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# An Evidence-based Approach to Feeding the Late Preterm Infant

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# AN EVIDENCE-BASED APPROACH TO FEEDING THE LATE PRETERM INFANT

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# ABSTRACT

**Purpose**: Introduction and management of oral feeding for preterm infants is a major challenge for clinicians in the neonatal intensive care unit (NICU). Feeding practices are often inconsistent and contradictory amongst clinicians and based on custom rather than evidence. Effective oral feeding is often the last challenge infants must master before discharge. Historically, medical management has driven practice on schedule driven feeding to initiate and progress oral feeding. However, studies have demonstrated that when feeding is changed from a scheduled and volume driven approach to an infant-driven approach infants can attain full oral feeding earlier by providing cues to regulate their feeding schedule (Ludwig & Waitzman, 2007). This approach has been associated with a shorter hospital stay.

**Significance of the project:** Gestational age and severity of illness may play a role in how long an individual infant remains in any one stage. There is wide variability at various gestational ages. A successful feeding in an infant-driven model of care includes the achievement of four goals: the feeding is safe, functional, nurturing, and individually and, developmentally appropriate (Ludwig, 2007).

**Methods**: The project was implemented in a 20-bed Level II nursery. Infants with gestational ages greater than 24 weeks were included. Project implementation occurred in three phases. Infant-Driven feeding scales (Ludwig & Waitzman 2007) were used as assessment of infant readiness to feed, quality of nippling and caregiver techniques. Focus groups with bedside nurses and parent satisfaction surveys were utilized.

**Project Outcomes**: Infant-driven feeding is a safe method of establishing oral feeds in infants. Younger gestationally-aged infants who are smaller in birth weight were managed by the infant-driven feeding protocol and showed important clinical gains in growth during the project. Analysis of the demographic data of pre-project and project infants demonstrates significant differences in overall length of stay.

**Clinical Relevance**: The research evidence supports the premise that infants will achieve full oral feedings more quickly with infant-driven feeding than when fed in the traditional manner, while continuing to achieve adequate growth. This practice change has the potential to translate into a reduction in hospital length of stay. Evidence indicates long term benefits include a decrease in oral aversion behaviors, a decrease in post-discharge failure to thrive, and a more positive feeding experience for both infants and family (Ludwig, 2007).

SECTION I

## BACKGROUND

The ability to feed by mouth is critical for newborns. Healthy term infants readily take to the breast or bottle immediately after birth. Successful and safe oral feeding depends upon the proper development of sucking, swallowing, and breathing, and their coordination in order to minimize oxygen desaturation, apnea, bradycardia, and/or aspiration, and maximize feeding efficiency. Late preterm or preterm infants must be fed by nasogastric or orogastric tubes until they develop the ability to feed orally. Infants with medical complications may require an alternative to oral feeding even after hospital discharge (Lau, 2012).

In 2007, there were 389,636 late preterm (defined as infants born at 34 to 37 completed weeks gestation) births in the United States, representing 9.0% of live births. These late preterm births represent a 12% increase over the number of infants born late preterm in 1997 (Martin, Kirmeyer, Osterman, & Sheperd, 2009). Near-term or late preterm infants constitute a unique clinical population garnering increased attention and research as differences from their term counterparts are appreciated. According to Wang, Dorer, & Fleming, (2004), newborn infants between 34 and 37 weeks of gestation have an increased incidence of respiratory distress, hypoglycemia, clinical jaundice, and temperature instability, and are more likely to undergo evaluations for sepsis. It is no wonder then that feeding difficulties, along with jaundice, infection, and failure to thrive, are among the common reasons for readmission in this group of late preterm infants (Cleaveland, 2010). Each of these medical issues has an effect on oral feeding success which is made more significant by the late preterm infants' lack of full flexor tone,

decreased endurance, and less coordinated suck, swallow; breathe synchrony (Ludwig, 2007).

Traditional feeding practice stems from a traditional medical model where a successful nipple feeding is characterized by volume intake or an empty bottle, regardless of infant behaviors or caregiver manipulation of the bottle during feeding (Ludwig & Waitzman, 2007). Feeding is typically volume and time driven, meaning that progress is defined by increased volume taken in by the infant in a specified period of time. The primary source for determining readiness is the time on the clock, not the overall state of the infant. This traditional model frequently involves the physician ordering nipple feedings at intervals such as once a shift, twice a day or every other feeding, based primarily on an infant's weight and gestational age (Ludwig, 2007).

More recently, feeding practices are based on infant behaviors which indicate a readiness to feed. These include at least a drowsy or quiet alert state, rooting, interest and competence in non-nutritive sucking, and fair to good muscle tone or a change in muscle tone from their sleep state (Ludwig, 2007). All of these indicators must be underscored by baseline autonomic stability and level of maturity. Starting the transition of feeding from gavage to nipple as soon as the infant demonstrates readiness (rather than by a gestational date) and providing feedings on a schedule as determined by infant cues (rather than on a predetermined schedule) has the advantage of achieving full oral feeding at the earliest date while the infant is still in the hospital. Additionally, cue-based or infant-driven feeding prevents the development of oral aversive behaviors which can have lifelong effects on oral development (Ludwig, 2007).

## Definition of Terms

Late-preterm infants: infants born between 34 weeks 0 days and 36 weeks 6 days gestation as measured by completed weeks of pregnancy (Engle, Tomashek, Wellman, & the Committee of Fetus and Newborn, 2007).

Preterm infants: infants born before 37 weeks gestation as measured by completed weeks of pregnancy (Merenstein & Gardner, 1998).

Gavage feeding of the newborn: a procedure in which a tube passed through the nose or mouth into the stomach is used to feed a newborn with a weak suck, uncoordinated sucking and swallowing, respiratory distress, tachypnea, or repeated apneic spells (Mosby, 2009).

Infant-driven feeding: process of feeding infants in response to feeding readiness cues and demonstrated feeding ability (Ludwig, 2007).

Cue-based feeding: nipple feedings which are initiated in response to the infant's behavioral cues and end when the infant demonstrates satiation as measured on the infant-driven feeding scale (Tosh & McGuire, 2007).

Infant hunger cues: behavioral indicators such as an alert state, sucking on fist, crying or fussiness and a wide open mouth which indicate infant is hungry as documented on the infant-driven feeding scale (Ludwig, 2007).

Pre-project infants: infants admitted to the neonatal intensive care unit, born between 34 weeks 0 days and 36 weeks 6 days, as identified in the neonatal admission log book.

Project infants: infants born under 36 weeks 6 days, hospitalized during the project implementation.

## Description of the project

The project implemented a program for educating nursing staff to evaluate infant feeding readiness using assessment of infant hunger cues in infants less than 36 weeks 6 days gestation, assessing staff performance and observing results of the feeding change.

The steps of the project included:

1. Education of nursing staff in assessment of the infant's potential for on demand feedings.

2. Staff observation as they evaluated infant readiness using the infant feeding readiness tool and feeding behaviors.

3. Observation of results of changing from a scheduled feeding policy to an on demand feeding schedule with bottle feeding or breastfeeding.

### *Recipients of project outcomes*

Research demonstrates that all infants, regardless of gestational age or birthweight, develop the ability to nipple feed at different intervals. Younger preterm infants at less than 32 weeks postconceptual age generally lack the neurologic development to coordinate breathing, sucking, and swallowing which are necessary to achieve successful oral feeding (McCain, 2003). In addition, they may not have the ability to express common hunger cues such as fussiness, crying, and fist sucking (McCain, 2003). Due to nursery routine, preterm infants well enough to be taking milk are fed on a regular schedule by an oral or nasal gavage feeding tube. However, as these infants reach 32 to 34 weeks postconceptual age, they may begin to develop their feeding ability enough to transition from gavage to nipple feedings from a bottle or from the breast (McCain, 2003).

Late preterm infants (34 to 36 weeks) are often treated like term infants (infants born greater than 37 weeks gestation) since late preterm infants exhibit the neurologic maturity to be successful at nipple feeding (Collinge, 1982). These infants are expected to breastfed or bottle-feed without problems. However, they may successfully take small volumes of breast milk or formula in the first few days of life but then exhibit feeding difficulties once higher volumes become a necessity for growth (Ludwig, 2007). Both younger preterm and late preterm infants need to be evaluated individually to determine which ones may be successful at nipple feeding and which ones may not.

Scheduled interval feeding of prescribed enteral volumes via oral or nasal gavage tube feeding is the current standard practice for infants born less than 37 weeks gestation (Merenstein & Gardner, 2010). However, nipple or breastfeeding preterm infants in response to their hunger and satiation cues (ad libitum or demand/semi-demand) rather than at scheduled intervals has been shown (Ludwig, 2007) to help in the establishment of independent oral feeding and increased nutrient intake and growth rates. In a randomized experimental study, McCain, Gartside, Greenberg, & Lott, (2001) found that healthy preterm infants (n=81) made the transition from gavage to oral feeding an average of five days faster with the use of the semi-demand method than the more customary method of gradually increasing the frequency of scheduled feedings. The infants, born at less than 34 weeks postconceptional age, were free of anomalies, severe intracranial hemorrhage, and chronic lung disease.

It is clear from both research and practical application within a nursery that a protocol designed specifically for infants born less than 37 weeks gestation is called for to anticipate their unique needs (Cleaveland, 2010). The National Institute of Child

Health and Human Development (NICHD) recognize the need for consistency in categorizing such infants because late preterm infants have specific needs and challenges (Raju, Higgins, Stark, & Lereno, 2006). Grouping them with more premature infants could complicate their care. Placing them within the same category as term infants merely because they look physically developed and mature can cause caregivers to overlook their unique needs.

*Participants in Project Implementation*

Participants in the project included infants born less than 37 weeks gestation, parents or guardians and bedside nurses.

Feeding challenges in the late preterm infant have been shown to be related to immature sucking and swallowing reflexes, which lead to improper latch-on for the breastfeeding infant as well as inadequate intake in the bottle-feeding infant (Fraser-Askin, Bakewell-Sachs, Medoff-Cooper, Rosenberg, & Santa-Donnato, 2007). As noted earlier, sucking, swallowing, and breathing must synchronize smoothly and effectively with highly accurate timing and coordination for safe and effective oral feeding. Late preterm infants often have fewer awake-alert periods and less postural stability than their full term counterparts. Decreased feeding, which often results in inadequate caloric intake, combined with low energy stores and high energy demands, places these infants at risk for inadequate hydration (Cleaveland, 2010). Healthcare providers and mothers may assume that the infant has ingested an adequate volume of milk when he falls asleep at the breast, when in reality the infant has exceeded his energy stores and has shut down without adequate caloric intake. Parents need to be educated regarding their infant's feeding cues, sleep-wake cycles, and how to promote postural stability (Cleaveland,

2010). Behaviors such as rooting, mouthing, and finger sucking indicate feeding readiness. Ensuring that the hips are flexed and the head and neck are aligned with the trunk provides appropriate postural stability, improving feeding success in the late preterm infant (Ludwig, 2007).

Immature brain development in late preterm infants is often overlooked because they are considered stable compared with extremely low birth weight premature infants. During the final few weeks of gestation, movements become smoother, oral motor skills more coordinated, and states of alertness more predictable (Ludwig, 2007). This immature brain development explains why late preterm infants fail at feeding when they are discharged without the proper instructions being given to their caregivers. It is necessary that the nursing staff and parents, as well as the pediatric providers, receive education in achieving safe and effective oral feedings in late preterm infants. The medical issues described earlier also make late preterm infants more susceptible to having a decreased state of arousal as well as poor endurance, resulting in early fatigue during feeding.

*Phases of Project Implementation*

The project was implemented in three phases. Phase I focused on staff education. Eighteen registered nurses attended a one hour didactic session on infant-driven feeding. Phase II focused on staff observation on use of the tool and coaching as required. Phase III was full implementation of the Infant-Driven Feeding Scales as a basis for infant driven feeding.

## Purpose of the project

The purpose of this project was to implement a program for educating staff to evaluate infant feeding readiness using assessment of infant hunger cues in infants 34 to 37 weeks gestation, assessing staff performance and observing results of the feeding change.

## Aims of the Project

Overall aims of the project included: (1) provision of guidelines for family, staff and physicians for the introduction and management of oral feeding for high-risk infants, (2) creation of positive feeding experiences while assisting infants in achieving full oral feeding in an attempt to prevent the development of oral aversive behaviors, and, (3) reduction of hospital length of stay through timely effective nutrient intake and accelerated growth rates.

## Risks and benefits

Potential risks identified in both a traditional medical approach and infant-driven approach to feeding include poor feeding, poor weight gain, increased stress and potential for failure, bradycardia, apnea and decreased oxygen saturations. Benefits include a potential for earlier hospital discharge through effective infant nutrition as measured by weight gain and improved parent satisfaction as evidenced by results on a parent satisfaction survey.

## Significance of the project

Most premature infants will be able to feed by mouth without difficulty as they approach term gestation. Gestational age and severity of illness may play a role in how long an individual infant remains in any one stage. There is a wide range in ability at

various gestational ages. For example, a healthy preterm infant at 33 weeks adjusted age may be able to achieve total oral feedings while a 44 week adjusted age infant with chronic lung disease may not.

A successful feeding in an infant-driven model of care includes the achievement of four goals: the feeding is safe, functional, nurturing, and individually and developmentally appropriate. Nipple feeding is a complex, highly coordinated sensorimotor experience for the preterm infant. Caregivers, especially nurses and parents, need to communicate about specific skills the infant has or has not gained while transitioning to oral feeding. Succinct, appropriate documentation of the transition to oral feeding is an integral part of this communication.

Facilitating a successful transition to oral feeding is a key factor in preparing an infant for discharge from the Neonatal Intensive Care unit (NICU). Historically, practice and documentation of oral feeding in the NICU is couched in the framework of a medical model. It follows the pattern of documentation for all other types of feeding, citing the route, the amount 'given,' and time required for the full volume to be completed. Although this is effective in determining input and number of full nipple feeds, it contributes little to the overall picture of how the infant is progressing with this complicated developmental task that is often the last hurdle required for discharge. The use of the Infant Driven Feeding Protocol will facilitate earlier transition for late preterm infants to oral feeding as well as provide details regarding the caregiver intervention in a concise, uniform, and objective manner.

# SECTION II

# REVIEW OF THE LITERATURE

A review of the literature was performed using the search engine OVID for the years 1990 to 2012. CINAHL, MEDLINE and the COCHRANE database were searched using the following key terms: cue-based feeding (711 articles), infant-driven feeding (52 articles), infant development (1,838,263 articles), and infant nutrition (491,578 articles), prematurity and late preterm infants (209,947 articles). Fifty journal articles were reviewed.

## Theoretical Basis

The synactive theory of development provides the basis for infant driven or cue-based feeding (Als & Brazelton, 1981). The theory posits that preterm infants interact with and adapt to their environment through the integrated activity of four subsystems - autonomic, motor, behavioral, and attentional. At the core of the theory is self-regulation, achievement of a balanced, stable integration of the subsystems. Thus, all autonomic, motor, and behavioral activity is driven by the infant's internal need to self-regulate. The synactive theory suggests that caregivers of preterm infants can assist infants in meeting self-regulatory goals by providing care contingent upon the infant's own behaviors (Pickler, 2004).

The autonomic subsystem involves organization of heart and respiratory rate and rhythm. The infant must gain control over autonomic functioning first, since the ability to achieve and maintain control in other areas depends on the smooth and reliable function of autonomic mechanisms. Bottle feeding stresses the fragile organization of the

preterm infant's autonomic subsystem, and infants with poor organization have difficulty bottle feeding (Pickler, 2004).

The motor subsystem involves the ability to achieve and maintain muscle tone, posture, and smooth body movement. An infant with poor motor organization may have difficulty bottle feeding, while the act of bottle feeding itself costs a preterm infant in terms of energy expenditure. Hence, an infant may become disorganized by a bottle feeding (Pickler, 2004).

The behavioral subsystem is reflected in the infant's level of wakefulness-from-sleep state to full arousal, and in the pattern of behavior state transitions. A quiet alert state at feeding has been correlated with improved bottle feeding outcomes (McCain et al, 2001). However, bottle feeding tends to tax the infant, possibly resulting in restlessness or agitated behavior states (Pickler, 2004).

The attentional subsystem portrays the availability of the infant for interaction and the ability to be alert during this interaction. It also involves the robustness of the infant's interaction with the caregiver (Als & Brazelton, 1981).

Preterm infants mature in each of the subsystems in a sequential fashion. An infant must first obtain stability of the autonomic and motor subsystems before he can move on to the higher level tasks, such as oral feeding. Oral feeding can stress the autonomic subsystem of the preterm infant, causing a disorganized state. If an infant cannot self-regulate and remain in an organized state then he will have difficulty in feeding (Als & Brazelton, 1981).

At any given point, if balance between the infant's subsystems and environment is not achieved, disorganized behavior may be demonstrated by the preterm infant. The

neonatal intensive care unit environment, with its excessive noise, light, multiple caregivers, and inconsistent care can overwhelm an infant leading to a disorganized state. Signs of disorganized behavior indicate stress and that the infant is not ready for oral feeding. Parents and nurses are often the first to recognize these signs of a disorganized state (Ludwig & Waitzman, 2007).

Although the feeding readiness model is not a test of synactive theory, the model considers the autonomic, motor, and behavior state organization before the feeding, during the feeding, and after the feeding (Pickler, 2004). Additionally, the relationships of these variables to other components of bottle feeding readiness and outcomes are also taken into account (Pickler, 2004).

## Empirical Literature

Nonnutritive sucking (NNS) is elicited when an infant sucks on a pacifier, a hand, or another object without transfer of liquid. During an infant's stay in the NICU, pacifiers are frequently offered to elicit a suck reflex as a comfort measure, during a gavage tube feeding and to improve state regulation.

Nutritive sucking and effective oral feeding requires a coordinated, rhythmic pattern of sucking, swallowing and breathing (SSB). As generally demonstrated by a healthy term infant, a mature sucking burst consists of 10-30 suck, inspire, swallow, expire sequences. Each sequence is followed by a short pause for recovery to occur. Preterm infants tend to exhibit an immature sucking pattern – consisting of 3-5 sucks and swallows followed by a pause (breathing) –that is often disorganized and lacking rhythm (Palmer, 1996). Their sucking efficiency may be compromised because of weak intraoral sucking pressure, diminished sucking frequency and shorter suck and sucking burst

durations. The mature sucking pattern, along with improved sucking efficiency and sucking pressures, begins to emerge by 35 weeks gestational age (Palmer, 1996). Preterm infants may show up to nine possible variations of the swallow-respiration pattern, in which the swallow may be preceded or followed by inspiration, an expiration, or apnea. The establishment of a coordinated rhythm of suck and swallow with integration of respiration occurs at 40 weeks gestation (Dougherty & Luther, 2008).

The sucking behavior of term infants consists of a rhythmic alternation of suction and expression. Suction is the negative intraoral pressure exerted by the infant while drawing milk into the mouth. Expression is the positive pressure believed to correspond to the stripping of the nipple between the hard palate and the tongue to eject milk into the mouth (Simpson, Schanler, & Lau, 2002). In a study with infants born between 26 and 29 weeks gestation, it was shown that the ability to transfer milk did not require the presence of a term sucking pattern (Lau, Sheena, Shulman, & Schanler, 1997). In fact, the majority of these preterm infants demonstrated a predominant sucking pattern of expression with no suction when first introduced to oral feeding. Limited transfer of milk occurred during this sucking pattern. Despite the use of such an "immature" sucking pattern, these infants were able to complete their oral feeding within the allotted time of twenty minutes without complications (Lau, et al., 1997).

The American Academy of Pediatrics recommends that preterm infants demonstrate competent oral feeding skills before hospital discharge (AAP, 2008). Often, a delay in discharge is observed secondary to the inability of preterm infants to feed by mouth successfully and safely. Success implies the ability to take all of the prescribed volume by mouth within an allotted time and maintain a sustained pattern of weight gain.

Feeding safely implies precise coordination of sucking, swallowing, and breathing while maintaining physiologic stability. To accomplish successful and safe feeding, the preterm or sick term infant must be capable of sustaining attention to the task of feeding for the duration of the feeding; controlling and coordinating the postural oral and upper airway motor systems during the physiologic demands associated with feeding; and protecting the airway from compromise by fluid (Thoyre, Shaker, & Pridham, 2005).

Developing infant feeding skill is a process that reflects the dynamic interactions between the internal subsystems of the infant and the external subsystems of the caregiver. Subsystems within the infant include the autonomic, state, and sensorimotor systems. These support the infant's posture, oral structures, upper airway, arousal, and physiologic regulation (Shaker & Woida, 2007). For preterm infants, these subsystems are in the process of maturing along convergent, but always synchronous, timelines. External subsystems include the social systems in the Neonatal Intensive Care unit (NICU), the culture of care in the NICU, and the physical environmental systems (type of bottle or nipple used and the activity, sound, and lighting of the room). All of these subsystems contribute to feeding skill (Thoyre, et al., 2005).

Evidence-based practice demonstrates that feeding preterm infants is a skilled nursing task that involves clinical decision making as to how and when to feed the infant (Medoff-Cooper, 2005). Therefore, in contrast to traditional feeding practice, many nurseries are now incorporating care practices that require the bedside nurse to identify infant feeding readiness signs to establish when an infant is ready to attempt nipple feedings (Ludwig, 2007). This practice lends itself to a cue-based feeding approach that is infant driven versus the physician driven approach in which feeding is guided by

documented physician directives. When an infant driven feeding approach is used, a successful feeding is no longer that of an empty bottle and/or what the caregiver did to achieve the task. A successful feeding in an infant-driven model of care includes the achievement of four goals: the feeding is safe, functional, nurturing, and individually and developmentally appropriate (Ludwig, 2007).

Simpson and colleagues (2002) conducted a randomized control trial examining whether transition from tube to oral feeding can be accelerated by the early introduction of oral feeding in preterm infants. The experimental group of preterm infants, regardless of age and weight, were offered oral feeding approximately 2.6 weeks earlier (31.1 week post-conceptional age) than the control group (33.7 week PCA) and achieved full oral feeding earlier. Weight gain and discharge weights were similar for both groups. This study found no correlation between the time it took to achieve full oral feeding and discharge home; however, the experimental group was discharged home ten days earlier than the control group. It should be noted that this study design only addressed oral feeding of the healthy premature infant.

Pickler, Cguarabai and Reyna (2006), studied a group of 88 preterm infants to examine how certain characteristics of nutritive sucking change over time and to determine the effect of certain factors on those changes. One of the factors they studied was feeding experience or practice. They found that infants given more opportunities to feed orally had the most suck bursts and higher sucking rates during the 14 days of the study.

McCain and Gartside, (2002), assessed a feeding protocol with preterm infants 32 to 33 weeks PCA who were allowed to orally feed every three hours, if behaviorally

ready, and continue each oral feed until sleeping or no longer actively sucking versus a control group that was orally fed based on the gradual increase of oral feeding sessions. The experimental group progressed to full oral feeding 5 days sooner than the controls. This is partially attributed to the increased opportunities for practice.

McCain, et al. (2001) conducted a randomized control trial (n = 89) of preterm infants 32 to 34 weeks PCA that showed that infants who were assigned a semidemand feeding protocol achieved oral feeding 5 days sooner and maintained satisfactory weight gain compared with control infants receiving standard care.

Kirk, Alder and King (2007), studied 51 preterm infants to determine if the use of a nursing-driven, cue-based clinical pathway for oral feeding initiation and advancement would result in the achievement of earlier oral feeding. The control group had oral feedings managed by physician order, and the study group had oral feedings managed by nursing staff using the clinical pathway. Study infants reached full oral feeding six days earlier than infants in the control group. This study was designed to assess oral feeding management of a broader group of premature infants and was not designed to look at infants with specific morbidities.

Drenckpohl, Dudas, Justice, McConnell and Macwan (2009), compared the clinical outcomes of two different oral feeding protocols. This was a retrospective study that included 200 preterm infants born <34 weeks gestational age. The control group included infants transitioned to full oral feeding with a protocol based on established feeding times. The intervention group was transitioned using a protocol based on infant feeding cues. It was noted that infants following the cue-based protocol began oral feedings one week earlier than the control group. There was no statistical significance

between the groups regarding when oral feedings were initiated, weight status during hospitalization and at time of discharge and length of stay.

Contingent caregiving (providing care when the infant indicates readiness to receive care) has been reported to have positive effects on immediate neurobehavioral responses and on long-term neurodevelopmental outcomes (Als & Gilkerson, 1995). Given the early readiness to begin nippling among healthy preterm infants, nipple feeding appears to be especially amenable to contingent caregiving by experienced NICU nurses. Preterm infants whose course of illness has been uncomplicated can be progressed by nursing staff and make a transition to full nipple feedings safely and efficiently as early as 35 to 36 weeks postconceptional age (McCain, 2003).

Hawdon, Beauregard, Slattery and Kennedy (2000) conducted a prospective study of 35 infants (mean gestational age 34 weeks) admitted to a neonatal intensive care unit over a three-month period. The authors documented a high incidence (14 of 35) of immature or abnormal feeding patterns when infants were assessed at 36 to 40 weeks post menstrual age. Neonates with prolonged respiratory support and delayed enteral and oral feeding were most affected. Compared with neonates who have normal initial feeding assessments, neonates with disorganized or dysfunctional feeding were six times more likely to vomit and three times more likely to cough when offered solid food at six months of age. The authors found that at twelve months of age significant differences were also found in tolerating lumpy food and enjoying mealtimes. The authors hypothesized that these feeding problems contribute to failure to thrive and psychosocial distress after discharge from the neonatal intensive care unit.

Iacovou and Sevilla (2012) used a sample of 10419 children from the Avon Longitudinal Study of Parents and Children to examine the relationship between feeding infants to a schedule and two sets of outcomes: mothers' wellbeing, and children's longer-term cognitive and academic development. Outcomes were compared by whether babies were fed to a schedule at 4 weeks of age. Maternal wellbeing indicators include measures of sleep sufficiency, maternal confidence and depression, collected when babies were between 8 weeks and 33 months. The authors concluded that feeding infants to a schedule is associated with higher levels of maternal wellbeing, but with poorer cognitive and academic outcomes for children.

Research has demonstrated that the swallow reflex is completely functional by 34 weeks post-conceptional age (McGrath & Braescu, 2004). Therefore, the anticipated development milestone for nipple feeding is around 34 week's post-conceptual age (PCA). Individual infants can nipple at 33 weeks PCA and some may not be able to nipple feed until more than 35 weeks PCA, as factors such as swallow-breathe coordination may still be immature or limited.

Transitioning infants from gavage feeding to full oral feeding is complex and requires a systematic approach. Many of the protocols examined are based on knowledge gained from research evidence; however, few of the protocols have been evaluated to determine their effectiveness. Each of the seven studies presented were conducted to determine if feeding preterm infants in response to their own hunger cues was more effective than offering oral feeds at predetermined intervals with set volumes of milk.

There is a trend in the literature toward establishing best practice regarding feeding readiness. Fifty journal references were reviewed. One systematic review of the

literature was located in the Cochrane Database of Systematic Reviews. McCormick, Tosh and McGuire (2010) examined 8 randomized controlled trials that compared demand/semidemand or ad libitum regimens with scheduled intervals regimens in preterm infants in the transition phase from intragastric tube to oral feeding. The available data did not provide enough evidence to conclude that demand/semidemand or ad libitum feeding affects clinically important outcomes for preterm infants.

Limited research exists on infant-driven feeding. Four peer-reviewed articles on oral or cue-based feeding were reviewed. Samples sizes ranged from 51 to 200 infants and each study compared results of a control versus study or intervention group. Successful feeding requiring infant maturity as well as infant experience with oral feeding and an infant-driven feeding model which results in earlier achievement of oral feedings were noted to be the dominant conclusions in each of the four studies.

In summary, the evidence suggests that a medically stable preterm infant should be assessed for oral feeding readiness when able to suck, even if using an immature pattern, and when able to achieve an alert state. As a number of factors will impact on the age at which an infant will reach this stage, infants may therefore be introduced at widely different ages. These criteria allow the approach to oral feeding to be individualized to each infant's capabilities and needs.

# SECTION III

# METHODOLOGY

Introduction and management of oral feeding for infants is a major challenge for nurses in the neonatal intensive care unit. Feeding practices vary amongst clinicians and are often inconsistent and contradictory. These practices are often based on custom rather than on evidence. Questions arise such as: When can we start nipple feeding? When can we give the infant more to eat? Can we advance to ad-lib feeds? There is a need to establish a consistent evidence based approach to feeding infants. Assisting the preterm infant to achieve the ability to fully orally feed takes time and is often a requirement for discharge. The purpose of this scholarly project was to initiate an infant-driven approach to feeding preterm infants.

Nursing and medical staff approval was obtained prior to implementation of the project. The scholarly project and aims were discussed with Dr Michael Lamacchia, Chairman, Department of Pediatrics (Appendix A); Dr. Adel Zauk, Chief of Neonatology (Appendix B); and Maria Brennan, Chief Nursing Officer (Appendix C) at St. Joseph's Healthcare System. Permissions were granted to proceed with implementation of the scholarly project. An expedited review was obtained from the Institutional Review Board (Appendix D) and the Medical Board (Appendix E) at St. Joseph's Healthcare System.

Prior to initiation of the scholarly project, one of authors of the Infant-Driven Feeding Scales was contacted and granted permission to use the three feeding scales in clinical practice (Appendix F).

The project was undertaken at the Intermediate Nursery at St, Joseph's Children's Hospital, part of the St. Joseph's Healthcare System in Paterson, New Jersey. The Intermediate Nursery is a 20-bed Level II unit employing over 20 registered nurses. Newborn infants admitted with gestational ages greater than 24 weeks were included in the project.

Signed informed consent was not required since there was no perceived risk to the infant and there will be no release of identifying data. Feeding is a routine part of hospital care for the newborn at any age for which parents give consent on admission, and the technique employed for the project did not involve invasive actions that would necessitate specific additional parental permission in accordance with existing hospital policies and ethical directives. Assessment and evaluation of infants is an ongoing process. For this project, assessment and evaluation were expanded to include cue based feeding behaviors. Confidentiality was achieved by assignment of random numeric codes to each infant for the duration of the project and aggregated results were reported.

Subjects were recruited from a tertiary care Neonatal Intensive Care unit in Paterson, New Jersey over a nine-month period from 2011 to 2012. The population included healthy preterm infants who no longer required ventilatory support.

All project infants were continuously monitored with Philips® cardiovascular respiratory monitors in addition to Massimo® pulse oximetry.

The project was implemented in three phases. Phase I focused on staff education. Phase II focused on the project leader observing the bedside nursing staff on use of the tool and coaching as necessary. Phase III was full implementation of the Infant-Driven Feeding Scales as a basis for infant driven (cue-based) feeding.

The Infant-Driven Feeding Scales (Ludwig & Waitzman, 2007) were used as an assessment of infant readiness to feed, a guide for intervention, and a means of documentation of nipple feedings. The Infant-Driven Feeding Scales are composed of three scales meant to be used together to capture the infant's readiness to nipple feed, the infant's feeding abilities, as well as the techniques used by the caregiver feeding the infant. The scales, used in conjunction with standard documentation of nippling time/duration, nippling quality, and nipple type, give the healthcare team a much clearer picture of the infant's feeding abilities (Ludwig & Waitzman, 2007).

Two of the three scales, readiness to nipple feed and quality of nippling, are five-point scales with 1 being the most optimal and mature infant response to nippling and 5 being the least. The caregiver technique scale is completed in letters to differentiate it from infant response (Appendix I) (Ludwig & Waitzman, 2007).

## Phase I

Twenty bedside nurses assigned as regular core staff to the Intermediate Nursery at St. Joseph's Healthcare System participated in educational sessions consisting of video and PowerPoint presentations (Appendix G). "Supporting better feeding outcomes – critical perspectives in co-regulated feeding in the NICU" by Catherine Shaker, MS/CCC-SLP, BRS-S is a thirty-minute video presentation which was viewed by all staff involved in the project. Additional one-on-one bedside instruction by the project leader was also employed. A unit bulletin board with evidence-based research articles and documentation tools was created. (Appendix H)

## Phase II

After completion of in-service education and coaching of all staff members to assure consistency of protocol, Phase II was initiated. Starting at 33 weeks gestation, each infant was assessed for feeding readiness by the bedside nurse. The Infant-Driven Feeding Scales (Ludwig & Waitzman, 2007) were utilized for assessment. There are three components to the scales which allow for assessment, intervention and a means of documentation of nipple feedings. (Appendix I). The Infant-Driven Feeding Scales presupposes autonomic stability at baseline and a postconceptual age of 33 weeks or greater (Ludwig & Waitzman, 2007).

*Description of Feeding Readiness Scale*

To score a 1 for readiness, an infant must be in an alert state or at least in a drowsy state before nursing care. This type of behavior is typically demonstrated by a more mature infant. The infant roots, actively brings hands to mouth, or actively takes a pacifier (Ludwig & Waitzman, 2007). A score of 2 for readiness indicates that an infant achieves this drowsy or alert state once they are gently handled for routine care. Premature infants do not routinely arouse independently for feeding, but many will become alert quite easily with gentle handling and then show signs of hunger (Ludwig & Waitzman, 2007). Only infants scoring a 1 or 2 on the readiness scale should then be nipple fed.

A score of 3 for readiness reflects an infant who may be briefly alert with care but shows no hunger behaviors such as rooting, bringing of hands to mouth, or taking the pacifier (Ludwig & Waitzman, 2007). The infant receives a score of 4 if he or she sleeps throughout care and demonstrates no hunger cues and no change in muscle tone (Ludwig

& Waitzman, 2007). A score of 5 indicates that an infant is demonstrating some medical instability, that is, needing increased oxygen with care, having apnea and/or bradycardia with care, or is tachypneic greater than the baseline with care (Ludwig & Waitzman, 2007).

Each infant was scored before current practice of interval gavage feedings occurring every three hours. Scoring was continued before each feeding, regardless of feeding method, until infant achieved full oral feedings by breast or bottle without support from gavage feedings. Scores were documented on the infant feeding assessment forms in the medical record. Once infants reached a level of maturity, stability and interest that was consistent with readiness criteria, nipple feedings were initiated.

A medical order for 'cue-based' feeding was requested by the bedside nurse before initiation. This order was documented on the physician order sheet. Infants were continually assessed for signs of distress (changes in heart rate, oxygen saturation, color, and respiratory status, loss of postural tone or state). Nipple feeding was suspended for any infant demonstrating signs of distress. Feeding was resumed when infants demonstrated physiologic stability.

*Quality of Nippling Scale*

The Quality of Nippling Scale encouraged the staff to observe the infant's feeding behaviors, document those behaviors by using one number from 1 to 5, as well as assess which caregiver techniques was needed based on the infant's quality of nippling. A successful nipple feeding is one in which the predetermined quantity is taken within 20 minutes.

To score a 1 for nippling quality, an infant must demonstrate a strong coordinated suck throughout the duration of the feeding experience (Ludwig & Waitzman, 2007). A score of 2 indicates that an infant nipples with a strong coordinated suck but, like many premature or high-risk infants, fatigues with progression (Ludwig & Waitzman, 2007). A score of 3 for quality reflects an infant with a consistent suck but who may have difficulty coordinating the swallow, may have notable loss of fluid, or difficulty in self-pacing (Ludwig & Waitzman, 2007). This infant may benefit from external pacing for breathing or for flow rate/swallow coordination. An infant receives a score of 4 if he or she nipples with a weak or inconsistent suck, has little or no rhythm, or requires some rest breaks during the feeding (Ludwig & Waitzman, 2007). A score of 5 indicates that an infant is unable, despite pacing, to coordinate suck/swallow/breathe, which may result in significant apnea or bradycardia and may have large amounts of fluid loss and/or significant tachypnea (Ludwig & Waitzman, 2007).

Scoring was continued until infant achieved full oral feedings by breast or bottle without support from gavage feedings. Scores were documented on the infant assessment feeding form in the medical record (Appendix K). A referral to the Feeding and Swallowing Center was initiated for an infant who consistently scored a 4 or 5 for feeding readiness and/or quality of nippling.

*Description of Caregiver Techniques Scale*

Documenting caregiver techniques used to aid in feeding is beneficial for subsequent staff members and provides consistency for the infant. The Caregiver Techniques Scale can be used as an indicator for the staff to identify which techniques an infant typically needs so that parents can be taught to use them successfully when needed

and consistency is maintained for the infant. Appropriate caregiver techniques include: external pacing, modified side-lying, chin support, cheek support and oral stimulation exercises (Ludwig & Waitzman, 2007).

External pacing is needed when an infant cannot independently coordinate a suck-swallow-breathe pattern. External pacing is a technique in which the caregiver, upon noting that the infant needs to take a breath or is overwhelmed by volume, may tip the bottle downward, allowing fluid to flow back into the bottle while leaving the nipple in the infant's mouth. External pacing allows a breathing pause during feeding (Dougherty, 2008).

Modified sidelying is generally the preferred position for feeding premature infants and mimics the breastfeeding position. This is a sidelying position with a slightly upright tilt, the head still being higher than the feet. This position allows the infant more control of the bolus/liquid and decreases the infant's risk of choking (Ludwig & Waitzman, 2007).

Chin support is utilized to help stabilize the lower jaw and prevent release of the nipple with each suck or to help bring the tongue/chin forward for a better stripping of the nipple (Ludwig & Waitzman, 2007). Cheek support is used to decrease intraoral space for better intraoral suction/pressure. Cheek support can be provided either unilaterally or bilaterally. It is provided by a supportive finger along the area of the cheek where the gums line up (Ludwig & Waitzman, 2007).

Oral stimulation exercises usually consist of the caregiver using a gloved finger dipped in formula/milk. Oral stimulation exercises will be used during interval gavage feedings to enhance the suck-swallow-breathe reflex (Ludwig & Waitzman, 2007).

Use of caregiver techniques was documented on the infant feeding assessment form in the medical record. Infants were assessed with each feeding and scores were documented on the infant assessment record (Appendix K).

## Phase III

Phase III was full implementation of the Infant-Driven Feeding Scales as a basis for infant driven feeding. A parent satisfaction tool (Appendix L) was used to assess parent satisfaction with the infant-driven approach to feeding. The survey was administered prior to infant discharge from the Intermediate Nursery.

## Data Collection

An initial draft (Appendix J) of the bedside documentation tool for assessing infant feeding readiness was established. Changes were initiated to the documentation tool by the nursing staff and the final documentation tool was completed (Appendix K). Changes included a legend for descriptors for each of the three feeding scales (readiness to nipple feed, quality of nippling and caregiver techniques) as well as notation of volume ingested at the time of feeding. The changes to the documentation tool were made for simplicity and clarity of documentation. The staff was challenged to review all current documentation tools for submission for computerized documentation. This tool will now be incorporated into the electronic medical record as a standard documentation tool for infant-driven feeding.

### *Quantitative Data – Preproject Chart Review*

Prior to initiation of the project, a retrospective chart review of thirty (30) medical records was conducted. The purpose was to extrapolate infant feeding characteristics, practices and outcomes prior to implementation of the scholarly project. Charts were

identified via an admission log book housed in the Division of Neonatology Office, St. Joseph's Healthcare System. The first thirty (30) admitted infants commencing in January 2011 were chosen. These infants were identified based upon gestational age and discharge to home. Medical records were reviewed for gestational age, birthweight, maternal age at time of delivery, type of medical insurance, elapsed time to first nipple feeding by bottle, elapsed time to full oral feedings by bottle, head circumference on admission and discharge, discharge weight and length of stay.

*Quantitative Data – Project Infants*

The project population consisted of twenty-seven (27) infants admitted to the neonatal intensive care unit beginning in January 2012. Data was collected on gestational age, birthweight, maternal age at time of delivery, type of medical insurance, elapsed time to first nipple feeding by bottle, elapsed time to full oral feedings by bottle, head circumference on admission and discharge, discharge weight and length of stay. Although not included as part of data analysis, scores on the Infant-Driven Feeding Scale were collected as part of the project.

The characteristics of the study population were assessed using descriptive statistics. Differences between the pre-project group and the project group on maternal age, medical insurance, gestational age, weight, head circumference, length of stay and time to full nipple feeding were evaluated using t-tests. PASW 18 statistical software package was used for all analyses. The statistical test was 2-sided and considered to be statistically significant at $p < 0.05$.

*Qualitative Data – Focus Group*

Two focus groups were used to discuss bedside nurses' experiences with the Infant-Driven feeding scales. Hand-written notes were taken during the interviews. Open-ended questions, such as: "What is your understanding of the purpose of the infant-driven feeding program?" and "Describe how this program impacts your nursing practice?" were used to begin discussions, but participants were encouraged to expand on their answers and interact with each other. Focus groups lasted 15 – 30 minutes, included 2-4 staff members, and were conducted by the principal investigator. Each participant received a $5.00 gift card to Au Bon Pain. Several themes emerged during data analysis which is discussed in the section on project outcomes.

*Qualitative Data – Parent Satisfaction Survey*

A parent satisfaction survey was completed by mothers of the post-intervention group. A demographic survey elicited methods of feeding their newborn, age of infant when he/she received first feeding of formula or human breastmilk, age of full feeds without intravenous therapy support and pacifier usage. In addition, parents were asked to rate using a 4-point Likert scale feelings of involvement with infant care.

# SECTION IV

## PROJECT OUTCOMES

This section presents the results of statistical tests showing the outcomes of the cue-based feeding protocol. Demographic data for selected infants prior to initiation of the cue-based feeding project and for the infants who received the cue-based feeding protocol for the project, comparative data for feeding outcome, and length of stay. PASW Statistics 18 (formerly SPSS Statistics) was used for data analysis. Descriptive statistics were summarized as mean (with SD) and frequency (%). Independent samples t-tests and Levene's test for equality of variances were used to determine if the variance within the pre-project and project groups of infants is similar for demographics and outcome measures. For all tests, $p$ values of $<.05$ were considered statistically significant. Levene's test for equality of variances was non-significant in all but maternal age on the infant-driven feeding variables.

### Demographic Data

Ethnicity and maternal age, type of insurance, gestational age, length of stay, birthweight, discharge weight, time to full nipple feeding and head circumference on admission and discharge are presented in Tables 1 and 2. The 30 infants cared for on the unit prior to initiation of the project had a mean gestational age of 33.83 weeks (range 30 – 36 weeks) while the 27 project infants had a mean gestational age of 29.78 weeks (range 24 – 33 weeks), a statistically significant difference ($t = 9.054$, $p = .000$), with the project infants being more premature, smaller at birth, and having a longer hospital stay. Of note, the project infants demonstrated a mean weight gain of almost two pounds

before discharge, while the selected pre-project infants who did not receive cue-based feeding had a mean weight gain of only seven ounces. It is important to note that the preproject infant group was larger in birthweight than the project group. By discharge the project infants experienced a four-centimeter growth in head circumference (range 29-33 centimeters, mean 31 centimeters), while the pre-project infants had a gain of only 1.23 centimeter growth during hospitalization.

Table 1. Patient Characteristics

| Variable | Pre-Project | Project | Sig. |
|---|---|---|---|
| | *N = 30* | N = 27 | |
| Gestational Age (weeks) | 30 – 36 weeks (mean 33.83 weeks) | 24 – 33 weeks (mean 29.78 weeks) | *p* = .000 |
| Birthweight (grams) | 1320 – 3070 grams (mean 2134.93 grams) | 610 – 1910 grams (mean 1329.22 grams) | *p* = .000 |
| Discharge Weight (grams) | 1860 – 3065 grams (mean 2322.17 grams) | 1725 – 2920 grams (mean 2112.37 grams) | *p* = .005 |
| Admission Head Circumference (centimeters) | 28 – 34 cms (mean 30.9333 cms) | 22.5 – 30.5 cms (mean 26.7963 cms) | *p* = .000 |
| Discharge Head Circumference (centimeters) | 30.5 – 35 cms (mean 32.1583 cms) | 29 – 33 cms (mean 30.9815 cms) | *p* = .000 |
| Time to full nippling (days) | 0 – 33 days (mean 10.93 days) | 9 – 80 days (mean 32.11 days) | *p* = .000 |
| Length of Stay (days) | 4 – 37 days (mean 15.87 days) | 15 – 85 days (mean 37.74 days) | *p* = .000 |
| Maternal Age (years) | 18 – 45 days (mean 30.53 years) | 15 – 41 years (mean 29.63 years) | *p* = .609 |

Length of stay in the pre-project group ranged from 4 – 37 days with a mean of 15.87 days while the project group had a range of 15 – 85 days with a mean of 37.74 days, a statistically significant difference ($t = .027, p = .000$). The longer length of stay in the project group may be related to the younger gestational age of project infants.

Medicaid insured 73.3% of the pre-project infants' families and 55.6% of the project infants' families. The mean maternal age was similar for both groups of infants.

Reported ethnic backgrounds of White or Black/Afro-American were 73.3% in the pre-project group as compared to 51.8% of the project group.

Table 2. Ethnicity

| | Preproject Frequencies N = 30 | Percent | Project Frequencies N = 27 | Percent |
|---|---|---|---|---|
| White (non-Hispanic) | 1 | 3.3 | 1 | 3.7 |
| White (Hispanic) | 20 | 66.7 | 10 | 37.0 |
| Black/Afro-American | 1 | 3.3 | 3 | 11.1 |
| Unknown | 2 | 6.7 | 4 | 14.8 |
| Other | 6 | 20.0 | 9 | 33.3 |
| Total | 30 | 100.0 | 27 | 100.0 |

There were statistically significant differences pre-project and project infants, in all but maternal age on the infant variables. Length of stay and time to full nippling was longer in the younger gestational age project infants.

## Comparative Data for Feeding Outcomes

Three measures described the feeding outcomes of the project: weight gain, head growth and time to full nipple feeding. A shorter length of stay was predicted for project infants. The findings demonstrated statistically significant differences between the groups for admission and discharge weight, admission and discharge head circumference and time to first nipple feeding. The pre-project infants possessed the characteristics of higher maturity with regards to gestational age and heavier birthweights than the project counterparts.

Infant weight at discharge ranged from a loss of 345 grams below admission weight to a gain of 1120 grams above admission weight in the pre-project group and ranged from 80 grams to 1730 grams above admission weight in the project group ($t$ = 7.596, $p$ = .000), with the project infants demonstrating a higher weight gain. Head growth also was greater for the project infants, with a range of 0.50 to 8.50 centimeters in the project group compared to 0 to 3 centimeters in the pre-project group ($t$ = - 6.82, $p$ = .000). The difference in amount of weight gain and head growth may have been influenced by the difference in gestational age on admission.

Time to full nipple feeding is defined as the duration in days from admission to achievement of full bottle feeding without gavage tube support for enteral nutrition. In the pre-project group this averaged 11 days while the project infants achieved full bottle feeding at an average of 32 days, a significantly longer time ($t$ = -6.67, $p$ = .000). This longer duration of time to full nipple feedings may have been due to younger gestational-aged infants during project implementation.

Analysis of the demographic data of pre-project and project infants demonstrates significant differences in overall length of stay and growth parameters. The pre-project infants were selected in consecutive admission order to the neonatal intensive care unit while the project infants were chosen based on caregiver and project leader availability. Differences in characteristics of the infants in the neonatal intensive care unit at the two time periods accounts for statistical difference in outcomes, however, the younger and smaller infants whose feeding was managed by the infant-driven feeding protocol showed important clinical gains in growth during the project.

Focus groups of nursing personnel were used to understand their experiences with infant-driven feeding. Nursing staff expressed satisfaction with their increased autonomy regarding nipple feeding progression. A user-friendly documentation tool for infant-driven feeding developed with feedback from the unit nurses added to nursing satisfaction during the implementation process. Table 3 describes a summary of staff interviews.

Table 3 Focus Group Comment Summary

| | |
|---|---|
| Benefits of infant-driven feeding | Increased autonomy and judgment<br>Developmentally appropriate – avoids force feedings<br>Infant sleeps better<br>Valuable education tool for parents |
| Challenges of infant-driven feeding | Confidence that infant will meet nutritional needs if allowed to go beyond strict 3 or 4 hour schedule<br>Parents not consistently at bedside to recognize cues and feeds<br>Education of reassigned staff to unit<br>Managing when more than one infant simultaneously cues to feed |
| Effect on workflow | Less organized<br>Takes more time to perform multidisciplinary patient care rounds |

*Parent Satisfaction*

This project's descriptive design used a survey questionnaire (Appendix L) of parents with infants in the project group to understand their experiences with infant feeding. Ten mothers of infants in the project group participated in completing the parent satisfaction survey prior to infant discharge. All parents strongly agreed that they were encouraged by the nursing staff to participate in feeding their infants. Five of the 10 mothers were encouraged to perform skin-to-skin or kangaroo care during daily visits. All of the mothers indicated receiving education on infant cues by the project leader resulted in them being better able to determine when the baby was ready to eat. Comments elicited from parents included the following: "Eventually I felt like I was part of the feeding process" and "I like to see more support for the breastfeeding mothers instead of just handing us a bottle of formula."

Table 4. Parent Satisfaction Survey Results (n = 10)

| | |
|---|---|
| Encouraged to perform skin-to-skin | 5 |
| Encouraged to participate in infant's care | 10 |
| Received appropriate and timely education on infant cues | 10 |

Length of stay was noted to be longer in the project group than the pre-project group. Through a retrospective chart review, the average length of stay for the pre-project group of infants with mean gestational age of 33.83 weeks at birth was 15.87 days (SD 8.51 days). This was approximately half the length of hospital stay for the project infants with a mean gestational age of 29.78 weeks (M = 37.74 days, SD 14.6 days, $t = -6.99$, $p = .000$). This may be due in part to younger gestational-aged infants in the project group.

Research demonstrates that all infants, regardless of gestational age or birthweight, develop the ability to nipple feed at different intervals. Younger preterm infants at less than 30 to 32 weeks postconceptual age generally lack the neurologic development to coordinate breathing, sucking, and swallowing which are necessary to achieve successful oral feeding (McCain, 2003). In addition, they may not have the ability to express common hunger cues such as fussiness, crying, and fist sucking (McCain, 2003). This physiologic immaturity in the younger-gestationally aged infants leads to a longer duration to achieve full nipple feedings.

Facilitating a successful transition to oral feeding is a key factor in preparing an infant for discharge from the neonatal intensive care unit. Our current mode of feeding at St. Joseph's Healthcare System is for the Neonatologist/Nurse Practitioner to either decide that it is time to initiate oral feeding or for the bedside nursing staff to ask if oral feedings can be initiated based upon their interpretation of the infant's feeding cues. One Neonatal Attending prefers to start nipple feedings when the infant reaches 1500 grams in weight. We now know that this is not developmentally appropriate. Infants should be transferred from tube feeding to oral feeding when they are physiologically capable, largely irrespective of weight or gestational age.

The results of this project support the premise that infants will achieve full oral feedings in an infant-driven approach to feeding, while continuing to achieve adequate growth. Infant-driven feeding is a safe method for establishing oral feedings in infants. A shorter length of stay was not achieved during this project as the two groups of infants differed in regards to gestational age and birthweight.

# SECTION V

## SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Facilitating a successful transition to oral feeding is a key factor in preparing an infant for discharge from the Neonatal Intensive Care unit (NICU). Historically, practice and documentation of oral feeding in the NICU is couched in the framework of a medical model. It follows the pattern of documentation for all other types of feeding, citing the route, the amount 'given,' and the time required for the full volume to be completed. Although this is effective in determining input and number of full nipple feeds, it contributes little to the overall picture of how the infant is progressing with this complicated developmental task that is often the last hurdle required for discharge. The use of the Infant Driven Feeding Protocol facilitates earlier transition for preterm infants to oral feeding as well as providing details regarding caregiver intervention in a concise, uniform, and objective manner.

For some infants, the transition from gavage to nipple feeding is prolonged. Preterm or sick infants may have complicated clinical courses. The most immature infant (most frequently between 23 and 27 weeks gestation) often has a high index of morbidity and is most at risk for prolonged transition to full oral feeding. Prolonged ventilatory support and complex medical procedures in this group of infants is often related to delays in achievement of feeding milestones.

This project was undertaken to change the current medical model of feeding infants on an ad-lib or demand schedule. Infant-driven feeding is a behavioral based practice rooted in the identification of infant hunger cues to progress an infant from gavage tube feedings to nipple feedings. Learning to feed is a key developmental process

for the preterm infant. The coordination of sucking, swallowing, and breathing is largely dependent on postconceptional age but may vary from infant to infant. Employing strategies to facilitate the transition from tube feeding to full oral feeds may shorten the hospital course.

Implementing this evidence-based practice project required time and patience on part of the project leader. Presenting the concept to the medical and nursing team was challenging. Change is not a process taken lightly by neonatologists grounded in a truly medical model. Hours were spent researching and gathering data to present in an organized fashion. Several drafts of the proposal were required in order to present a clear description of the project to the medical staff. The concept of identifying infant hunger cues was explained through discussion of the normal progression of infant development in the areas of sucking and swallowing. Reflecting on the developmental milestones of their own children helped to drive this concept home.

In the end, the nursing staff warmly embraced the concept of infant-driven feeding. The initial response was, "Oh no, another paper to fill out!" After education and practice it became evident that the nursing staff was pleased to have the autonomy to make decisions on behalf of the infants in their care. Bedside staff nurses were able to identify infant readiness cues and progress infant nippling competency without direction from physician colleagues. Staff was often amused by their own ability to identify readiness cues and feeding techniques often became a game amongst the day shift and the night shift. Comments such as, "look at Baby M. – he is awake, alert and sucking on his hand – I think it is time to nipple feed him," or "Night shift can feed a stone" were often heard throughout the unit.

At times it was burdensome for the staff if two infants demonstrated hunger cues at the same moment in time. Nurse: infant staffing ratios for the twenty bed unit is often 1:4. However, the four infant assignments can be onerous depending on the care each infant requires during a particular nursing shift. For example, one nurse could have three infants on the same feeding schedule, multiple medications to be administered, procedures to be done (whether on the unit or off the unit), parent education and another infant requiring extensive lab work to be obtained. All this while trying to identify infant readiness cues and initiate the infant driven feeding protocol. The issue was resolved through teamwork and open communication by trading assignments and sharing the workload.

An initial record of the documentation tool was drafted (Appendix J) by the project leader and revised by the nursing staff without direction. The second tool (Appendix I) demonstrated a clear, concise method of documenting infant cues and caregiver techniques. This document has now been incorporated into the electronic medical record.

The key to successful change and implementation of evidence-based data is education as well as passionate championship for quality care delivery. All neonatal care providers want to deliver the best care they believe in. Colleagues want to see tangible data and proof that whatever is being preached is proven to be effective and that national and international leaders in the fields are promoting the change. Many of the best practices in neonatology (nosocomial infection prevention, nutritional practices such as early total parenteral nutrition, trophic feedings and minimizing extrauterine growth retardation and optimizing growth) are emphasized in neonatal conferences and by

leaders in the field. Convincing colleagues and promoting change for the better is fostered by a learning environment supported by evidence-based literature.

## Project Sustainability

The project completion date was April 2012. Since that time, little work has been performed on maintaining the infant-driven approach to feeding in the Intermediate Nursery at St. Joseph's Healthcare System. Time constraints and regulatory demands prevented the continuance of the project. An ever-changing unit census, a high-volume infant apnea program and a demanding parent population left little time for the project leader to keep a pulse on the infant-driven feeding protocol.

Several key hospital-driven initiatives required the attention of the project leader during implementation of the infant-driven feeding program. Initiatives such as car seat challenges, whole body cooling protocol for hypoxic-ischemic encephalopathy and mandated state-wide screening for critical congenital heart disease pulled attention away from infant-driven feeding practices. Participation in an existing national collaborative to reduce bloodstream infections in the neonatal population added to an already burdensome workload.

In June 2012, an infant car seat challenge program was implemented. All infants under 37 weeks gestation and/or birthweights under 2500 grams were required to undergo a ninety-minute evaluation for apnea, bradycardia and/or oxygen desaturations. The increased frequency of oxygen desaturation or episodes of apnea or bradycardia experienced by preterm and low birth weight infants positioned semireclined in car seats may expose them to increased risk of cardiorespiratory events and adverse neurodevelopmental outcomes (Bull & Engle, 2009). The Academy of Pediatrics (Bull &

Engle, 2009) suggests that preterm infants should have a period of observation of 90 to 120 minutes in a car safety seat before hospital discharge. Educating parents about the proper positioning of preterm and low birth weight infants in car safety seats is important for minimizing the risk of respiratory compromise. This was a huge undertaking which required input from the project leader who is also a Certified Infant Car Seat technician.

Infant driven feeding is a paradigm shift that requires a change in thinking. It takes time to change the feeding culture and build "trust" that this feeding method is safe and effective. Education is key in making infant driven feeding a success. This paradigm is changing and must continue to change if we are to improve long-term feeding outcomes and support the preterm infant's and the family's long-term well-being after neonatal care (Thoyre, 2007).

It is hoped that through staff re-education and awareness of the outcomes of this project that infant-driven feeding will resurface and become a standard of practice at St. Joseph's Healthcare System. Medical and nursing administrative support is present to actualize the goals and aim of this capstone project. A lot of work has been undertaken to have an evidence-based protocol available and bedside nursing staff need to be encouraged to implement the protocol for all infants.

## Plans for the future

Plans for the future involve re-educating the staff on the infant-driven feeding protocol. This will be accomplished through a self-learning module and review of the DVD "Supporting better feeding outcomes: Critical perspectives on co-regulated feeding in the NICU" by Catherine Shaker. An evidence-based practice guideline has been developed as a result of this project and plans are underway to implement in April 2013.

Daily multidisciplinary rounds will be scheduled to identify infants who will benefit from the infant-driven feeding protocol. Infant-driven feeding will be discussed at monthly departmental meetings. It takes time to change the feeding culture paradigm and build trust that this method of feeding is safe.

All new staff members will receive training in infant-driven feeding during the orientation period. Routinely, new staff members undergo a 12-week didactic and clinical orientation period. Discussion with the unit education specialist has occurred and the neonatal education plan has been altered to reflect the practice change. Support from the lactation consultant will be obtained to initiate infant-driven feeding in the breastfeeding family. A certified lactation consultant is involved with every infant admitted to the neonatal intensive care unit at some point during hospitalization and after discharge.

The pre-project and project infants included in this protocol varied on gestational age, birthweight and length of stay. A future project would include matching the project infants with a group of infants having similar demographic characteristics to demonstrate a more reliable comparison to see if the initial project really made a difference. Future research to consider is the effect that cue-based feeding has on extremely low birth weight infants and infants with congenital anomalies.

The initiation of oral feeding should be undertaken after careful, individualized assessment of the NICU infant, keeping multiple factors in mind. The clinical decision to initiate oral feeding should not be solely based on an infant's gestational age. Initiation and management or oral feeds should be done consistently and ideally based on nursing observation of individual infant feeding readiness. Feeding skills develop and mature at different rates in individual infants. The healthy late preterm or preterm infant benefits

from the contingent care giving of the bedside nurse, who progresses feeding based on assessment of the infant. Nurses and other healthcare providers should expect the feeding skills of infants to mature at their own pace as influenced by severity of illness. Extremely premature infants or those with a high morbidity will take longer to transition to full oral feeding and may not reach the 36 – 40 week milestone.

Learning to feed is a key developmental process for the preterm infant. The coordination of sucking, swallowing, and breathing is largely dependent on postconceptional age but may vary from infant to infant. Employing various strategies to facilitate the transition from tube feeding may increase success in breastfeeding, decrease the time to full oral feedings, and shorten the hospital course.

High-quality cue-based feeding in the NICU requires the entire NICU team to move from a volume-driven approach to an infant-guided, coregulated approach. The infant-driven approach to feeding is time intensive and the ideal situation would be to have additional nursing staff members available at the bedside to accomplish this approach to infant feeding. This paradigm is changing, and must continue to change, if we are to improve long-term feeding outcomes and support the preterm infant's and the family's long-term well-being after NICU cares.

Moving away from a volume driven approach toward an infant-driven approach in the NICU is essential for improving feeding outcomes, the infant's well-being, and the parent-infant relationship both during and well beyond discharge from the hospital.

Readiness can no longer be determined by the time on the clock or non-individualized orders in the chart. As bedside caregivers, we must have the skills and knowledge to determine what an infant is telling us at each feeding, respect that

communication and act accordingly. It has been amazing to see these infants achieve full oral feeding safely and more efficiently when their cues are respected and documented clearly.

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# Appendix A
# Letter of Support, Dr. Michael Lamacchia


703 Main Street
Paterson, New Jersey 07503
973.754.2500

April 19, 2011

Institutional Review Board
St. Joseph's Regional Medical Center
703 Main Street
Paterson, New Jersey 07503

Dear Review Board:

Diane McClure, RN, MSN, CCRN, CPNP has submitted her research project entitled "Implementation of an Infant-Driven Feeding Protocol" to me for review.

Upon review, I approve this project.

Cordially,

Michael Lamacchia, MD
Chairman
Department of Pediatrics

ML:pv

# Appendix B
# Letter of Support, Dr. Adel Zauk


703 Main Street
Paterson, New Jersey 07503
973.754.2500

April 11, 2011

Patrick Perin, MD
Chairman, Institutional Review Board
St. Joseph's Healthcare System
Paterson NJ

Dear Dr. Perin,

I would like to take this opportunity to endorse a doctoral capstone project developed by Diane McClure, RN, MSN, CCRN, CPNP. The project is entitled, "Implementation of an Infant-Driven Feeding Protocol."

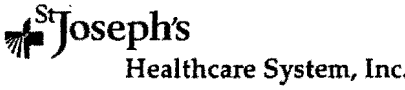
Ms. McClure has the full support of the Division of Neonatology, St. Joseph's Healthcare System. We look forward to the outcomes of this study.

Sincerely,

A Zauk

Adel Zauk, MD, FAAP
Chief, Neonatology
St. Joseph's Healthcare System
Paterson NJ

Appendix C
Letter of Support, Maria Brennan




703 Main Street
Paterson, New Jersey 07503

April 27, 2011

Patrick Perin, MD
Chairman, Institutional Review Board
St. Joseph's Healthcare System
Paterson, NJ 07503

Dear Dr. Perin:

I would like to take this opportunity to endorse a doctoral capstone project developed by Diane McClure, RN, MSN, CCRN, CPNP.

Sincerely,

Maria Brennan RN MSN

Maria Brennan, MSN, RN, CPHQ
Vice President, Patient Care Services
Chief Nursing Officer

Appendix D
Approval letter, St. Joseph's Healthcare System
Institutional Review Board

St Joseph's
Regional Medical Center

703 Main Street
Paterson, New Jersey 07503
973.754.2000

**INSTITUTIONAL REVIEW BOARD**
**(973) 754-2768 FAX (973) 754-4355**
**FWA00001533 IRB00000892 IORG0000560**
**EXPEDITED REVIEW APPROVAL – 2011**

**April 27, 2011**

**Diane McClure, RN, MSN, CCRN, CPNP**
**St. Joseph's Regional Medical Center**
**703 Main Street**
**Paterson, NJ 07503**

**Dear Ms. McClure:**

**PR#11-026**, "Implementation of an Infant-Driven Feeding Protocol." Approved through expedited review April 27, 2011 by Patrick V. Perin MD.

I have examined your study mentioned above along with its accompanying documents requested for expedited review and have determined that your study meets the conditions for approval through expedited review under 45 CFR 46 and 21 CFR 50, 56. Approval is granted.

As you know, the IRB is also responsible for monitoring the conduct of your project. This approval will be TERMINATED on April 27, 2012. Any project classified as TERMINATED –ALL ACTIVITY MUST CEASE. To that end, if it is your intention to continue this project beyond its approval date we require a written report approximately 1 month prior to it's TERMINATION date requesting its continuation. In addition, any circumstances, positive or negative of such importance as to warrant the immediate attention of the Board, **MUST** be reported immediately. Should this study be completed, please submit a closure letter along with any findings to the IRB.

Thank you for presenting this study for expedited review and I hope that your efforts in the proposed area of research you are conducting is fruitful and rewarding.

Yours truly,

Patrick V. Perin, MD
Chairman, Institutional Review Board
**PVP/lh**

Appendix E
Approval letter, St. Joseph's Healthcare System Medical Board

St Joseph's Healthcare System

St. Joseph's Regional Medical Center
Medical Staff Office
703 Main Street
Paterson, NJ 07503
(973) 754-2770 phone
(973) 754-2772 fax

St. Joseph's Wayne Hospital
Medical Staff Office
224 Hamburg Tpk.
Wayne, NJ 07470
(973) 956-3388 phone
(973) 956-3387 fax

May 24, 2011

Diane McClure, APN
SJRMC-NICU
703 Main Street
Paterson, NJ 07503

Dear Ms. McClure:

Please be advised that your **Protocol: PR#11-026, "Implementation of an Infant Driven Feeding Protocol"** was approved previously by IRB and endorsed by the Medical Board at its meeting on May 23, 2011.

You may go ahead with this project. Please accept our best wishes for your success with this endeavor.

Sincerely,

John Ambrose, MD
Medical Staff President

# Appendix F
# Permission letter, Kara A. Waitzman



**McClure, Diane**

**From:** Diane McClure [dmc827@verizon.net]
**Sent:** Monday, January 21, 2013 7:33 AM
**To:** McClure, Diane
**Subject:** FW: permission to use IDF scales
**Attachments:** image001.jpg; IDFS permission for St. Joseph's New Jersey.doc

**From:** Kara Ann Waitzman [mailto:Kwaitzman1@earthlink.net]
**Sent:** Monday, April 11, 2011 6:32 PM
**To:** 'Diane McClure'
**Subject:** permission to use IDF scales

Diane
It was nice to talk with you on Friday and I am so impressed with your continued pursuit of clinical improvement! I am attaching the permission letter for your hospital to use the Infant-Driven Feeding Scales©. Keep me posted on what your administration decides about education. I hope you have safe travels on Wednesday.
Sincerely
Kara Ann Waitzman, OTR/L, CIMI
President, Creative Therapy Consultants
8540 Wildcat Rd
Tipp City, OH 45371
937-604-0856
www.creativetherapyconsultants.com

April 10, 2011

Diane McClure,RN MS N CCRN CPNP
Neonatal Advance Practice Nurse
NICU
St. Joseph's Children's Hospital
703 Main Street
Paterson, NJ 07503

Susan Ludwig, OTR/L and Kara Ann Waitzman, OTR/L grant permission to the NICU at St. Joseph's Children's Hospital in Paterson, New Jersey (a division of St. Joseph's Healthcare System) to use the Infant-Driven Feeding Scales™ (IDFS). We do ask that your feeding policy and/or documentation state they were 'reprinted with permission from Kara Ann Waitzman, OTR/L, CIMI and Susan Ludwig, OTR/L '

The IDFS discussed are as they appear in the September 07 issue of Newborn and Infant Nursing Reviews.

We have found that implementation of the IDFS has been most successful in NICUs that make unit-wide education a priority regarding changing the culture of feeding in the unit as well as actual use of the scales. This education is provided by Kara Ann Waitzman and Sue Ludwig through Creative Therapy Consultants at www.creativetherapyconsultants.com.

Best of luck to you and please feel free to contact us via email with any questions!

Sincerely,

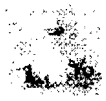
Sue Ludwig, OTR/L
Kara Ann Waitzman, OTR/L, CIMI
karawaitzman@infantdriven.com

Appendix G
Staff education
Infant Driven Feeding Protocol

3/1/2013

## INFANT DRIVEN FEEDING PROTOCOL

Diane McClure RN MSN CCRN CPNP
Capstone Project
Seton Hall University
Doctorate in Nursing Practice
April 2013



## Objectives

- To understand the importance of evaluating and individualizing infant feeding readiness and feeding quality
- To gain insight in understanding the importance of providing a safe and pleasurable feeding experience
- To understand the importance in building autonomy for those involved in infant feeding
- To gain knowledge on the journey taken to implement a feeding policy/protocol in the NICU

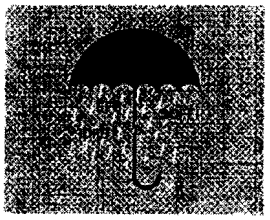
## Why cue based feeding?

- Benchmarks used by parents to measure parenting success (especially mom)
- Hot topic nursing/medical journals
- Infant driven feedings
- Cue based feedings
- Best practice
- Decrease LOS

## Cue based feeding

- Cue based feeding is defined as nipple feedings initiated in response to the infant's behavioral cues and ends when the infant demonstrates satiation (Tosh and McGuire, 2007).
- A cue is a "signal to speak or act; a prompt or reminder; or a response-producing stimulus" (Encarta World Dictionary, 2009).

## Cue based feeding



## Principles of Good Feedings

- Partner with parents
  - Feeding choice (breast/bottle)
  - Feeding discharge plans (transition)
  - Evaluate safe home bottles/nipples
- Safe, pleasurable environment
  - Feeding is a social event!
  - Positioning: stability, alignment, flexed, comfortable
  - Guide/pace feedings
- Nutrition
  - Provide adequate calories/nutrients

3/1/2013

## Review of Literature

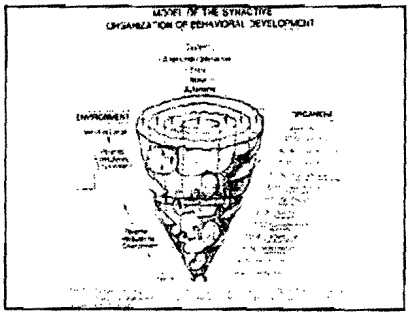
- Initiation of oral feeding is feasible before 33 weeks post menstrual age
- There is a relationship between the achievement of full oral feeds and the timing of hospital discharge
- Full oral feedings can be attained when infants provide cues to regulate feeding schedule

## Review of Literature

- Non nutritive sucking accelerates the transition from tube to oral feedings
- Oral stimulation may accelerate and improve outcomes related to oral feedings

## Theoretical Perspective Heidelise Al's Synactive Theory of Development

- This framework emphasizes the integration of the physiologic and behavioral systems and how the maturing infant balances input from the environment while coping with the internal physiologic demands
- Subsystems: autonomic, motor, state, attention/interactions, self-regulatory




## Subsystems of Functioning

- ***Motor*** - tone, movement, activity and posture
- ***Autonomic*** - basic physiologic functioning of body; skin color, tremors/startles, heart rate, respiratory rate
- ***States*** - level of CNS arousal; sleepy/drowsy, awake/alert and fussing/crying
- ***Attention/interaction*** - ability to interact; alert; robustness of interaction
- ***Self -regulatory*** - presence and success of infant's efforts to achieve and maintain a balance of the other four subsystems

## Infant Feeding Factors

- Nonnutritive sucking (NNS) is elicited when an infant sucks on a pacifier, a hand or another object without transfer of liquid
- Nutritive sucking pattern (NS) requires a coordinated, rhythmic pattern of sucking, swallowing and breathing (SSB).

3/1/2013

## Infant Feeding Best Practices

- Universe of Developmental Care Model
  - Nonnutritive sucking offered with each non oral feeding contingent on infant's state
  - Assessment of readiness cues and the quality of oral feeding is documented with each oral feeding encounter
  - Education regarding the benefits of breast milk is provided and family choice supported

## Best Practice (continued)

- Transitioning to oral feedings
  - Based on physiologic maturity, not gestational age or weight
  - Use methods to support transition to breastfeeding
- Discharge planning and post-discharge nutrition
  - Establish post-discharge nutritional needs and plan
  - Facilitate post-discharge transition to direct breastfeeding

## SJ Feeding Goals

- Preterm infants demonstrate competent oral feeding skills
- Infant driven model (cue-based)
  - Feedings safe, functional, nurturing, individualized and developmentally appropriate
- PO all prescribed volume (15-20 mins)
- Maintain a steady weight gain
- Precise coordination of SSB maintaining physiologic stability

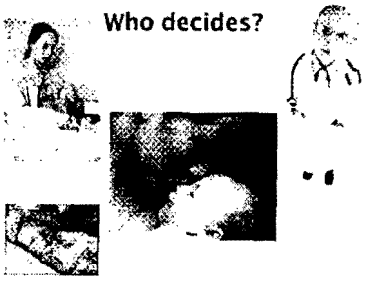
## SJRMC Feeding Goals

- Parents comfortable & ready!
- Appropriate follow-up with SLP if warranted
- Improved communication between providers
- Innovative protocol that provides autonomy for the team!

## Feeding Readiness Cues

- Good muscle tone
- Ability to engage in sucking patterns
- Ability to maintain oxygen saturations
- Feeding without apnea episodes
- Awake, alert

## Who decides?



3/1/2013

## The Baby's Plan (Infant-Driven)

## OR . . . .

## Behavioral Cues = Communication

## Physiologic Cues

- STABILITY
  - SMOOTH RESPIRATIONS
  - PINK/EVEN COLOR
  - STABLE OXYGEN SATURATIONS
  - COORDINATION OF SUCK/SWALLOW/ BREATHE SEQUENCE
- STRESS
  - APNEA/TACHYPNEA
  - COLOR CHANGES
  - NASAL FLARING
  - STERNAL RETRACTIONS
  - YAWNING/SNEEZING
  - SHALLOW BREATHS

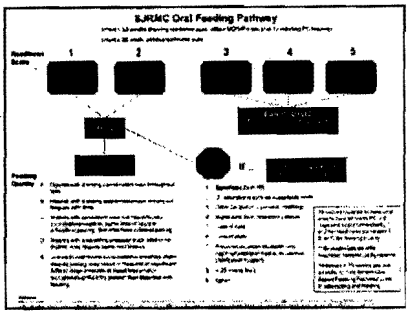
## Motor Cues

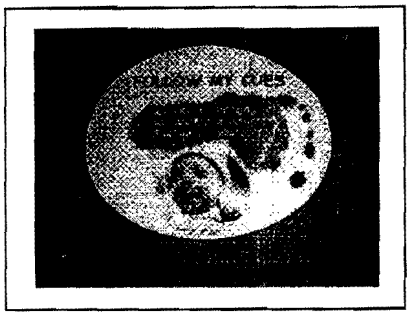
- STABILITY
  - GRASPING
  - ROOTING/SUCKING
  - HANDS TO MOUTH
  - FLEXION
  - SMOOTH MOVEMENT
- STRESS
  - ARM SALUTES
  - FINGER SPLAYS
  - LEG BRACING
  - FLACCIDITY
  - TONGUE TIP ELEVATION

## State Control Cues

- STABILITY
  - ALERT
  - SEEKS AUDITORY & VISUAL STIMULI
  - EYE CONTACT
  - DEEP SLEEP
  - CALM/ANIMATED
- STRESS
  - DROWSY
  - GRIMACING
  - DISORGANZIED
  - AWAKE BUT DULL
  - HYPER-ALERT

3/1/2013



## Distress Signals

| | |
|---|---|
| Bradycardia | Flaccid tone |
| Sneezing | Hyperextension of extremities |
| Yawning | Grimacing |
| Gagging | Finger splaying |
| Tremors or twitching | Arching |

## Distress Signals

- State -Related Stress
  - Diffuse sleep or awake states
  - Eye aversion
  - Irritability
  - Crying
  - Staring

## NICU Experience

- Requires expertise of nursing staff
- Team approach
- Lost amongst chaos/routines
- Families lack understanding infant behaviors/state regulation
- Medicine/nursing lack respect of achievement
- Managed care
  - "Just a grower/feeder"
- Difficult eaters affect family!

3/1/2013

## Hypothesis

- To assess the effect of an evidence based feeding protocol for infants using infant hunger cues versus feeding prescribed volumes at scheduled intervals on growth rates and the time to hospital discharge.
- It is anticipated that infants will demonstrate an average weight gain of 15 to 30 grams/ day.

## Methodology

- Infants admitted to the NICU at SJRMC with gestational ages greater than 32 weeks
- Study commences September 1, 2011 and concludes April 30, 2012
- Signed informed consent is not required since there is no perceived risk to the infant and there will be no release of identifying data

## Project Description

- Target infants will be 33 to 36 weeks post conceptual age
- Nursing staff will be educated on accurate assessment of readiness for oral feedings in the neonate
- Journal articles will be provided in the unit as resources on protocols and behavioral cues
- A cue-based tracking tool will be used for documentation and analysis

## Procedure

## The Pathway.....

- Begins once the baby is $\geq$ 32 weeks and is tolerating full enteral gavage feedings
- Is designed for oral feeding initiation advancement based on the baby's behavioral readiness signs and hunger cues
- Is to be managed by the bedside nurse

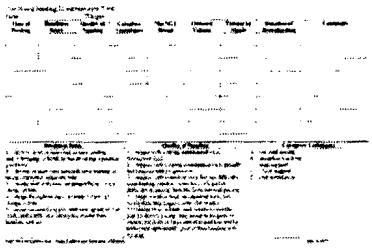
## Behavioral Readiness

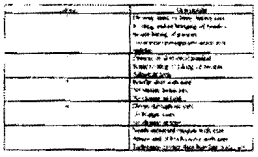
- Tolerating full enteral feedings
- Tolerating skin-to-skin contact
- Able to sustain non-nutritive sucking on pacifier
- Able to transition to an alert state
- Respiratory rate <70

3/1/2013

## Hunger Cues

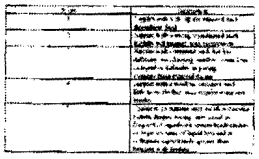
- Going from a sleep to an awake state
- Hands to mouth
- Sucking motion of mouth
- Rooting
- Sucking on a pacifier





## Infant Feeding Readiness Scale

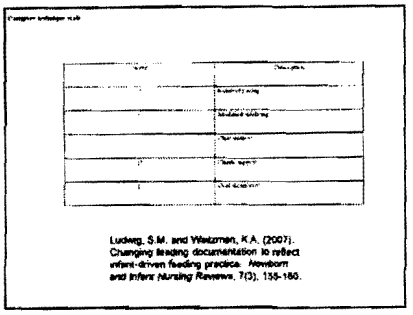
- Scores of 1 or 2 - infant should be nipple fed
- Infants will be assessed prior to every feed
- Scoring continues until infant on full nipple or breast feeding
- Scores documented on the infant feeding assessment form in the medical record
- Obtain order for 'cue-based' feeding when scores consistently 1 or 2



## Quality of Nippling Scale

- Observe infant's behaviors during nippling feeding
- Scoring continues until infant on full nipple or breast feeding
- Scores documented on infant feeding assessment record
- Scores of 4 or 5 may warrant consult with feeding team

3/1/2013



Ludwig, S.M. and Weitzman, K.A. (2007). Changing feeding documentation to reflect infant-driven feeding practice. *Newborn and Infant Nursing Reviews*, 7(3), 155-160.

## Caregiver Techniques

- Used to aid in feeding
- Beneficial for subsequent staff members and parents
- Provides consistency for infant
- Documented on infant feeding assessment record in medical record

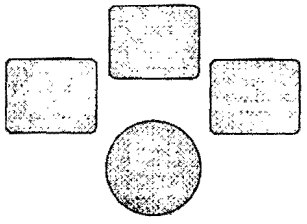
## Potential Benefits

- Shorten length of stay
- Earlier transition to full nipple feedings
- Decreased incidence of oral aversion
- The infant controls the feeding progress
- The breast feeding experience is improved as evidenced by the infant's ability to latch on and nurse

## Potential Risks

- Poor feeding
- Poor weight gain
- Increased stress and potential for failure
- Bradycardia, apnea
- Decreased oxygen saturations
- Feeding intolerance with higher risk for lung aspiration

## Sensitive Indicators



## Nippling Successfully?

- **Successful implies:**
  - The ability to take all of the prescribed volume by mouth
  - The entire prescribed volume taken within 20 minutes without adverse events
    - Adverse events: oxygen saturation dropping $\geq 5\%$ of baseline values or bradycardia, heart rates $< 100$
  - Maintaining a sustained pattern of weight gain

3/1/2013

## Relevance to Nursing Practice

- Nurse autonomy
- Developmental support
- Sensitive caregiving
- Applying evidence based practice in clinical setting
- Educating parents about behavior responses

## Future Research

- Infants with a complicated medical course
- Infants with high index for morbidity
- Extremely low birth weight premature infants
- Infants with congenital anomalies

## Expected Outcomes

- Reach transition from full tube to oral feedings by 32 to 34 weeks post-conceptual age
- Achieve full oral feedings by 35 to 37 weeks
- Have consistent weight gain
- Decreased length of hospital stay

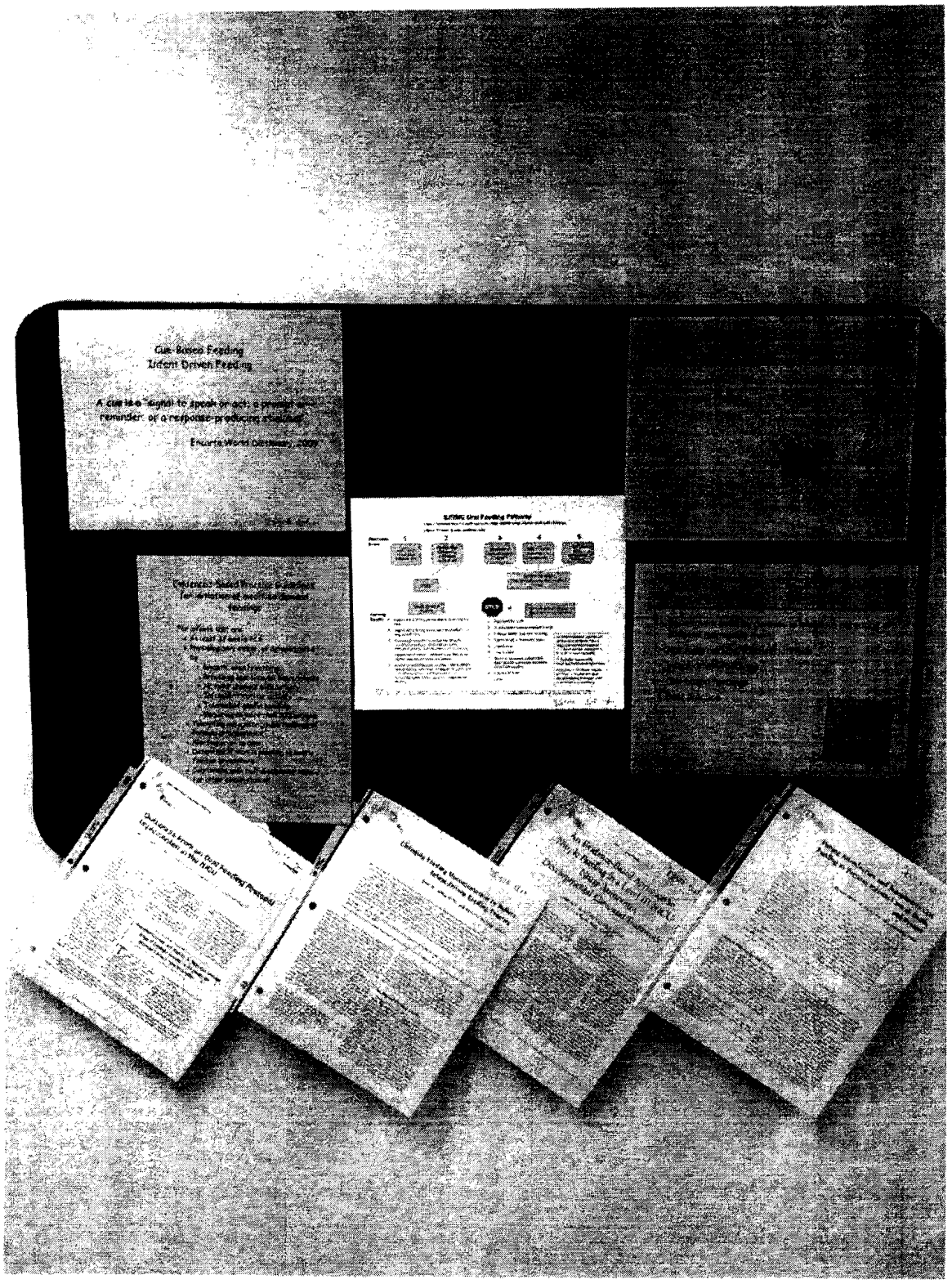
Can a baby be autonomous ?

## Assist families in becoming the best possible advocate for their child!

Who really needs to know how to feed the baby?

Thank you!

Appendix H
Bulletin board



Appendix I
Infant Driven Feeding Scales

Infant-Driven Feeding Scales

**Feeding Readiness Scale**

| Score | Description |
|---|---|
| 1 | Drowsy, alert, or fussy before care<br>Rooting and/or bringing of hands to mouth/taking of pacifier<br>Good tone (presupposes autonomic stability) |
| 2 | Drowsy or alert once handled<br>Some rooting or taking of pacifier<br>Adequate tone |
| 3 | Briefly alert with care<br>No hunger behaviors<br>No change in tone |
| 4 | Sleeps throughout care<br>No hunger cues<br>No change in tone |
| 5 | Needs increased oxygen with care<br>Apnea and/or bradycardia with care<br>Tachypnea greater than baseline with care |

**Quality of nippling scale**

| Score | Description |
|---|---|
| 1 | Nipples with a strong coordinated suck throughout feed |
| 2 | Nipples with a strong coordinated suck initially but fatigues with progression |
| 3 | Nipples with consistent suck but has difficulty coordinating swallow, some loss of liquid or difficulty in pacing<br>Benefits from external pacing |
| 4 | Nipples with a weak/inconsistent suck, little to no rhythm, may require some rest breaks |
| 5 | Unable to coordinate suck-swallow-breathe pattern despite pacing, may result in frequent or significant apneas/bradycardias or large amounts of liquid loss and/or tachypnea significantly greater than baseline with feeding |

**Caregiver technique scale**

| Score | Description |
|---|---|
| A | External pacing |
| B | Modified sidelying |
| C | Chin support |
| D | Cheek support |
| E | Oral stimulation |

Ludwig, S.M. and Waitzman, K.A. (2007). Changing feeding documentation to reflect infant-driven feeding practice. *Newborn and Infant Nursing Reviews*, 7(3), 155-160.

Appendix J
Original draft of the documentation tool for infant assessment
Infant Feeding Documentation Tool

| Name: _____ Date: _____ GA: _____ Adjusted age: _____ Number of days of oral feeding: _____ | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | | | | | | | | | | | | | | |
| **State**<br>Prior to Disturbed<br>Prior to Feed | | | | | | | | | | | | | | |
| **Engagement/Readiness Cues/Feeding skills**<br>Rooting | | | | | | | | | | | | | | |
| Mouthing | | | | | | | | | | | | | | |
| Sucking | | | | | | | | | | | | | | |
| Crying | | | | | | | | | | | | | | |
| Active | | | | | | | | | | | | | | |
| Suck,swallow,breathe coordination | | | | | | | | | | | | | | |
| Effective latch | | | | | | | | | | | | | | |
| Other | | | | | | | | | | | | | | |
| **Disengagement/Distress cues/Feeding difficulties**<br>Change in heart rate, oxygen saturation, apnea | | | | | | | | | | | | | | |
| Increased work of breathing | | | | | | | | | | | | | | |
| Suck,swallow,breathe incoordination | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fatigue/decreased tone | | | | | | | | | | | | | | |
| Irritable | | | | | | | | | | | | | | |
| Other | | | | | | | | | | | | | | |
| Interventions<br>Side-lying | | | | | | | | | | | | | | |
| External pacing | | | | | | | | | | | | | | |
| Increase in oxygen | | | | | | | | | | | | | | |
| Discontinue oral feed | | | | | | | | | | | | | | |
| Other | | | | | | | | | | | | | | |
| Method of feed | | | | | | | | | | | | | | |
| Amount taken per method | | | | | | | | | | | | | | |
| Length of oral feed | | | | | | | | | | | | | | |
| Fed by parent/nurse | | | | | | | | | | | | | | |
| RN initials | | | | | | | | | | | | | | |

Method of feed: Br (breast); B (bottle); T (NG or OG tube)
State: 2 (deep sleep); 3 (active sleep); 4 (drowsy); 5 (quiet alert); 6 (active awake); 7 (crying)
Increased work of breathing: 1 (panting); 2 (chin tugging); 3 (nasal flaring/blanching)
Suck, swallow, breathe concerns: 1 (loss of bolus); 2 (gulping); 3 (coughing)

Adapted from Premji, S.S., McNeill, D.A., & Scotland, J. (2004).

Appendix K – Revised documentation tool for infant feeding assessment

Cue Based Feeding Documentation Tool

Date Weight

| Time of Feeding | Readiness Score | Quality of Nippling | Caregiver Techniques | Nip/NGT Breast | Ordered Volume | Volume by Nipple | Duration of Breastfeeding | Comments |
|---|---|---|---|---|---|---|---|---|
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| Readiness Score | Quality of Nippling | Caregiver Techniques |
|---|---|---|
| 1 = drowsy, alert or fussy before care; rooting and/or bringing of hands to mouth/taking a pacifier; good tone<br>2 = drowsy or alert once handled; some rooting or taking of pacifier; adequate tone<br>3 = briefly alert with care; no hunger behaviors; no change in tone<br>4 = sleeps throughout care; no hunger cues; no change in tone<br>5 = needs increased oxygen with care; apnea and/or bradycardia with care; tachypnea greater than baseline with care | 1 = nipple with a strong coordinated suck throughout feed<br>2 = nipples with a strong coordinated suck initially but fatigues with progression<br>3 = nipples with consistent suck but has difficulty coordinating swallow, some loss of liquid or difficulty in pacing; benefits from external pacing<br>4 = nipples with a weak/inconsistent suck, little to no rhythm, may require some rest breaks<br>5 = unable to coordinate suck-swallow-breathe pattern despite pacing, may result in frequent or significant A/Bs or large amt of liquid loss and/or tachypnea significantly greater than baseline with feeding | A = external pacing<br>B = modified sidelying<br>C = chin support<br>D = cheek support<br>E = oral stimulation |

Appendix L
Parent satisfaction survey

St. Joseph's Healthcare System
Paterson New Jersey

Parent Satisfaction Survey
Infant-Driven Feeding

How are you feeding your baby?
_____breastfeeding only _____bottlefeeding only _____both

How old was your baby when he/she received their first feeding of breastmilk or formula?
_____days

How long did it take for your baby to reach full oral feeds (when your infant no longer had an IV)?
_____days or _____ weeks or _____months

Was your baby offered a pacifier during his/her stay in the NICU?
_____yes or _____no

On a scale of 1 (strongly agree) to 4 (strongly disagree), please answer the following questions:

| | 1 Strongly Agree | 2 Agree | 3 Disagree | 4 Strongly Disagree |
|---|---|---|---|---|
| I was encouraged by my baby's nurse to participate in feeding my baby. | | | | |
| I was encouraged to do Kangaroo Care with my baby. | | | | |
| The nurses taught me cues or signs for when my infant was hungry. | | | | |
| I was given enough information about feeding my baby before I brought him/her home. | | | | |

Adapted from York Hospital NICU Discharge Survey 2008.