants delivered late preterm occurred in those delivered via CD. Authors review literature regarding medical indications for CD and decline in still birth and mortality rates in recent years. The authors note that obstetric interventions at preterm gestation to reduce risks for the mother and fetus need to be optimally balanced with risks to the infant.	**II-2**
McIntire, D. D. and K. J. Leveno (2008). "Neonatal mortality and morbidity rates in late preterm births compared with births at term." Obstet Gynecol **111**(1): 35-41.	Retrospective chart review of a cohort of 133,022 singleton live births with prenatal care at US tertiary care hospital in Texas from 1988-2005. Study confirmed increased risk for morbidity and mortality in LPIs. Eighty percent of LPI deliveries were due to idiopathic preterm labor or PROM. Twenty percent had identifiable medical problems such as PIH, placental accidents, fetal disorders and maternal medical disorders. Authors speculate that current obstetrical management of some mothers ≥ 34 EGA with idiopathic preterm labor or PROM should be re-evaluated. "Indeed, 46% of our cohort with PROM between 34-36 weeks received labor induction and could have potentially been managed expectantly in an effort to delay delivery."	**II-2**

Yoder, B. A., M. C. Gordon, et al. (2008). "Late-preterm birth: does the changing obstetric paradigm alter the epidemiology of respiratory complications?" Obstet Gynecol **111**(4): 814-822.	Secondary analysis of a prospective, cohort study of 14,531 inborn infants at a US military base hospital in Texas from 1990-1998. Aim: To analyze the effect of gestational age, mode of delivery and maternal-fetal risk factors on the incidence of respiratory problems in infants ≥ 34 weeks EGA. Primary outcome variable was infant respiratory morbidity defined as oxygen requirement >24 hours and or need for any assisted ventilation. Univariant and multivariant analysis was conducted on data stratified over three time eras 1990-1992, 1993-1995, 1996-1998. CD increased from 8.1% to 14%, LPI births increased by 37%, births > 40 wks decreased by 39%, and median delivery age declined from 40 to 39 weeks. The five factors independently related to respiratory morbidity birth were delivery at 34-36$^{6/7}$ wks, five minute Apgar <7, nonreassuring fetal heart rate, any CD and male gender. Odds ratio for respiratory morbidity for infants born at 34 wks=24.1, 35 wks=8.9, and 36 wk= 4.5.	**II-2**
Dewey, K. G., L. A. Nommsen-Rivers, et al. (2003). "Risk factors for suboptimal infant breastfeeding behavior, delayed onset of lactation, and excess neonatal weight loss." Pediatrics **112**(3 Pt 1): 607-619.	Prospective, study to determine the incidence and risk factors for suboptimal infant feeding behavior in a city-wide cohort of 280 of 328 eligible mothers of term singleton infants born > 37 wks gestation. Infants delivered in one of five US hospitals in Northern California during a 10 month recruitment period in 1999. Suboptimal infant breastfeeding behavior was defined as IBFAT ≤10 (maximum possible 12). CD was one of several factors associated with suboptimal infant feeding and delayed lactogenesis.	**II-2**
Wigton, T. R., R. K. Tamura, et al. (1993). "Neonatal morbidity after preterm delivery in the presence of documented lung maturity." Am J Obstet Gynecol **169**(4): 951-955.	Retrospective, single site, chart review to determine the incidence of significant neonatal morbidity in a cohort of 213 preterm infants with documented fetal lung maturity delivered in a tertiary-care, US hospital in Illinois from 1988-1991. One case of grade 3 IVH, one NEC, and one RDS occurred in the 151 neonates born at ≥34 wks gestation. Twenty-seven percent of the near-term infants required admission to the special care nursery.	**II-3**
"ACOG committee opinion No. 404 April 2008. Late-preterm infants." Obstet Gynecol **111**(4): 1029-1032.	Expert opinion from the Committee on Obstetric Practice. Authors note that LPI births increased 16% from 1992 to 2002. Pediatric literature regarding the increased morbidity and mortality of the LPI and physiologic vulnerabilities in pulmonary function, cardiac function, temperature control, hypoglycemia, and hyperbilirubinemia is reviewed. Authors state that "preterm delivery should only occur when an accepted maternal or fetal indication for delivery exists. Examples may include nonreassuring fetal status or maternal condition that is likely to be improved by delivery."	**III**
Fuchs, K. and C. Gyamfi (2008). "The influence of obstetric practices on late prematurity." Clin Perinatol **35**(2): 343-360, vi.	Expert review of standard management of maternal and fetal complications of pregnancy, and examination of current practice with regard to LPI births. Authors conclude that many of the current obstetric practice guidelines for delivery when there is not a worsening of maternal or fetal status should be critically re-evaluated.	**III**

Gestational Age Assessment		
Ballard, J. L., J. C. Khoury, et al. (1991). "New Ballard Score,	A refined maturation score was used to assess gestational maturity. This score was correlated with GA estimates derived from LMP confirmed with prenatal ultrasound. The New Ballard Score (NBS) had good	**III**

expanded to include extremely premature infants." J Pediatr **119**(3): 417-423. 417-423	correlation within two weeks of ultrasound. Of note, the NBS tended to overestimate the GA of infants born 32-37 weeks GA.	

Breastfeeding Assessment		
Howe, T. H., K. C. Lin, et al. (2008). "A review of psychometric properties of feeding assessment tools used in neonates." J Obstet Gynecol Neonatal Nurs **37**(3): 338-349.	Systematic review to describe and compare the reliability, validity and responsiveness of currently available neonatal feeding assessment tools. Data from 16 of 54 articles are presented. Seven tools reviewed included (NOMAS (Neonatal Oral-motor Assessment Scale, to assess breast or bottle feeders), IBFAT, MBA, LATCH, PIBB and SAIB (Infant BF Assessment Tool, Mother-baby Assessment, LATCH, Preterm Infant Breastfeeding Behavior Scale, Systematic Assessment of the Infant at Breast) to assess BF infants only and EFS (Early Feeding Skills) for bottle feeders only. Table1 nicely compares components, purpose, scoring system and who should score feedings for each tool. Table 2 lists psychometric properties from each of the 16 studies. NOMAS can be used with term or preterm, bottle or BF infants, however, it has been more extensively studied in bottle feeders. It has more consistent results than the other tools, however, a trained professional must administer it. Mixed results in reliability and validity were reported in the other tools. Authors conclude that there is "no general consensus regarding components comprising successful feeding behaviors." Small sample size was a limitation all studies. Most studies evaluated infants only in the first 3 days of life. Most of the feeding tools are designed to detect problems not changes in feeding over time.	**II-3**
Hill, P. D. and T. S. Johnson (2007). "Assessment of breastfeeding and infant growth." J Midwifery Womens Health **52**(6): 571-578.	Systematic review and expert opinion. Authors describe six breastfeeding assessment tools listing primary references and inter-rater reliability from the references. Tools included in this review are Infant Breastfeeding Assessment Tool (IBFAT), Systematic Assessment of the Infant at Breast (SAIB), Mother-Baby Assessment (MBA), LATCH, Lactation Assessment Tool (LAT), Mother-Infant Breastfeeding Progress Tool (MIBPT). Authors feel the lack of audible swallowing in the IBFAT is a deficiency. MBA, LATCH and MIBPT focus on mother and baby and therefore may be preferable. Higher LATCH scores in one study correlated with success at breastfeeding out to six weeks postpartum. Authors also discuss expected infant weight gain, test weighing, infant elimination patterns, and current infant growth charts in relation to optimal breastfeeding. There is no discussion regarding these tools when evaluating the late preterm infant.	**II-3**
Riordan, J., K. Gill-Hopple, et al. (2005). "Indicators of effective breastfeeding and estimates of breast milk intake." J Hum Lact **21**(4): 406-412.	Prospective, multi-site, observational study of 82 singleton term infants and their mothers to determine which breastfeeding indicators are associated with actual human milk intake. A convenience sample was recruited from three US hospitals (two Midwest and one Northeast) and outpatient clinics in the summers 2001 and 2003. Nurse evaluators assigned scores of 0, 1, or 2 to breastfeeding indicators rooting, time to latch on, suckle, and observable swallow < 96 hours of age or audible swallow ≥ 96 hours of age. Scores were compared with test weights before and after the feed. Results: Observable swallowing and rooting were significant predictors of milk intake <96 hrs of age and audible swallowing was the only significant predictor ≥ 96 hrs. CD and epidural anesthesia were significantly associated with less milk intake.	**II-3**

Schlomer, J. A., J. Kemmerer, et al. (1999). "Evaluating the association of two breastfeeding assessment tools with breastfeeding problems and breastfeeding satisfaction." J Hum Lact **15**(1): 35-39.	Convenience sample of 30 first time breastfeeding mothers were assessed by LATCH and IBFAT at 12 hours and 1 week of age. Aim; To evaluate the effectiveness of the two tools in predicting breastfeeding satisfaction and problems as determined by Maternal Breastfeeding Evaluation Scale and Potential Early Breastfeeding Problem Tool. As scores on the LATCH and IBFAT increased, maternal satisfaction scores tended to increase, but not significantly, and breastfeeding problem scores tended to decrease (r=0.5, p=0.06 and r=0.49, p=0.06; respectively). The authors note that small sample size limited their ability to detect significant correlations.	**II-3**
Riordan, J. M. and M. Koehn (1997). "Reliability and validity testing of three breastfeeding assessment tools." J Obstet Gynecol Neonatal Nurs **26**(2): 181-187.	Observational study of 23 breastfeeding sessions of 11 mother infant dyads. Five recordings were of poor quality resulting in the loss of two dyads from the convenience sample. Three nurse raters evaluated sessions on two separate occasions 6 months apart. Each session was evaluated using the Infant Breastfeeding Assessment Tool (IBFAT), Mother Baby Assessment (MBA), and LATCH assessment tools. Correlations for LATCH & IBFAT r=.69, MBA and IBFAT r=.78, LATCH and MBA r=.68. Average rater agreement for each tool was, MBA 84%, LATCH 78%, IBFAT 77%. The authors note a lack of consistency in the way raters rank-ordered the ratings and felt the tools not sufficiently reliable to use in clinical practice in their current form.	**II-3**
Matthews, M. K. (1988). "Developing an instrument to assess infant breastfeeding behaviour in the early neonatal period." Midwifery **4**(4): 154-165.	Single center observational study conducted at al University in Newfoundland, Canada. AIM: To evaluate the efficacy of a newly developed breastfeeding assessment tool, Infant Breastfeeding Assessment Tool (IBFAT). This tool assigns a score of 0-3 for infant behaviors (readiness to feed, rooting, fixing and sucking). Sixty mothers were enrolled and scored 920 feeding sessions; 77 of which were simultaneously scored by the principal investigator. There was 91% agreement between the mother and the primary investigator. Low IBFAT scores were not predictive of lack of breastfeeding at four weeks.	**II-3**
Jensen, D., S. Wallace, et al. (1994). "LATCH: a breastfeeding charting system and documentation tool." J Obstet Gynecol Neonatal Nurs **23**(1): 27-32.	Description of a breastfeeding documentation tool. The LATCH was developed as a tool to identify interventions needed and to facilitate charting; not as a judgment of the breastfeeding dyad. LATCH is an acronym standing for Latch, Audible swallow, Type of nipple, Comfort breastfeeding, and Hold or position. Validity and inter-rater reliability are not assessed.	**III**
Mulford, C. (1992). "The Mother-Baby Assessment (MBA): an "Apgar score" for breastfeeding." J Hum Lact **8**(2): 79-82.	Description of a breastfeeding assessment tool, Mother-Baby Assessment (MBA). A breastfeeding session is evaluated by scoring mother and infant on five breastfeeding components, signaling, positioning, fixing, milk transfer and ending. Inter-rater reliability and validity are not assessed.	**III**

Feeding Techniques		
Cup feeding		
Collins, C. T., P. Ryan, et al. (2004). "Effect of bottles, cups, and dummies on breast feeding in preterm infants: a randomised controlled trial." BMJ **329**(7459): 193-198.	The largest of the five studies included in the 2007 and 2008 Cochrane Reviews. RCT conducted in two Australian tertiary referral hospitals and 54 peripheral hospitals where infants were transferred from April 1996 to November 1999. Singleton or twin infants (n=319), 23-33 wks EGA at birth, were randomly assigned to one of four groups when ready for oral feeds and their mother was not available to breastfeed: 1) cup only 2)cup & dummy (pacifier) 3) bottle only 4) bottle & dummy. Outcomes analyzed between groups included amount of breastfeeding at discharge and 3 and 6 months post-discharge and length of hospital stay. Sixteen infants were excluded from analysis due to death or withdrawal from study. Cup feeding significantly increased the odds of	**I**

	full breastfeeding at discharge, had no significant effect on *any* breastfeeding at discharge or breastfeeding at 3 and 6 months, and was associated with significantly increased length of hospital stay (59 vs 48 days). **Fifty-six percent of infants in the cup feeding group were noncompliant and had a bottle introduced at the request of the mother (44%) and the nurse or midwife (44%).** The authors note that compliance with cup feeding was less in the one tertiary hospital and in the peripheral hospitals not accustomed to use of the technique prior to the study.	
Howard, C. R., F. M. Howard, et al. (2003). "Randomized clinical trial of pacifier use and bottle-feeding or cupfeeding and their effect on breastfeeding." Pediatrics **111**(3): 511-518.	RCT of 700 infants (36-42 weeks) delivering at Rochester General Hospital over a 22 month period 1997-1998 to evaluate cup vs. bottle-feeding and early (2-5 days) vs. late (>4weeks) pacifier introduction on breastfeeding. Mothers requesting supplementation or when supplementation was medically indicated, were randomized to one of four groups: 1) bottle early/pacifier, 2) bottle/late pacifier, 3) cup/early pacifier, 4) cup/late pacifier. Cup vs bottle did not significantly affect continued breastfeeding at 1 month or longer-term breastfeeding. Early pacifier use negatively affected overall breastfeeding duration.	**I**
Rocha, N. M., F. E. Martinez, et al. (2002). "Cup or bottle for preterm infants: effects on oxygen saturation, weight gain, and breastfeeding." J Hum Lact **18**(2): 132-138.	RCT included in 2007 and 2008 Cochrane Reviews conducted in a University Hospital in San Paulo, Brazil. Aim: 1) To determine if low rates of breastfeeding in the preterm infants in their unit could be reversed by cup feeding. 2) To determine if episodes of oxygen desaturation and weight gain differed between cup feeding group and bottle feeding group. Eighty-three mother infant dyads stratified by birth weight were randomly assigned to receive supplemental feeds via bottle or cup. Five infants were dropped from the study leaving 34 in the bottle and 44 in the cup groups. Gestational age at birth was 32-36 weeks. Oral feeds began at a mean of 37 weeks in both groups. Length of hospital stay is not compared between the two groups. Results: 1) Duration of feeding sessions was no different in the groups (13.4 min bottle; 11.8 min cup). 2) Cup fed infants had fewer severe oxygen desatruations (<85%), however, there was no difference in mean value of lowest oxygen saturation recording. 3) Weight gain was the same in both groups (14.7 grams/day bottle; 14.1 grams/day cup). 4) Breastfeeding rates at the first follow-up visit 5-15 days after discharge were the same, however 56% of the bottle and 57% of the cup group had stopped breastfeeding. 5) Of those breastfeeding at the time of the first follow-up visit, a significantly higher number of mothers in the cup group continued to breastfeed at the 3 month post discharge visit	**I**
Marinelli, K. A., G. S. Burke, et al. (2001). "A comparison of the safety of cupfeedings and bottlefeedings in premature infants whose mothers intend to breastfeed." J Perinatol **21**(6): 350-355.	Prospective randomized cross over study to compare safety of cup feeding vs bottle feeding. HR, RR, and oxygen saturation were monitored during feeds of 56 premature (≤ 34 weeks) infants at a Children's Hospital in Connecticut, USA. Ten times greater frequency of oxygen desaturation <90% in bottle feeds over cup feeds was noted. However volumes of intake were lower in the cup feeds and durations of feeds were longer.	**I**
Mosley, C., C. Whittle, et al. (2001). "A pilot study to assess the viability of a randomised controlled trial of methods of supplementary feeding of breast-fed pre-term babies."	Study is included in 2007 and 2008 Cochrane Reviews. Randomized control pilot study in a single hospital in the UK to evaluate the impact of cup vs bottle feedings on breastfeeding of preterm infants at discharge, and to assess the feasibility of RCT to investigate this question. Sixteen mother/singleton-infant dyads were recruited (gestational age 32-37 weeks) with two excluded from analysis because they were fed before randomization into the study. Breastfeeding prior to discharge was the same for both groups (four of the six cup-fed infants and six of the eight bottle fed infants were exclusively breastfed prior to discharge). The authors note that the small	**I**

Midwifery **17**(2): 150-157.	sample size may have failed to detect a difference in the two supplemental feeding methods.	
Kliethermes, P. A., M. L. Cross, et al. (1999). "Transitioning preterm infants with nasogastric tube supplementation: increased likelihood of breastfeeding." J Obstet Gynecol Neonatal Nurs **28**(3): 264-273.	Study is included in the 2008 Cochrane Review. Randomized control trial conducted in a US private regional perinatal in Missouri. Aim: To compare nasogastric tube vs. bottle feedings as methods to supplement breastfeeding when transitioning preterm infants to breastfeeding. Outcome measures included rates of exclusive and partial breastfeeding at 3 days, 3 months, and 6 months post discharge and safety of each feeding method. Of 99 infants (GA 26-35 weeks, BW 1000-2500grams) enrolled over 22 months, the final study consisted of 46 infants in the bottle group and 38 in the NG group. After adjusting for confounders, the NG group was 4.5 times more likely to partially breastfeed and 9.4 times more likely to exclusively breastfeed at discharge. Significant differences in favor of the NG group persisted at 3 days and 3 months after discharge. The NG group had slightly fewer total apnea and bradycardia episodes (127 vs 136), however, they had more episodes requiring stimulation than the bottle group (32.7 vs. 23.3). Hospitalization was not prolonged in the NG group. The authors conclude that NG supplemental feeds are safe and have a positive effect on breastfeeding of the preterm infant.	**I**
Collins Carmel, T., M. Makrides, et al. (2008) Avoidance of bottles during the establishment of breast feeds in preterm infants. Cochrane Database of Systematic Reviews DOI: 10.1002/14651858.CD005252.pub2	Systematic review of four studies included in the 2007 review comparing cup vs. bottle feeds when transitioning from NG feeds to breastfeeding and one additional study from 1999 that compared NG tube feeds vs bottle feeds. The four authors of this review are different than the authors of the 2007 review. Two of the references included in the review are not accessible in PubMed e.g., Collins PhD thesis and Gilks. In addition, unpublished data from Gilks and Klierthermes are included in the review. The lead author is the first author of the largest study of the five (Collins). See above for details of the four studies accessed from PubMed. The studies were randomized or quasi randomized controlled trials to determine the effect of avoidance of bottle feeds during establishment of breastfeeding on the likelihood of successful breastfeeding and to determine if alternatives to bottle feeds are safe. Studies were conducted in neonatal units in the US, England, Brazil and Australia and published 1999-2004. All but one were single center studies. Sample size ranged from 14 to 303. Upper limit for GA differed between the studies ranging from < 34 to < 37 weeks. Three studies stratified infants at randomization by birth weight and two by GA. Alternatives to bottles feeding included cup, gavage tube, paladai, finger feeding, dripper, spoon or other. These feeds were not to replace a breastfeeds and were only given when the mother was not available to breast feed or if extra milk was thought necessary after a breastfeed. The authors concluded that breasttfeeding rates at discharge are improved in infants who received supplemental feeds via cup, however, this difference was not sustained beyond discharge and hospital stay was lengthened. The authors of the previous review came to the same conclusion and felt that cup feeding could not be recommended over bottle feeding when premature infants were transitioning to breastfeeding. Please refer to discussion of Collins for significant limitations of this study.	**II-1**
Flint, A., K. New, et al. (2007) Cup feeding versus other forms of supplemental enteral feeding for newborn infants unable to fully breastfeed. Cochrane Database of Systematic Reviews DOI: 10.1002/14651858.CD005092.pub2	Systematic review of four randomized studies included in the review in 2008 Cochrane Review. The authors of this review are different than the 2008 review. Studies compared cup vs bottle feeds when transitioning from NG feeds to breastfeeding. Authors conclude that cup feeding could not be recommended over bottle feeding because there is no advantage in breastfeeding after hospital discharge and it may lengthen hospital stay.	**II-1**

Abouelfettoh, A. M., D. A. Dowling, et al. (2008). "Cup versus bottle feeding for hospitalized late preterm infants in Egypt: a quasi-experimental study." Int Breastfeed J **3**: 27.	Quasi-experimental control study of 60 infants 34-36 wks gestation delivering at the Pediatric University Hospital in Egypt. Aim: 1) To determine if late preterm infants who received cup feedings vs bottle feedings prior to discharge were more likely to breastfeed at six weeks after discharge. 2) To determine if cup feeders exhibited more mature breastfeeding behavior compared to bottle feeders when evaluated using the Premature Infant Breastfeeding Behavior Scale (PIBBS). These infants essentially had no experience breastfeeding prior to discharge, mothers did not pump to establish milk supply, and there was a high attrition rate. One wk after discharge, 80% of the feeds were breastfeeding in the cup group vs 64.4% in the bottle group. Full breastfeeding was achieved by 47% of the cup group vs. 33% of the bottle group. The cup group had statistically significant higher PIBBS scores over six weeks than did the bottle group. Limitations of the study design include nonrandom group assignment and a nonblinded assessor.	**II-2**
Dowling, D. A., P. P. Meier, et al. (2002). "Cup-feeding for preterm infants: mechanics and safety." J Hum Lact **18**(1): 13-20; quiz 46-19, 72.	Single site observational study of a convenience sample of 8 preterm infants at a US tertiary care hospital in Ohio were observed during18 cup-feeding sessions to evaluate the mechanics of cup feeding in preterm infants transitioning to oral feeds. RR, HR, oxygen saturation, and volume of intake were recorded while oral mechanisms were measured by with a stretch-sensitive mercury strain gage connected to a plethysmograph. Volume of intake was < 1.5 ml during three sessions and therefore excluded from analysis and the polygraph malfunctioned during three other sessions. Mean duration of cup feeding session was 15.3 mins±3.9 min. HR, RR and O2 saturations remained stable. Mean volume of milk intake was only 4.6±2.2 mL (1.5-8) and 6-66% of that volume was lost onto the bib. The authors speculate that the method of cup-feeding used in this study, ie. infant lapping up the milk rather than pouring milk into the mouth may have contributed to lower intakes as compared to previous studies.	**II-3**
Howard, C. R., E. A. de Blieck, et al. (1999). "Physiologic stability of newborns during cup- and bottle-feeding." Pediatrics **104**(5 Pt 2): 1204-1207.	Observational study conducted at two US tertiary care hospitals in New York and Ohio. A convenience sample of 98 healthy term formula fed newborns was randomly assigned to cup (51) or bottle feedings (47). Heart rate, respiratory rate, and oxygen saturation were monitored in these infants and 25 breastfeeding infants. There were no differences in outcome measures between the cup and bottle feedings, however, both groups had increased HR, RR, and decreased oxygen saturation as compared to the breastfed infants.	**II-3**
Wight NE, (2010). "Supplementation in the Breastfed Infant." Module from San Diego County Breastfeeding Coalition. available at breastfeeding.org.	Expert opinion and review of past and current supplementation practices, normal physiology of the infant transitioning from intra to extra-uterine environment, risks of inappropriate supplementation, indications for supplementation and methods for supplementing the breastfeeding infant. The full term infant is the primary focus of this review. Commentary is well referenced with an extensive reference list at the end.	**III**
(2009). "ABM clinical protocol #3: hospital guidelines for the use of supplementary feedings in the healthy term breastfed neonate, revised 2009." Breastfeed Med **4**(3): 175-182.	Even though this protocol address supplementation of the full term infant, many of the same principals apply. It discusses the issue regarding the best method for administering complementary feeds. The authors' recommend cup feedings as the method of choice as recommended by the World Health Organization in 1992.	**III**
Thomas, J., K. A. Marinelli, et al. (2007). "ABM clinical protocol #16:	Expert review. This protocol reviews the importance of a proactive approach in assisting breastfeeding of the hypotonic infant, especially the infant with Down's Syndrome. The techniques discussed are applicable to late	**III**

breastfeeding the hypotonic infant." Breastfeed Med **2**(2): 112-118.	preterm infants as they frequently have difficulties maintaining a good latch as a result of diminished tone, strength and stamina. Techniques discussed include the "Dancer Hand" position, breast compressions while the infant is sucking, and use of silicon nipple shields. The Dancer Hand position is described in detail with an illustrative picture.	
Neifert, M. R. (2001). "Prevention of breastfeeding tragedies." Pediatr Clin North Am **48**(2): 273-297	Expert review of breastfeeding failures with a discussion about high- risk situations such as breastfeeding the near-term infant. Discussion includes strategies to prevent breastfeeding failure including identification of "red flags" indicating inadequate breastfeeding, nipple confusion, supplementation, timely follow-up, and test weights.	**III**
Lang, S., C. J. Lawrence, et al. (1994). "Cup feeding: an alternative method of infant feeding." Arch Dis Child **71**(4): 365-369.	Expert opinion and experience with 84 infants when cup feedings were introduced for provision of supplemental oral feeds in neonatal unit in England beginning 1989. Fifty-eight infants in the second half of the study received all supplemental feeds via a cup. Authors discuss theoretical advantages of cup feeding including the extension of the infant's tongue and lapping up the milk may better prepare the infant to latch, improved ability to pace the feeding with better control of breathing and swallowing, and ease of cleaning cup over a bottle or tube is important in regions where sanitation may be compromised. Technique of proper cup feeding is well described. The authors conclude that cup feeding is an alternative method for feeding premature infants.	**III**
Nipple Shields		
Meier, P. P., L. P. Brown, et al. (2000). "Nipple shields for preterm infants: effect on milk transfer and duration of breastfeeding." J Hum Lact **16**(2): 106-114; quiz 129-131.	Secondary analysis of data collected of a cohort study of 34 preterm infants randomized to the intervention arm of clinical trial designed to evaluate research-based best breastfeeding practices of preterm infants. The study was conducted in one of two large teaching hospitals in the US over a 12 month period 1997-1998. Milk transfer was measured by test weights with and without a nipple shield. Milk transfer was significantly greater when the nipple shield was used, 18.4 ml vs 3.9 ml ($p<0.0002$); all 34 infants demonstrated greater milk transfer (mean increase, 14.4 ml; range, 2.0-41.0 ml) with the shield. Mean duration of breastfeeding was 169.4 days and mean duration of shield use was 24.3% of the total breastfeeding experience	**II-2**
Chertok, I. R. (2009). "Reexamination of ultra-thin nipple shield use, infant growth and maternal satisfaction." J Clin Nurs **18**(21): 2949-2955.	Observational study to examine weight gain in term infants with and without nipple shield (NS) use over the first two months of life and maternal satisfaction with NS. Mothers were given NS in the postpartum units by nurses or lactation consultants to assist with lactation. Convenience sample of 54 mothers (57% West Virginia, USA and 43% Israel) responded to a structured telephone survey. Results: There was no difference in infant weights between dyads with and without NS use. Sixty-six percent were no longer using the two months. Ninety percent of mothers reported a positive experience with the NS.	**II-3**
Chertok, I. R., J. Schneider, et al. (2006). "A pilot study of maternal and term infant outcomes associated with ultrathin nipple shield use." J Obstet Gynecol Neonatal Nurs **35**(2): 265-272.	Observational study of mother-infant dyads receiving lactation support from lactation consultants at two US hospitals in Washington. Aim: 1) To ascertain maternal satisfaction with nipple shield (NS) use through a structured telephone survey (n=32). 2) Compare serum prolactin, cortisol and infant test weights with and without NS use during two different breastfeeding sessions in a subset of 5 infant – mother dyads. GA 37-42 weeks. Results: Infants ranged in age from 10-21 days (mean 13 d) days at the time of the survey. Six mothers were no longer using the NS at the time of the survey. One of these mothers was giving her infant pumped breast milk exclusively. Reasons for nipple shield use were infant related 16, mother related 12, mother and infant 4. Twenty mothers (62.5%) reported no difficulties with nipple shield use. Six mothers experienced nipple soreness with NS, 5 experienced difficulties with NS falling off, 2 were concerned about infant becoming dependent on NS, 2 reported their infant swallowed too much air with NS, and 1 reported NS use was messy.	**II-3**

	There was no difference in prolactin, cortisol and infant test weights between the breastfeeding sessions with and without a NS.	
Powers, D. and V. B. Tapia (2004). "Women's experiences using a nipple shield." J Hum Lact **20**(3): 327-334.	Retrospective telephone survey of a cohort of mothers who used NS in the practices of the authors (IBCLCs) over a three year period in Montana, USA. Aim: To identify reasons for, duration of, and mothers' perceptions regarding NS use. Results: Approximately 7% (287) of the 4200 mothers seen had documented NS use. Telephone contact was made with 202. Reasons for NS use included: flat nipples 62%, disorganized suck 43%, sore nipples 23%, engorgement 15%, prematurity 12%, short frenulum 1%. Sixty percent began NS use on the infant's first or second day of life. Two thirds of the mothers discontinued NS use at a mean time of 2 weeks. Eighty-eight percent felt the NS helped them to succeed at breastfeeding. A copy of the questions asked during the structured telephone interview is in the appendix.	**II-3**
Brigham, M. (1996). "Mothers' reports of the outcome of nipple shield use." J Hum Lact **12**(4): 291-297.	Retrospective telephone survey of a cohort of mothers using NS seen in US breastfeeding center affiliated with an urban hospital in Washington. Aim: To determine patterns of use and satisfaction with NS use. One hundred twenty-six of 500 mothers seen in 1994 used a NS. Forty percent (51) were reached by telephone. Reasons for NS use included, latch problems (73%), sore nipples (10%), both latch and sore nipples (18%). Of those infants with latch problems, flat or inverted nipples accounted for 46 %, engorgement 16%, nipple confusion 8%, and prematurity 3%, Down's syndrome 3%, and infant with weak with suck 3%. Average age of infant at initiation of NS was six days (1-42 days) and average duration of NS use was 27 days (2 days - 4.5 months). Eighty-six percent (44) found the NS helped with breastfeeding, and 37 were able to discontinue use of the shield and continue to breastfeed.	**II-3**
Clum, D. and J. Primomo (1996). "Use of a silicone nipple shield with premature infants." J Hum Lact **12**(4): 287-290.	Retrospective chart review of 15 preterm infants using a NS to transition to breastfeeding in tertiary care US hospital in Washington. Aim: To assess volume of breastmilk intake and breastfeeding outcomes. Infants were 25-36 wks EGA at birth and began to transition to breast at a mean of 34 wks post menstrual age. Intake volume with a nipple shield ranged from 13-112% of that proscribed by the physician. Nine infants consumed ≥ 50% of their feeds with the use of a nipple shield. Ten (71%) were exclusively breastfeeding at discharge. Three infants were transitioning off the NS at discharge. The authors felt NS facilitated the process of breastfeeding in these premature infants.	**II-3**
Eglash, A., A. L. Ziemer, et al. (2010). "Health professionals' attitudes and use of nipple shields for breastfeeding women." Breastfeed Med **5**: 147-151	Observational study to determine health professionals specializing in breastfeeding medicine reasons for and concerns regarding the use of nipple shields, and their perceptions regarding mother's opinions of nipple shields. A convenience sample of 490 health professionals specializing in breastfeeding medicine responded to the survey that was distributed via listservs of professional breastfeeding organizations. Results: Nipple shield use was 92%. Most frequent reason for use was "help preterm infant < 35 wks latch" (33% frequent, 29% not uncommon,16 % rarely). Most common concern was "lack of follow-up by those handing out the shield" (50% frequently, 23% not uncommon,8% rarely). Most common opinion of mothers as reported to the health professional was it was "the shield is helpful" (62%, 34% not uncommon). .	**III**
Bodley, V. and D. Powers (1996). "Long-term nipple shield use--a positive perspective." J Hum Lact **12**(4): 301-304.	Case report of ten mother-infant dyads seen by two lactation consultants in Montana, US to report the successful use of NS. NS was recommended by the authors for infant's inability to latch in seven, sore nipples one, both sore nipples and latch problems in two. Eight mothers would have discontinued breastfeeding had they not used the NS. NS use was < 6 wks in six and 6-14 wks in four dyads. Weight gain was appropriate or accelerated in all infants. All infants received breastmilk exclusively. The authors describe how the mothers	**III**

	discontinued the use of the nipple shields.	
Elliott, C. (1996). "Using a silicone nipple shield to assist a baby unable to latch." J Hum Lact **12**(4): 309-313.	Case report of the successful use of nipple shield use in full term infant unable to latch. The infant transitioned to breastfeeding without the use of the shield at two weeks of age.	**III**
Wilson-Clay, B. (1996). "Clinical use of silicone nipple shields." J Hum Lact **12**(4): 279-285.	Expert opinion and chart review of 32 mother-infant dyads presenting to a lactation consultant in Texas, USA who received an ultra-thin silicone NS as an intervention. The author discusses the physiology of infant suckling at the breast and issues regarding NS use in detail. Thirty-two of 248 mothers seen over a 13 month period received NS for breast refusal (69%), latch difficulties (25%), sore nipples 6%. Of these 50% had flat or inverted nipples, 41% had breast engorgement. Seventy-five percent of these moms were using a bottle for some or all feeds when they presented. With NS use, 56% were able to breastfeed for ≥ six wks, 38% weaned, and 6% gave their infants expressed breastmilk in a bottle. The author discusses the importance of a mother's emotional state during times of breastfeeding difficulty and the effect on breastfeeding outcomes. The author felt the NS can be a useful tool for managing the breast-refusing infant when other measures have failed.	**III**
Finger feeding		
Oddy, W. H. and K. Glenn (2003). "Implementing the Baby Friendly Hospital Initiative: the role of finger feeding." Breastfeed Rev **11**(1): 5-10.	Observational study evaluating breastfeeding rates before and after becoming "Baby Friendly". As part of the BFHI accreditation process, a NICU in one hospital in Western Australia changed their method of giving oral feeds from bottle to finger feeds alternating with breastfeeding. Prior to BFHI 8 of 18 (44%) were breastfed at discharge compared to 12 of 17 (71%) after BFHI implementation. There was no concordant control group. The authors attribute the difference in breastfeeding rates in NICU graduates before and after BFHI to the institution of finger feedings rather than bottle feedings as this was the only step that could be adopted in their unit.	**III**

Pumping		
Jones, E., P. W. Dimmock, et al. (2001). "A randomised controlled trial to compare methods of milk expression after preterm delivery." Arch Dis Child Fetal Neonatal Ed **85**(2): F91-95.	Sequential randomized controlled trial conducted in a Neonatal Unit in England of 36 mothers of premature infants (mean GA=30 weeks). Mothers were randomized to perform sequential or simultaneous breast pumping with or without breast massage. Milk yield per expression was greatest for simultaneous pumping with massage (125.08 g) vs simultaneous w/o massage (87.69 g) vs sequential w massage (78.71` g) vs sequential w/o massage (46.07 g). Fat concentration was not affected by the increase in volume.	**I**
Morton, J., J. Y. Hall, et al. (2009). "Combining hand techniques with electric pumping increases milk production in mothers of preterm infants." J Perinatol **29**(11): 757-764.	Observational study of a convenience sample of 52 of 67 enrolled mothers delivering preterm infants at US tertiary care university affiliated hospital in California were instructed to pump with a Symphony® pump 8 times daily and hand express colostrum as frequently as possible for the first 3 days. After day three they were instructed to pump ≥ 8 times daily until they could express only drops. Mothers (n=48) returned after discharge and were instructed in hands on pumping (pumping, massaging breasts after milk flow stopped then remove remaining milk using either more pumping, pumping with breast compressions, or just manual expression of milk). Mothers were stratified in to three groups according to frequency of hand expression in the first day. Mothers who used hand expression > 5 times/day had significantly increased milk volumes in the first two	**II-3**

	weeks. Mean milk volume increased 48% in those mothers using hands on pumping despite pumping less. Pumping > 7 times daily statistically increased mean daily milk volumes at two weeks but not 8 weeks. Even though this study included only infants < 31 EGA, the technique may be applicable for the mothers of the smaller LPI.	
Hopkinson, J. M., R. J. Schanler, et al. (1988). "Milk production by mothers of premature infants." Pediatrics **81**(6): 815-820.	Observational study of a convenience sample of 32 mothers who delivered AGA infants 28-30 weeks gestation at a US tertiary care hospital in Texas who were enrolled one week postpartum and instructed to pump with an electric breast pump and record date, time, duration, and volume of milk collected at each expression for 30 days. Optimal milk production was associated with five or more milk expression per day and pumping durations that exceeded 100 min/d.	**II-3**

Test Weights		
Funkquist, E. L., T. Tuvemo, et al. (2010). "Influence of test weighing before/after nursing on breastfeeding in preterm infants." Adv Neonatal Care **10**(1): 33-39.	Retrospective, cohort chart review study comparing breastfeeding outcomes and weight gain of premature infants in two different tertiary care hospitals in Sweden, one using test weights and the other infant observation, to assess adequacy of milk intake when breastfeeding. Charts were reviewed of all consecutive infants (EGA > 28 wks- <36 wks). Sixty-four infants were identified over a 15 month period in Unit A and compared to 59 infants in Unit B over a 21 month period. Weight trends were the same in both groups. Infants in the unit utilizing test weighing attained exclusive breastfeeding earlier, $35^{6/7}$ wks vs. $36^{3/7}$ wks and were discharged at a lower gestational age, $33^{4/7}$ wks vs $34^{4/7}$wks. Attainment of exclusive breastfeeding was the same in both hospitals.	**II-2**
Wilhelm, S., T. K. Rodehorst-Weber, et al. (2010). "The relationship between breastfeeding test weights and postpartum breastfeeding rates." J Hum Lact **26**(2): 168-174.	Secondary analysis of a prospective study conducted to determine the effect of motivational interviewing on days of breastfeeding. Aim of this study was to determine whether test weights were associated with breastfeeding self-efficacy, intention to sustain breastfeeding, and days of breastfeeding. A convenience sample of 73 primiparous breastfeeding mothers were recruited through prenatal classes, office visits or at the time of delivery in US hospitals in the Midwest. Test weights at 2-4 days, 2 wks, and 6 wks were positively correlated with breastfeeding duration. Test weights at 6 wks were positively correlated with self-efficacy at 6 wks and with intention to breastfeed at 2-4 days, 2 wks, and 6 wks.	**II-3**
Scanlon, K. S., M. P. Alexander, et al. (2002). "Assessment of infant feeding: the validity of measuring milk intake." Nutr Rev **60**(8): 235-251.	Systematic review of literature between 1966-2000 regarding test weighing, direct observation and doubly labeled water methods to determine a valid method for assessing infant milk intake for clinical practice and public health research. Authors selected 32 validity studies for review through keyword searches of MEDLINE and POPLINE and reference lists of articles identified through the online search. Eleven studies regarding test weights, 3 direct observation, and 4 doubly labeled water method in breastfed infants were reviewed. The doubly labeled water method measures an infant's total energy expenditure from which an investigator can calculate milk consumption. Test weights on electronic scales and doubly labeled water correlated best with actual intake. Test weighing a sample of feeds and multiplying to estimate daily intakes produced correlations only slightly lower than performing tests weights for every feed. Direct observation of feeds was an inaccurate predictor of actual intake, This difference held for mothers, nurses, and lactation educators.	**II-3**

Meier, P. P., J. L. Engstrom, et al. (1994). "A new scale for in-home test-weighing for mothers of preterm and high risk infants." J Hum Lact **10**(3): 163-168.	Observation study conducted in a level III NICU in a US tertiary care university affiliated hospital in Illinois. Aim: To determine the accuracy of test-weighing on a new portable electronic scale that could be used in the home after discharge. Weights of 30 preterm and/or high risk infants ready for discharge were performed by their mothers on the new scale and compared to the weight obtained by the investigator on the standard electronic scale (reference). In addition both mother and investigator estimated the quantity of milk intake. Mother and investigator were blind to the other's determinations and estimations. The weights obtained by the mother on the portable scale correlated well with the reference weights (r=1.0). The difference in mother's and investigator's estimates with the reference values were large and random with no systematic tendency to over or underestimate milk intake.	**II-3**
Meier, P. P., T. Y. Lysakowski, et al. (1990). "The accuracy of test weighing for preterm infants." J Pediatr Gastroenterol Nutr **10**(1): 62-65.	Observational study conducted in level three NICU in a US tertiary care university affiliated hospital in Illinois. Fifty clinically stable preterm infants, weighing 1,088 – 2440 grams were weighed before and after feeding a known volume in an infant feeder on a mechanical scale and a new electronic scale. The electronic scale was an accurate indicator of intake. (Pearson's product moment correlation = 0.97).	**II-3**

Skin-to-skin		
Chiu, S. H. and G. C. Anderson (2009). "Effect of early skin-to-skin contact on mother-preterm infant interaction through 18 months: randomized controlled trial." Int J Nurs Stud **46**(9): 1168-1180.	RCT designed to examine the effect of skin-to–skin contact (SSC) on mother-late preterm infant interaction through 18 months. Study was conducted in two US hospitals (Washington and Ohio). Control dyads (n=45) received standard care with the infant in an incubator, table warmer or bassinette. Dyads in SSC (n=50) were encouraged to have SSC early and as often and as long as possible. There were no data presented that quantified the actual time spent in SSC while in the hospital or after discharge in either group. Dyads were video-taped during a feeding session at 6 and 12 months and teaching session at 6, 12, and 18 months. Nursing Child Assessment Satellite Training Program Feeding and Teaching scales were used to evaluate each session by blinded and trained raters. Inter-rater reliability was 90%. At discharge there were 50 dyads in the SSC group and 48 in the control group; 40-42 dyads were studied over time in the SSC group and 30-34 in the control group. Unexpectedly, infants in the SSC group had lower infant response scores at the six month visit (p=0.001) for clarity of cues and response to mother. This finding disappeared at the 12 and 18 month visits. All other scores showed no statistical difference between the groups. Limitations of this study acknowledged by the authors included heterogeneity between groups, lack of documentation of SSC after discharge at follow-up visits, and diffusion of SSC to control parents who may have watched the intervention group putting their infants SSC. There was no documentation regarding timing and quantity of SSC prior to discharge.	**I**

Bergman, N. J., L. L. Linley, et al. (2004). "Randomized controlled trial of skin-to-skin contact from birth versus conventional incubator for physiological stabilization in 1200- to 2199-gram newborns." Acta Paediatr **93**(6): 779-785.	RTC included in 2007 Cochrane Review. Aim; To compare skin-to-skin care (SSC) vs conventional method of care (CMC) in a servo controlled incubator for the first six hours after birth measuring temperature, HR, RR O2 saturation and glucose. Study was conducted in two South African hospitals serving mothers on public assistance. Dyads were randomized immediately after delivery when they were all placed SSC on mother's chest and receiving routine post delivery care. Twenty infants in the SSC (mean GA 34.2) were secured to their mothers' chest with towels and transported to the observation unit where mother and infant remained for the first six hours after birth in a recliner chair. The 14 infants in the CMC (mean GA 35.3) were placed in a servo controlled incubator immediately and at one hour transported to the observation ward and mothers to the hospital ward. Even though the infants in the SSC group were one week less mature and had a mean weight 40 grams less than the CMC group, they had significantly improved physiologic stabilization scores in first 6 hrs and in the sixth hour (p=0.031and 0.021). Three in the SSC group had abnormal physiologic parameters vs 12 in the CMC group. Eight of the abnormal parameters in the CMC were for hypothermia and only one in the SSC group. Two infants in the CMC group were transferred to NICU and one in the SSC group for supplemental oxygen. The study was designed for infants to receive CPAP if needed while SSC, however, the three infants transferred to the NICU were transferred for CPAP when the attending physician was not aware of the study or was not comfortable keeping the infant SSC. Limitations of this study identified by the authors include the unexpected randomization of more infants to the SSC group, poor recruitment due to loss of qualified nurses moving out of South Africa, and potential selection bias. There were 104 missed opportunities to enroll mothers due to failure to call a researcher in or researcher arriving late. Even with these limitations this offers evidence that SSC postnatal habitat is superior to conventional care for the relatively healthy late preterm infant.	**I**
Anderson, G. C., S. H. Chiu, et al. (2003). "Mother-newborn contact in a randomized trial of kangaroo (skin-to-skin) care." J Obstet Gynecol Neonatal Nurs **32**(5): 604-611.	RTC included in 2007 Cochrane Review. Study was conducted in an urban hospital in Midwestern USA and a community hospital in Northwestern USA to determine amount of time held in two groups. The dyads were randomized to receive skin to skin care (SSC) or routine care (control group). Data was analyzed for time in the postpartum suite and in the NICU. In addition, the SSC group was divided into time held skin to skin and time held wrapped. Time held skin in all groups was less than expected primarily due to hospital routines. Total contact time for SSC dyads (skin to skin plus wrapped) was more than double that of controls.	**I**
Moore, E. R., G. C. Anderson, et al. (2007). "Early skin-to-skin contact for mothers and their healthy newborn infants." Cochrane Database Syst Rev(3): CD003519.	Updated systematic review of studies designed to assess the effects of skin to skin care (SSC) on breastfeeding, behavior, and physiological adaption in healthy mother-newborn dyads. Twenty-nine randomized and one quasi-randomized studies involving 1925 dyads of various socioeconomic backgrounds from North and South America, Asia, Africa, Europe and Israel were included. Results showed a statistically significant positive effect on success of first breastfeed, breastfeeding duration, maternal breast engorgement, and state anxiety. There was no difference in body weight change, number of breastfeeding problems, mother's perceptions of adequacy of milk supply, length of hospital stay and infant heart or respiratory rate. Subjects in four studies were healthy newborns assigned to normal nursery in the 32-36 weeks EGA.	**II-1**
Anderson GC, Moore E, Hepworth J, Bergman N. Early skin-to-skin contact for mothers and their healthy newborn infants.	Review of 16 randomized and one quasi-randomized controlled clinical trials comparing early skin-to-skin contact with usual hospital care. Statistically significant and positive effects were found on breastfeeding at one to three months after birth on breastfeeding duration.	**II-1**

The Cochrane Database of Systematic Review 2003, Issue 2. Art. No.: CD003519.DOI: 10.1002/14651858.CD003519.2003: Issue 2		
Nyqvist, K. H., G. C. Anderson, et al. (2010). "Towards universal Kangaroo Mother Care: recommendations and report from the First European conference and Seventh International Workshop on Kangaroo Mother Care." Acta Paediatr **99**(6): 820-826.	Expert opinion of International Network on Kangaroo Mother Care and the author. History of and evidence for kangaroo (skin to skin) care is discussed. The authors note there are two trends in this practice, intermittent care with sessions of one to a few hours in skin to skin contact in high tech NICUs and continuous skin to skin contact in low income settings in hospitals with fewer resources. The authors discuss the importance of the father in addition to the mother in the provision of skin to skin contact, obstacle to, and guidelines for implementation of kangaroo care. The authors conclude that even in high tech NICUs the practice of continuous skin to skin contact should be enhanced.	**III**

General Review and Management		
Colaizy, T. T. and F. H. Morriss (2008). "Positive effect of NICU admission on breastfeeding of preterm US infants in 2000 to 2003." J Perinatol **28**(7): 505-510.	Systematic review of pregnancy risk assessment monitoring system (PRAMS) data from 27 states from 2000-2003 to investigate the effect of admission to NICU on breastfeeding. Breastfeeding was defined as answering yes to "did you ever breastfeed or pump breast milk for your baby after delivery." Duration was coded as never, bf <1 wk, number of wks bf out to > 4 weeks. Data set consisted of138,359 survey respondents (94% of the full data set) stratified by EGA of infants: < 32 wks, 32-34$^{6/7}$ wks, 35-37$^{6/7}$ wks. All preterm (defined as <38 wks), NICU-admitted infants were more likely ever to breastfeed (OR 1.34, CI 1.21, 1.48) and to breastfeed for 4 wks (OR 1.21, CI 1.1, 1.33) than non admitted preterms infants. NICU admission was associated with greater initiation and longer duration of breastfeeding in the mothers of infants born 35-37$^{6/7}$ wks, however, these infants were the least likely of all groups to continue to breastfeed for at least 4 wks (OR 0.78, 95% CI 0.73, 0.83). The protective effect of NICU admission on breastfeeding of the preterm infant is different from previous studies. The authors speculate that the positive effect of NICU admission on breastfeeding was due to increased exposure to positive messages regarding bf and higher levels of direct bf assistance, however, the authors were concerned about the poor performance of the infant born 35-37$^{6/7}$ wks GA as compared to the other age groups.	**II-1**
Ishiguro, A., Y. Namai, et al. (2009). "Managing "healthy" late preterm infants." Pediatr Int **51**(5): 720-725.	Retrospective chart review of a cohort of infants born hospital in Japan 1998 – 2000 comparing management of infants born 35 – 36 weeks EGA **and** weighing ≥ 2000 grams with those infants born ≥ 37 weeks EGA. Hospital policy called for all infants ≥ 35 EGA and weighing ≥2000 grams and not requiring immediate medical attention to be admitted to the newborn nursery with well full term infants. LPI had significantly higher admission rates to the NICU after delivery than full term infants. More importantly 37.8% of infants born at 35	**II-2**

	weeks and 18.1% of infants born at 36 weeks were admitted to the NICU from the newborn nursery. Hypoglycemia accounted for 38.4% and apnea for 16.2% of these admissions. All episodes of apnea occurred in the first two days of life. The authors conclude that all infants born 35 – 36 wks EGA should have percutaneous oxygen and glucose monitoring for the first two days after birth.	
Tomashek, K. M., C. K. Shapiro-Mendoza, et al. (2006). "Early discharge among late preterm and term newborns and risk of neonatal morbidity." Semin Perinatol **30**(2): 61-68.	Systematic review of a cohort using linked birth certificate and hospital discharge data from Massachusetts between 1998 and 2002 to compare the risk of hospital readmission, and or observational stay between all vaginally delivered term and late preterm infants who were discharged early (<2-night hospital stay). Breastfed LPI was 1.8 times more likely to require hospital related care and 2.2 times more likely to be readmitted. Authors conclude that breastfed LPI discharged early experience significantly more neonatal morbidity than term infants.	**II-2**
Cleaveland, K. (2010). "Feeding challenges in the late preterm infant." Neonatal Netw **29**(1): 37-41.	Review of physiologic vulnerabilities and discussion of feeding challenges secondary to fewer awake – alert periods and less postural stability combined with low energy stores and increased energy demands of LPI compared to full term infant. A case of a 36 week old who developed hyperbilirubinemia, and ultimately needed NG feeds of expressed breastmilk for 72 hours due to inability to effectively breastfeed is discussed. The author makes the case for a standardized order set and team approach to the LPI after delivery.	**III**
Ramachandrappa, A. and L. Jain (2009). "Health issues of the late preterm infant." Pediatr Clin North Am **56**(3): 565-577,	Comprehensive expert review of late prematurity including definition, epidemiology, etiology, pathophysiology, short-term and long-term health consequences and management.	**III**
Walker, M. (2008). "Breastfeeding the late preterm infant." J Obstet Gynecol Neonatal Nurs **37**(6): 692-701.	Review and recommendations for management. Problems of the LPI and mother of LPI are reviewed succinctly. Interventions reviewed include: 1) temperature regulation and the importance of skin to skin care, 2) proper positioning of the infant with low tone to avoid compromise of the airway including a discussion and picture of the dancer position, 3) approach to flat, inverted or engorged nipples including the use of nipple shields, 4) breast massage while the infant is nursing, 5) supplementation. Effect of self regulation with regard to state of alertness and breastfeeding is reviewed. List of resources for parents of LPI is included at the end of the article.	**III**
Wight, N.E., Morton JA, Kim JH. (2008). "Breastfeeding the Late Preterm infant." Best Medicine: Human Milk in the NICU. Amarillo, TX: Hale Publishing;	Review of epidemiology, physiologic vulnerabilities and care of the LPI from the time of delivery through discharge. Resources for the clinician are provided along with an extensive reference list. Key concepts are reiterated at the end of the chapter: 1) Human milk is best. 2) LPI is not the same as a term infant even if they look term. 3) Establishing and maintaining full milk supply is essential. 4) Supplementation usually is necessary. 5) Mother and infant should be kept together as much as possible. 6) Anticipatory guidance and close follow-up are key. 7) Any human milk is better than none.	**III**
California Perinatal Care Collaborative. Care and Management of the Late Preterm QI Infant Toolkit. (2007). http://www.cpqcc.org	Compilation of materials derived from experts across California addressing the vulnerability of and inpatient management strategies for the late preterm infants. Power point presentation, quality improvement plan, sample policy and procedures, sample feeding plans, sample patient education materials, discharge guidelines, annotated bibliography, and a learning module are included.	**III**

Hubbard E., Stellwagen L., Wolf A. "The late preterm infant: A little baby with big needs." Contemporary Pediatrics. Nov. 1, 2007. Available at http://www.modernmedicine.com/modernmedicine/Features/The-late-preterm-infant-A-little-baby-with-big-nee/ArticleStandard/Article/detail/472738	Review of the physiologic vulnerabilities of the late preterm infant with recommendations regarding hospital management. When possible, authors suggest routine evaluation by a lactation consultant. Guidelines for how and when to supplement breastfeeding are provided. The increased risk for significant hyperbilirubinemia and SIDS are discussed. Guidelines for discharge readiness and timing and frequency of outpatient follow-up are provided.	**III**
Meier, P. P., L. M. Furman, et al. (2007). "Increased lactation risk for late preterm infants and mothers: evidence and management strategies to protect breastfeeding." J Midwifery Womens Health **52**(6): 579-587.	Review and recommendations for management. Literature regarding increased morbidities and mortality of the LPI and risk factors of mothers of LPI for delayed lactogenesis is reviewed. Even though there is no research specifically evaluating the BF mechanics and milk intake patterns of LPI, the authors apply what is known about sucking efficiency and total milk consumed by the bottle feeding preterm infant when they reach 34-37 adjusted age to the LPI. Suction pressures sufficient to extract milk are not present until ~ 36 wks adjusted age. These weak suction pressures would explain why the LPI does not maintain an effective latch at the breast and why they slip off during pauses. The author's share their experience with 24 mothers of preterm infants who were discharged at a mean postmenstrual age (PMA) of 36 wks with a full milk supply. The first week after discharge they consumed 30% of daily intake at the breast and gradually increased such that most infants were able to transition to taking all feeds at the breast 6 wks after discharge (~42 wks PMA). Recommendation include the importance of using a hospital grade pump for infants unable to suck effectively for at least 15 minutes, proper positioning with good support of the infant's head, nipple shields, and importance of careful follow-up after discharge.	**III**
Isaacson, L. J. (2006). "Steps to successfully breastfeed the premature infant." Neonatal Netw **25**(2): 77-86.	Review of challenges premature infants and mothers may face and infant behavioral states relating to readiness for breastfeeding. There is also a discussion of the practical aspects of breastfeeding the premature including pictures of different positions. The information in this article may be helpful for providers working with the smaller infants in the 34-35 week EGA range.	**III**
Rajah, T. N., R. D. Higgins, et al. (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.	Summary of a workshop held in July 2005 to address issues regarding infants born between 34 and 36 completed weeks. The late preterm designation was proposed to identify infants born from $34^{0/7}$ weeks through $36^{6/7}$ weeks gestation. This designation was felt to better convey the fact these infants are not term and as a result are physiologically more vulnerable than a tem infant. The increasing incidence of LPI deliveries from 1992-2002 is noted and recommendations are made to better describe the epidemiology, etiology, contribution to neonatal morbidity and mortality, economic impact and postdischarge outcomes of LPI infants. Recommendations are made to better understand obstetrical issues related to LPI deliveries. Neonatal issues are reviewed and suggested research be done to better understand these issues. The panel emphasized the importance of educating parents and health care providers about the increased vulnerabilities of the LPI.	**III**
AAP Policy Statement. Breastfeeding and the Use of	Even though this policy does not directly address the late preterm infant, many of the recommendations are applicable e.g. follow-up visit at 3-5 days of age, another visit at 2-3 weeks of age, with special attention to	**III**

Human Milk. (2005). **115** (2): 496-501	adequacy of breastfeeding	
Wight, N. E. (2003). "Breastfeeding the borderline (near-term) preterm infant." Pediatr Ann **32**(5): 329-336.	Review of the topic for the general pediatrician or primary care provider with primary references.	**III**

Hyperbilirubinemia		
Maisels, M. J., J. M. Deridder, et al. (2009). "Routine transcutaneous bilirubin measurements combined with clinical risk factors improve the prediction of subsequent hyperbilirubinemia." J Perinatol **29**(9): 612-617.	Retrospective, nested, case-control study of 75 infants readmitted for treatment of hyperbilirubinemia (≥ 17 mg/100ml) who had not received phototherapy prior to discharge over a 24 month period to a US hospital in Michigan matched with 75 randomly selected controls from the remaining population of the 11,456 infants delivered during this period. All infants had transcutaneous bilitrubin (TcB) measurements daily before discharge. Gestational age, race mode of delivery, sex, feeding method, predischarge TcB, bruising, jaundice in first 24 hours and length of stay were analyzed. Combining the TcB percentile, GA, and exclusive breastfeeding provided the best prediction for readmission with bilirubin>17 and was better than any clinical risk factor alone. For the 62 cases and 65 controls with more than one bilirubin before discharge, the calculated hourly rise of predischarge bilirubin in the cases was 0.22 ±0.07 mg/100 ml and 0.13 ± 0.07 mg/100ml in the controls.	**II-2**
Smith, J. R., A. Donze, et al. (2007). "An evidence-based review of hyperbilirubinemia in the late preterm infant, with implications for practice: management, follow-up, and breastfeeding support." Neonatal Netw **26**(6): 395-405.	Systematic literature review designed to answer the question, "Are late preterm infants at greater risk than term infants for emergency department (ED) visits, hospital readmissions, and neurologic deficits secondary to unconjugated hyperbilirubinemia?" Seven retrospective case or cohort control studies relating to ED admission or hospital readmission and four studies relating to neurodevelopmental outcome were reviewed with tables comparing and contrasting the studies. Authors found that LPIs are at increased risk for rehospitalization, and neurologic deficits relating to unconjugated hyperbilirubinemia compared to term infants. Authors also provide their guidelines for breastfeeding support of the LPI to prevent unconjugated hyperbilirubinemia.	**II-3**
(2010). "ABM clinical protocol #22: guidelines for management of jaundice in the breastfeeding infant equal to or greater than 35 weeks' gestation." Breastfeed Med **5**(2): 87-93.	Review of bilirubin physiology and the difference between breastmilk jaundice and starvation jaundice in the breastfed infant. Guidelines for treatment are presented.	**III**
Adamkin, D. H. (2009). "Late preterm infants: severe hyperbilirubinemia and postnatal glucose homeostasis." J Perinatol **29 Suppl 2**: S12-17.	Review of the physiologic vulnerabilities with consequent increased length of hospital stay, increased readmission rate and increased mortality for the late preterm infant. Author discusses problems of hyperbilirubinemia and hypoglycemia in the LPI in more detail. Criteria for discharge, AAP guidelines for management of hyperbilirubinemia and an algorithm for glucose screening and management of hypoglycemia are included.	**III**

(2007). "Guidelines for detection, management and prevention of hyperbilirubinemia in term and late preterm newborn infants (35 or more weeks' gestation) - Summary." Paediatr Child Health **12**(5): 401-418.	Review in the form of a position statement of the Canadian Paediatric Society. Risk factors for hyperbilirubinemia, with an emphasis on LPI infant, blood group incompatibility and importance of Coombs testing and G-6-PD deficiency are discussed. Recommendations for universal bilirubin screening and risk assessment are presented. Management of the infant is reviewed including the need for good breastfeeding support, phototherapy, and safety of continuing breastfeeding infants receiving phototherapy, use of IVIG, supplemental fluids and exchange transfusion.	**III**
(2004). "Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation." Pediatrics **114**(1): 297-316.	Review and expert opinion with special emphasis placed on managing hyperbilirubinemia in near term infant while still preserving breastfeeding.	**III**
Maisels, M. J. and T. B. Newman (1998). "Jaundice in full-term and near-term babies who leave the hospital within 36 hours. The pediatrician's nemesis." Clin Perinatol **25**(2): 295-302.	Review and expert opinion regarding management of the jaundiced or potentially jaundiced infant and why the approach has changed. Risk factors such as maternal diabetes, history of a previously jaundiced sibling, East Asian ancestry, EGA< 38 weeks, oxytocin during labor, male sex, breastfeeding, G6PD deficiency, and short hospital postpartum stays are discussed. The authors emphasize bilirubin levels peak after discharge, especially in the LPI and infants discharged at or before 36 hours of age. The authors nicely illustrate the importance of interpreting bilirubin levels with reference to the infant's age in hours not days and suggest that all infants should have a screening bilirubin level obtained before discharge. +	**III**

FREQUENTLY USED ABBREVIATIONS FOR LPI ANNOTATED BIBLIOGRAPHY
BF—breastfed; LPI –late preterm infant; CD—cesarean delivery; BW—birth weight; GA—gestational age; EGA—estimated gestational age; AGA—appropriate for gestational age; SGA—small for gestational age; LGA—large for gestational age; NICU—neonatal intensive care unit; wks—weeks; HR—heart rate; RR – respiratory rate; O2—oxygen; NEC—necrotizing enterocolitis; PDA—patent ductus arterosis; IVH—intraventricular hemorrhage; IVF—in vitro fertilization; RDS—respiratory distress syndrome; TTN—transient tachypnea of newborn; PPROM—preterm prematurely ruptured rupture of membranes; PROM—premature rupture of membranes; CPAP—continuous positive airway pressure; ALTE—acute life threatening event; SIDS—sudden infant death syndrome; IMR—infant mortality rate LB—live births; RR—respiratory rate; OR—odds ratio; aOR—adjusted odds ratio; CI—confidence interval

Ankyloglossia: See ABM Protocol #11: Guidelines for the Evaluation and Management of Neonatal Ankloglossia and its Complications in the Breastfeeding Dyad with annotated references.

Galactogogues: See ABM Protocol #9: Use of Galactogogues in Initiating or Augmenting Maternal Milk Supply with annotated references.

*US Preventive Services Task Force Ranking of Evidence from Scientific Studies
I Evidence obtained from at least one properly randomized controlled trial.
II-1 Evidence obtained from well-designed controlled trials without randomization.
II-2 Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one center or research group.

II-3 Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments (such as the results of the introduction of penicillin treatment in the 1940s) could be regarded as this type of evidence.

III Opinions of respected authorities, based on clinical experience, descriptive studies and case reports; or reports of expert committees.

The Academy of Breastfeeding Medicine
Date: 12-31-2010

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