

**IMPLEMENTING A CUE BASED FEEDING PROTOCOL  
AND STAFF EDUCATION PROGRAM IN THE  
NEONATAL INTENSIVE CARE UNIT**

by

Jennifer L. Crouse Hood

An education leadership portfolio submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Education in Educational Leadership

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## **DEDICATION**

“There is no foot too small that it cannot leave an imprint on the world.”

- Albert Jackson

This project is dedicated to all the babies I have had the pleasure of working with, and all the future babies I will have the chance to meet. I can only hope that I have touched your lives the way you have inspired me to complete this work. This is only the beginning and I promise to never stop fighting for what is best for you.

“Some people say they could never work with sick kids, but for me it’s the opposite. They have this will to survive that is so strong. They never give up. You can’t ask for anything more than that.”

- Rosemary Levington

## TABLE OF CONTENTS

LIST OF TABLES.....	x
LIST OF FIGURES .....	xi
ABSTRACT.....	xxii

### Chapter

1 INTRODUCTION.....	1
2 PROBLEM ADDRESSED.....	3
3 IMPROVEMENT STRATEGIES.....	8
4 IMPROVEMENT STRATEGY RESULTS.....	28
5 REFLECTIONS ON IMPROVEMENT EFFORTS .....	39
6 REFLECTIONS ON LEADERSHIP DEVELOPMENT.....	49
REFERENCES .....	54

### Appendix

A IMPLEMENTING A CUE BASED NICU FEEDING PROTOCOL.....	60
B LITERATURE REVIEW AND STAFF WEBSITE .....	84
C LOGIC MODEL.....	116
D ORGANIZATIONAL CHART.....	117
E CUE BASED FEEDING PROTOCOL COMPARISON CHART .....	120
F AREA NICU SURVEY .....	127
G PRE- AND POST-CUE BASED FEEDING KNOWLEDGE SURVEY.....	136
H FOCUS GROUPS .....	158
I FEEDING OBSERVATIONS.....	171
J CUE BASED FEEDING BEDSIDE SCORING AUDITS.....	178
K UMMC CUE BASED FEEDING PROTOCOL AND GUIDELINES.....	180
L STAFF CUE BASED FEEDING TRAINING MODULE .....	196
M STAFF IMPLEMENTATION RESOURCES .....	201
N UNIT POSTER DISPLAY.....	208
O IRB APPROVAL LETTER.....	209



## LIST OF FIGURES

Figure C1	Logic Model .....	116
Figure D1	Organizational Chart.....	119
Figure E1	Venn Diagram Protocol Comparison.....	126
Figure F1	Standardized Protocols Utilized on Units Surveyed.....	128
Figure F2	PO Feeding Initiation Determination.....	129
Figure F3	Feeding Success Matters.....	131
Figure G1	Years' of Medical Experience of UMMC NICU Staff.....	136
Figure G2	Years' of NICU Experience of UMMC NICU Staff .....	137
Figure G3	Percentage of Staff Identifying Indicators of Stress.....	138
Figure G4	Cue Based Feeding Tenets.....	139
Figure G5	Faster Flow Nipple Utilization.....	141
Figure G6	Staff Understanding of Infant Events During Feedings.....	142
Figure G7	Staff Understanding of Chin and Cheek Support.....	143
Figure G8	Staff Response to a 33-week old sleepy Infant.....	144
Figure G9	Feeding Appropriateness for 32-week Infant with Stress Cues.....	146
Figure G10	Appropriateness to feed 33-week old Infant with Active Rooting.....	147
Figure G11	Appropriateness to continue feeding with Stress Cues.....	148
Figure G12	Staff Confidence Level in Assessing Readiness.....	149
Figure G13	Staff Confidence Level in Recognizing Stress and Instability.....	150

Figure G14	Staff Confidence Level in Responding to Stress and Instability .....	151
Figure I1	Cue Based Strategies Observed.....	172
Figure I2	Volume Driven Strategies Observed.....	173
Figure K1	Cue Based Clinical Decision Making Protocol.....	193
Figure K2	Cue Based Algorithm.....	194
Figure K3	Cue Based Feeding Algorithm.....	195
Figure L1	Powerpoint Education Module.....	198
Figure M1	Cue Based Feeding Reminder Sheet.....	202
Figure M2	Cue Based Feeding Staff Handout.....	203
Figure M3	Traffic Light Feeding Cues Handout.....	204
Figure M4	Cue Based Feeding Go Live Reminder Sheet.....	205
Figure M5	Rounding Script.....	206
Figure M6	Staff Lounge Display.....	207
Figure M7	Feeding Strategy Room Sign.....	207
Figure M8	Cue Based Feeding Handbook.....	207
Figure M9	RN Station Sign.....	207
Figure N1	Poster Regarding Cue Based Feeding Project Results.....	208

## **LIST OF TABLES**

Table A1	Description of Planned Artifacts.....	78
Table E1	Cue Based Feeding Comparison Chart.....	122

## **ABSTRACT**

The overarching aim of this Education Leadership Portfolio (ELP) is to describe current best practices in premature infant feeding, construct a new protocol for cue based feeding for our Neonatal Intensive Care Unit, and devise an educational module for staff training, to improve the utilization of developmentally supportive feeding techniques and to standardize care. The end goal of this project was to ensure our staff were providing evidence-based interventions, in a consistent manner.

A variety of strategies were used in carrying out this effort. I first reviewed research, completed a protocol comparison chart, and surveyed feeding procedures used in other NICUs. All of these helped me to understand the problem in general. To address the problem on our unit, I decided I needed to collect more information about the current feeding procedures used in our unit, as well as capture staff knowledge and attitudes about cue based feeding. To gather this information, I conducted focus groups, developed and asked staff to complete a knowledge-based survey, and observed their feeding practices. Based on these, a formalized protocol and guidelines were developed along with an education module including development of staff resources to support the implementation of the protocol and guidelines, as well as to support effective staff training.

The protocol was then implemented for two months. After this implementation period, I assessed our progress by conducting a second round of focus groups, a post knowledge survey, feeding observations, feeding session audits, and a poster, to convey results of the project to staff. Based on the results we were able to see a culture shift on our unit regarding feeding. Staff members were able to more consistently identify stress cues and appropriately respond to them, and were observed to utilize developmentally supportive cue based strategies more often during feeding interactions. Feeding is a daily topic of conversation and our team is more consistently documenting and discussing feeding readiness and quality in relation to the feeding progression of infants in our care. Results also helped us to identify several areas of program development to continue to improve our efforts to shift our unit to a cue based feeding model.

The information found in this project will help expand other evidence-based research initiatives regarding infant feeding and nutrition. The data will also be used to improve our initial implementation efforts in regard to cue based feeding on our unit.

## **Chapter 1**

### **INTRODUCTION**

This portfolio project addressed the process of creating and implementing a cue based feeding protocol, including a staff education program, at the Neonatal Intensive Care Unit (NICU) at University of Maryland Medical Center (UMMC). As a Speech-Language Pathologist (SLP) within this unit, there was significant interest, and need, to address the growing concern regarding consistent feeding practices that aligned with currently accepted evidenced-based best practice, in targeting the oral feeding development of premature infants. Prior to implementation of this standardized protocol, a wide variety of approaches were utilized on the unit, with no consistent practices among nursing and medical staff. This often lead to confusion among nurses, therapists, doctors, and parents, impacting the patients' ability to feed effectively and safely, and sometimes prolonging discharge from the facility.

Previously, NICU practices have focused more on volume driven feeding, with the sole goal of a certain volume intake each day, regardless of how the infant consumed that volume. However, research has now demonstrated the importance of cue based or Infant Driven Feeding©, encompassing not only the quantity the infant consumes, but also the quality of the feeding (Shaker, 2013; Ludwig & Waitzman, 2014; Wellington & Perlman, 2015; Thoyre, Hubbard, Park, Pridham, & McKechnie, 2016). The overarching aim of this project was to describe current best practices in premature infant feeding, construct a new protocol for cue based feeding for our NICU, devise an educational module for staff training, to improve the utilization of

developmentally supportive feeding techniques, and to standardize care provided on our unit.

To accomplish this goal, multiple strategies were used to build my understanding of the problem, design and implement solutions to the problem, and then assess their effectiveness. First, to understand the problem a literature review, organizational chart, protocol comparison chart, logic model, and an area NICU survey regarding feeding procedures on other units, were completed. Once I was able to understand the basic problem, additional data were collected about feeding practices via focus groups, knowledge-based surveys, and feeding observations to understand current practices, staff knowledge, and staff attitudes related to feeding. The results of the literature review along with the data collected in our unit were used to develop a formalized cue based feeding protocol and guidelines, as well as education modules, including development of staff resources, to support implementation. The protocol was then implemented for two months. After this implementation period, I assessed our progress towards the objectives.

The portfolio includes six additional chapters. Chapter 2 further describes the problem addressed, including the organizational context and the overall goal for the project. Chapter 3 presents the strategies I used to address the problem. Chapter 4 reports on the results of these strategies in implementing cue based feeding in our unit. Chapter 5 reflects on the efficacy of the improvement efforts and makes recommendations for next steps to continue progress on the unit. Reflections on my development as a leader are summarized in Chapter 6. References and appendices complete the document, including the initial project proposal, and all artifacts completed as portions of this project.

## **Chapter 2**

### **PROBLEM ADDRESSED**

At the onset of this project, our NICU did not have an established standardized feeding protocol, or training program, to educate staff regarding feeding best practices. Methods varied drastically from nurse to nurse and a variety of feeding practices were implemented by staff. Research on feeding practices has changed over the years from a volume driven culture, where the sole focus of feeding was the volume of intake, to an infant driven culture, focusing more on the quality of the feeding, including physiological stability and infant communication cues, to gauge the success of the feeding. Although the research has demonstrated and supported these findings, the transfer to consistent clinical practice has been much slower.

With volume driven feeding, the sole indicator of successful feeding is the amount ingested, while cue based feeding focuses on the infants' cues, and allows the infant to determine when a feeding is offered and when a feeding is stopped. This method as described by Ludwig and Waiztman (2014) utilizes each infant's developmental level and maturity to guide decisions before, during, and after feedings. With this approach, caregivers allow the infant to communicate self-regulation and physiological stability, leading to more efficient feedings. Gavage feeding, where the remainder of the feeding is provided through a feeding tube, is utilized until the infant can consistently take in their needed volume in positive, safe feedings.

Prior to this project feeding on our unit was primarily approached in the context of a volume driven culture, with the only indicators of success being empty bottles and



weight gain. Despite therapists trying to educate and demonstrate cue based practices, nurses were often pressured to utilize more volume driven strategies such as faster nipples, chin/cheek support, and feeding past distress cues, in a well-intentioned effort to empty the bottle, while not developmentally supporting the infant.

Because our unit does not discharge babies home with nasal feeding tubes, the baby must be either taking full oral feeds, go to a rehabilitation facility, or undergo surgery for placement of a gastrostomy tube as a longer term alternative nutrition for discharge home. These options are not ideal. This initiative involved creating and implementing a developmentally supportive model of cue based feeding, to support our babies, with the best evidenced-based clinical methods. Adoption of a protocol standardizing the approach to feeding was expected to yield more consistent intervention practices. Using a standardized cue based approach aligns with the mission and vision of the hospital, to provide evidence-based, state-of-the-art medicine, to our most delicate patients. Development of a standardized protocol would also allow us to improve developmental and health outcomes for these patients.

### **Organizational Context**

UMMC is in the heart of Baltimore, Maryland. The mission of the hospital includes delivering superior healthcare, while training the next generation of healthcare professionals, and discovering ways to improve health outcomes not only in Maryland, but across the country. The vision is to provide high value and compassionate care, improving health in Maryland and beyond, educating future health care leaders, and discovering innovative ways to advance medicine worldwide. Specifically, the Children's Hospital's focus includes providing state-of-the-art medicine with family-centered care. There is understanding that children are not merely small adults, which is

why at UMMC they are treated as unique individuals. Aligned with this mission and vision, a brand new state of the art NICU was opened in 2015. The unit is a 52 bed, Level IV NICU, targeting care for the most critically-ill babies. The NICU medical team of doctors, nurses, and support staff, provides care for a wide range of problems from premature birth and congenital heart defects, to breathing issues and kidney problems. The facility cares for twice the number of babies as most community-hospital NICUs, with the experience needed to help even the most critically-ill babies survive and thrive. A specialized transport team helps bring babies via air or ground ambulance to the Children's Hospital for the complex care they need, with babies traveling from all over the Delmarva Peninsula.

Due to the complexity of patients at this facility, they often remain as patients for an extended time, encompassing the period of learning to orally eat. Often, feeding is the last developmental milestone achieved prior to the infant being able to discharge home. Our unit utilized a mixture of feeding approaches centering around the various physicians' theoretical treatment philosophies, and differing methods of implementation by nurses, with wide ranges of clinical experience. These varying treatment practices often left nurses, staff, and families confused, as treatment approaches or methods changed once a doctor was rotated off service, or when shift change occurred. This often led to multiple changes in plans of care, ultimately impacting length of stay and discharge.

The pediatric feeding team, consisting of Occupational Therapists (OTs) and Speech Language Pathologist (SLPs), have previously attempted to construct a feeding protocol utilizing current best practices, focusing on infant driven, cue based feeding. However, the team has faced multiple challenges involving consistent physician

support, staff turn-over leading to inability to focus on protocol development, and lack of therapists' availability to focus on the vast amount of program development and training for physicians, staff, and parents needed for adequate protocol implementation.

### **Organizational Role**

I currently serve as a Pediatric SLP within the Children's Hospital at UMMC. One of my primary roles is as a feeding specialist in the NICU, assessing and treating oral motor and feeding deficits, in premature infants. I work on a team of other feeding specialists, including SLPs and OTs. At my prior place of employment, the feeding team utilized a cue based approach, and I saw great improvement in patient outcomes, and decreased prevalence of aversive feeding behaviors, with movement away from volume driven feeding practices. During my time as a therapist at UMMC, the feeding team tried to integrate cue based feeding into our assessments and treatments and provide nursing and family education regarding the importance of evaluating and responding to infant cues, in relation to feeding. We also communicated with the medical team regarding these practices. However, these practices need to occur on a unit-wide basis, with a more standardized approach, for there to be widespread impact, and to make cue based feeding the normative practice for our unit.

I had not been involved in previous attempts to develop and implement a standardized cue based feeding protocol on this unit, as I have only been employed in this setting for two years. However, I work closely with other members of the feeding team who have previously attempted implementation of a cue based protocol. I assumed a lead role in the development, implementation, and evaluation of the cue based protocol on the unit. I identified a neonatologist to support my efforts, and to have a voice within the neonatology team. The feeding team shared the responsibility of

implementing the staff training and new protocol, and nurses and doctors on the unit also had critical roles in the project. The neonatologists approved the protocol for implementation and were supportive of cue based feeding practices for infants in their care. Nursing staff were responsible for day-to-day implementation. Parents also served as feeders, as one of the tenets of cue based feeding includes training parents in co-regulation, so infants can continue to be efficient and successful feeders at home, following discharge.

This project served as the springboard for a much larger project within our organization regarding infant feeding. The program will be expanded to include parent training, to establish safe discharge plans for infant feeding, encompassing quality feedings with understanding of stability and stress cues. Performance improvement projects will be undertaken to evaluate and compare traditional feeding methods, with cue based methods, for outcome measures such as length of stay, length of time to full oral feeds, and prevalence of feeding difficulties post discharge. This project developed the foundation for a much larger infant feeding and nutrition project.

### **Chapter 3**

## **IMPROVEMENT STRATEGIES**

This project proposed the development of a standardized cue based feeding protocol, and staff training program, to be implemented in the NICU at UMMC. Research has demonstrated such protocols promote consistency among caregivers in the initiation and management of oral feedings (Thomas, 2007; Shaker, 2013). The implementation of this staff training program, and cue based protocol, was intended to enhance the consistency of targeted feeding practices, which in turn was expected to increase positive feeding outcomes for our infants and families. A standardized approach encompassing readiness cues, disengagement cues, and developmentally supportive techniques (Comrie & Helm, 1997; Shaker, 2013) allows focus on delivering developmentally supportive care. These techniques allow our infants to rely on consistent feeding practices, instead of having to re-learn the practices of each different feeder they may encounter during their stay. It was hoped this protocol would also prevent utilization of practices supported by volume driven culture, which may impact infant experiences and development, leading to potential long-lasting feeding aversions.

A variety of strategies were used in carrying out this effort. I first reviewed current research, identified key stakeholders through development of an organizational chart, completed a protocol comparison chart to understand currently available feeding protocols, and surveyed feeding procedures used in other NICUs in the area. All of these helped me to understand the problem in general. To address the problem on our unit, I decided I needed to collect more specific information about the current feeding

procedures used in our unit, as well as staff knowledge and attitudes about cue based feeding. To gather this information, I conducted focus groups, developed and asked staff to complete a knowledge-based survey, and observed their feeding practices. Based on these, a formalized protocol and guidelines were developed, along with an education module including development of staff resources, to support the implementation of the protocol and guidelines and improve effectiveness of staff training. Each of these strategies is briefly described below.

### **Literature Review**

A thorough literature review regarding current evidence in feeding practices for premature infants allowed me to understand the contending approaches available guiding former practice and current evidence-based best practice. The full literature review is contained in Appendix B. Oral feeding is one of the most complex behaviors required for infants. Feeding is especially difficult for babies who are born prematurely, or who have medically complex conditions. Feeding requires integration of multiple body processes, including the coordination of sucking, swallowing, and breathing, while maintaining physiological stability, to prevent adverse events (Bertoncelli et al., 2012). Premature babies demonstrate difficulty with oral feeding, due to differences in muscle tone, state regulation, endurance, and coordination of suck, swallow and breathe behaviors, when compared to full-term babies. Often, preemies lack the ability to coordinate these systems, and may communicate stress during feeding. Two primary schools of thought have guided feeding practices with this population including volume driven and cue based feeding methods.

## **Volume Driven Feeding**

Volume driven feeding includes focus on the infants' ability to ingest a prescribed volume by mouth, within a certain time-frame, with the sole outcome measure being weight gain (Shaker, 2013). This method of feeding often leads to encouragement to eat when the infant may be demonstrating fatigue, instability, or lack of hunger cues/interest. The goal is to get the volume into the baby, with the sole focus on quantity of feeding, versus quality of feeding. This often leads to well-intentioned strategies such as manipulating the bottle, encouraging the infant to continue sucking, feeding when the infant is trending into a sleepy state, providing a faster flow nipple, unswaddling the baby to re-alert them, or providing chin/cheek support to 'help' the infant consume additional volume faster (Shaker, 2013). Even when an infant may display stress cues or changes in physiological stability, the feeding continues to get the baby to consume the entire volume.

While it is vital for infants to ingest a certain volume to maintain calories and gain weight, focusing solely on the volume ingested does not consider the context of important developmental feeding milestones, and maintenance of physiological stability. During this critical developmental period, the baby is devising and making permanent motor and sensory pathways (Shaker, 2013). Volume driven methods of feeding may cause the establishment of negative pathways and responses. Enough negative experiences through utilization of volume driven practices leaves the infant at higher risk for long term altered oral sensitivity, facial or oral defensiveness, oral feeding delays, food refusals, dysphagia, and failure to thrive (Dodrill et al, 2004). This may result in the need for extensive feeding therapy, or in some cases hospitalization, requiring additional time from home or school, further disrupting the family unit.

Given the significance of food in our culture, disruptions in family mealtimes with a child who has significant aversions or restricted intake can result in high stress, and place further pressure on eating, often leading to significant distress for both the child, and the parents.

### **Cue Based Feeding**

Mounting evidence warrants a shift in thinking and practice towards cue based feeding, also known as Infant Driven Feeding© (IDF) (Ludwig & Waitzman, 2007; Browne & Ross, 2013; Shaker, 2013). Cue based feeding utilizes each infant's developmental level and maturity to guide decisions before, during, and after feedings. Ludwig and Waitzman (2007) stressed the importance of utilizing behavioral cues to help guide feedings, allowing the infant to communicate self-regulation and physiological stability, leading to more efficient feedings. The infant is observed in the moment, and the caregiver continuously modifies the approach through individual interventions, to support the infant's stability (Shaker, 2013). Strategies utilized in this method to support developmental feeding practices include selection of a controllable flow rate, utilizing an elevated sidelying position, swaddling to optimize postural control, and avoiding prodding. The goal of the feeding is for the infant to be engaged, without signs of distress. Intake will then improve with development, if the infant's needs are respected.

Protocols allowing the infant to drive the feeding through communication signals support their development toward becoming competent and efficient oral feeders, the goal for all infants. Through this communication, the caregiver anticipates and accommodates the infant's needs. This allows for avoidance of adverse events because the caregiver acts proactively versus reactively. Intake is only viewed within



the context of the infant's development, and is a by-product of a quality feeding, versus the sole goal of a feeding (Shaker, 2013). Research has demonstrated utilizing cue based feeding decreases the amount of time between first oral feed and full oral feeds, provides consistency in feeding practices, increases confidence among caregivers, and lowers healthcare cost by decreasing length of stay and resource utilization (Kirk, Alder, & King, 2007; Ludwig & Waitzman, 2007; Newland, L'Huillier, & Petrey, 2013; Wellington & Perlman, 2015; Thoyre, Hubbard, Park, Pridham, & McKechnie, 2016). These outcomes support a shift in thinking and clinical practice towards cue based feeding methods.

### **Conclusions Impacting Improvement Strategies**

The literature review convinced me that a shift in our unit's thinking and understanding of cue based feeding methods was needed in order to improve infants' oral feeding skills, the unit's consistency in feeding practices, and lower healthcare costs for these families. With pressures in healthcare to cut costs and decrease length of stay, movement towards a cue based protocol could help our infants improve developmental skill acquisition and move towards being home sooner, which is also a good outcome for patients and their families. To make the literature review useful for our team, I created a feeding information website staff can reference to learn more about developmentally appropriate feeding practices. The link for this website can also be found in Appendix B. Once the cue based method was chosen, I developed a logic model to outline the steps I would need to utilize to guide development of the new protocol and education modules for implementation, and an organizational chart to identify key stakeholders within the framework to include and consult during program development.

### **Logic Model and Organizational Chart**

The logic model helped to identify key inputs and steps necessary to address the problem. The full model is contained in Appendix C. It helped define a path forward and laid out the resources needed to address the problem.

The organizational chart assisted in the identification of key stakeholders who would need to be involved in discussions regarding construction and implementation of the cue based feeding protocol. The chart can be found in Appendix D. Discussing the protocol with these parties was essential to gain their support, and to outline critical details of the protocol to ensure their approval. These parties also served as resources to further develop the tenets of our cue based approach from a medical, nursing, nutritional, and rehabilitation perspective. By including all members of the team, each group within our unit was represented, and felt they had a voice at the table. The research was also reviewed to determine currently available feeding protocols to consider when establishing our guidelines.

### **Protocol Comparison**

A protocol comparison chart was utilized to examine currently available cue based feeding protocols identified during the literature review. The complete chart is available in Appendix E. Three protocols were examined including *Support of Oral Feeding for Fragile Infants* (SOFFI) (Philbin & Ross, 2011), *Infant Driven Feeding* (IDF) (Ludwig & Waitzman, 2014), and *Early Feeding Skills Assessment* (EFS) (Thoyre, Shaker, & Pridham, 2005). The protocols were examined for clinical utility, ease of use, and supported research outcomes.

The SOFFI protocol contained very explicit decision making tools; however, there were so many that utilizing them in daily practice was decided to be cumbersome

by our nursing and therapy staff. In addition, SOFFI only addressed bottle feeding, and our unit is also currently working on increasing breastfeeding. Our team did not want to limit staff by choosing a tool that excluded breastfeeding. Components of SOFFI our team decided to incorporate into our program included continually assessing the infant throughout the feeding and discontinuing the feeding if the infant stopped actively participating in the feeding.

The EFS is a comprehensive tool allowing for assessment of a multitude of both skill and quality indicators related to feeding. Because of this, the tool can be easily utilized to track progress of developmental progression of feeding skills. Our team decided this tool might be better utilized in individual cases by feeding therapists, given the length of the tool, requiring scoring of 36 measures, that would be difficult for the nurses to take responsibility of scoring at every feeding. This tool also requires specialized training to administer. The team also felt this tool did not provide as much support for decision making during the feeding. Additionally, the EFS does not currently have any validated research to support effectiveness or reliability of the tool. Both the SOFFI and IDF protocols are supported by research studies demonstrating achievement of oral feedings in significantly less time than those utilizing traditional feeding methods (Horner et al., 2013; Wellington & Perlman, 2015).

IDF had great program tenets including supporting development, changing the feeding culture, and creating positive experiences which resonated with our team. Our team also liked the scoring scales to assess feeding readiness and feeding quality. The scales allow for scoring of both breast and bottle feeding, and provide guidance for supporting non-nutritive sucking experiences if the infant is not developmentally ready for oral feeding. The one downside to the IDF protocol identified by our team was

possible subjectivity of some of the ratings and scorings. Given the number of positives regarding this protocol, the number of other units utilizing this protocol, and the research outcomes, our team decided to use the IDF protocol (Ludwig and Waitzman, 2014) as a framework for our protocol and guidelines. The team decided to address the issues regarding subjectivity by providing ample education during our hands-on sessions, and providing additional scoring practice, to ensure consistency of scoring among staff. We also implemented cue based feeding scoring audits, to validate scores between nurses, during the first few weeks of implementation, with discussion and education if scores did not agree. An area NICU survey helped in understanding feeding practices of other units, to further guide program development and understand methods of other similar units.

### **Area NICU Survey**

I created a survey to gather information related to other NICUs' feeding practices to guide our decision making with protocol development. Questions were devised to collect demographic information about the unit including level of care, number of beds, and who handled feeding on the unit. Additional questions focused on whether the unit was utilizing a standardized protocol for feeding, who determined when feeding was initiated, and what flow rate nipple they utilized for infants. Final questions involved how feeding success was measured on each unit. The specific survey questions are listed in Appendix F.

The survey was emailed to regional NICUs and posted within a professional focus groups for NICU feeding professionals. Thirty-eight units responded to the survey; however, only 33 fully completed the survey. Full results of the survey are contained in Appendix F; salient results are highlighted here. Results indicated that

45% of the units were utilizing a standard protocol of some type, with 12 units utilizing the IDF scale. On 44.7% of the units, infants determined when to initiate feeding based on cues, compared to other units who utilized physician orders (34.2%) or RN judgement (5.0%). This was important to our program because it demonstrated units who choose a standardized protocol were more likely to allow the infant to guide the feeding versus others determining when to initiate feeding. This supported our goal of shifting towards a more cue based feeding culture through development of this standard protocol. No significant differences were found between Level of NICU and who determined initiation of feeding which was surprising, as it was expected neonatologists in higher acuity units would want more control over initiation of feeding, due to the medical complexity of their typical infant populations. This was a concern we had as a Level IV NICU given the medical complexity of our infants. We felt medical providers would want more control over the feeding process versus allowing the infant to drive the feeding despite this being supported in the research.

Finally, results indicated that infant success in feeding was defined as taking prescribed volume at every feeding by 52.6% of units, consistent weight gain by 68.4% of units, feeding across caregivers by 57.8% of units, and infant physiological stability by 50% of units. No significant differences were noted in utilization of a standardized protocol and what determined a successful feeder. This is important because it indicates that education of staff on the importance of a multitude of factors related to the infants' feeding skills is needed. Weight gain is important but it is only a piece of the puzzle, and these results show that despite the use of a more standard protocol, these beliefs due not disappear.

Given the demographics of the survey participants (most of the respondents were level IV nurseries), the results can be successfully generalized to our unit, given most units were Level IV. This survey indicated a large percentage of units are using some form of standardized protocol, and most are utilizing the IDF protocol by Ludwig and Waitzman (2014). This further supported my goal of developing a standardized protocol for our unit, and further solidified the choice of the IDF framework, given the number of other similar units who were utilizing this protocol. These results also helped me determine other specific details of our protocol including utilization of slow flow nipples to start feeding, what age to initiate scoring for feeding readiness, and guidelines for feeding infants requiring respiratory support. These details were essential to include in our protocol to allow for the least amount of subjectivity and to improve consistency among caregivers on the unit. A knowledge-based survey was utilized to measure baseline understanding and attitudes towards cue based feeding.

### **Knowledge-based Survey**

A knowledge-based survey was completed to assess staff knowledge and confidence in cue based feeding techniques. I created this survey with input from the feeding therapy team and two RN representatives. We focused on questions allowing for assessment of cue based feeding knowledge, identification of potential stress cues, opinions and utilization of volume driven strategies, scenario examples involving their response to certain infant cues, and assessment of confidence levels for utilizing cues to initiate feedings, recognize stress cues, and respond to stress cues. The specific survey questions and a summary of all results are available in Appendix G. The survey was completed at the initiation of the project in March 2018, and then again at the completion of education modules and two months of protocol implementation (see

Chapter 4 for these results). The survey included twelve questions, and was sent to staff members including nurses, physicians, and therapists, via a SurveyMonkey link in their email. After completing the survey anonymously, staff members could enter a drawing for a gift card for participating.

### **Participant Demographics**

Ninety of 165 staff members (55.0%) completed the pre-survey. Participants for the pre-survey included 77 nurses, 10 doctors, two feeding therapists, and one nurse practitioner. These participants worked a variety of shifts including day shift, night shift, and mixed/rotating shifts. Years of experience in the medical profession and the NICU ranged from less than one year to over 30 years.

### **Cue Based Feeding Knowledge**

All participants were able to identify the purpose of cue based feeding. Staff demonstrated less recognition of more subtle stress cues including change in alertness, finger splaying, and loss of latch. Staff also demonstrated less understanding of the importance of relationship building within the cue based framework.

### **Current Feeding Practices**

Current feeding practices were also assessed. Some staff identified faster flow nipples as allowing infants to eat faster, potentially decreased energy required to eat, and increased intake, despite this not being supported in research. Faster flow nipples can place infants at risk for desaturation events or instability and can increase the workload. Fast flow nipples should not be utilized for most preterm infants and should first be assessed by a feeding therapist.

Staff also reported in the pre-survey that desaturation events during feedings were normal for premature babies. Even though premature, if supported with the proper

techniques, premature infants should not be demonstrating desaturation events during feeds and if they are, feedings should be stopped to support recognition of these events as a form of stress for the infant. Staff need to understand the importance of these events as indicators of stress and that it is likely the infant demonstrated other stress cues prior to the desaturation events, where a supportive technique may have prevented the event from occurring. Chalking these events up to prematurity is supportive of the volume driven culture to get the volume in no matter the quality of the feeding.

A portion of staff also felt chin/cheek support was not a specialized intervention and would utilize this strategy without it first being assessed by a feeding therapist. Chin and cheek support can increase the flow rate for the baby, also placing the patient at risk for desaturation events or instability. Developmentally, chin and cheek support are not warranted due to the nature of the sucking pattern and is only required by a small subset of infants who demonstrate anatomical differences. In the event there are not anatomical differences, chin and cheek support is often utilized in the volume driven culture to get the baby to continue to take volume if they are not actively participating or demonstrating decreased suction strength due to fatigue.

### **Cue Based Feeding Scenarios**

The survey also included scenarios for participants to determine an appropriate response based on infants' cues. Staff were given a scenario for a 33-week-old infant who was initially awake and alert, but after five minutes started to become sleepy. During the pre-survey, 61% responded they would twist or manipulate the nipple to re-engage sucking, 74% reported they would reposition the infant, 26% reported they would stop and gavage the rest of the feeding through the infants' feeding tube, 25% would use chin/cheek support, and 76% would unswaddle the infant to re-alert them.



These percentages are discouraging as these are all volume driven strategies, with the exception of gavage feeding the remainder of the feeding, indicating a need for significant education regarding supportive cue based strategies.

### **Staff Confidence in Cue Based Feeding**

The last question asked respondents to indicate their confidence in determining an infant's readiness to feed, recognizing stress and instability, and responding to stress and instability during feeding. Pre-implementation confidence scores indicated staff were not fully confident in any of these three areas.

### **Overall Conclusions from Pre-Survey**

The results of the pre-survey indicated areas where we could target our unit-based education module and bedside resources. Based on staff responses to the survey, our education module would need to address the continuum of infant stress cues and explain desaturations and changes in vitals are not normal for even premature babies to demonstrate during feeding. Education also needs to address that fast-flowing nipples often increase the flow rate, creating more work for the baby, versus helping them be more efficient feeders. Similarly, chin/cheek support is a specialized intervention which may increase flow rate and put the infant at risk for increased incoordination. Education should also target not twisting or manipulating the nipple, or unswaddling babies if they fall asleep, and the importance of recognizing these as stress cues.

Through these results, I decided to incorporate visual models using videos within the educational modules to address caregiver confidence in identifying infants' readiness to feed, recognition of stress cues, and how to respond to these cues with supportive techniques, as well as when to end the feeding. I felt this would allow caregivers to visually see what these stress cues might look like, and supportive

techniques they could utilize to respond when they see infants demonstrating these cues. The results of the survey helped us identify areas in need of further education for our unit staff regarding cue based feeding knowledge. Focus groups were also utilized to further understand both knowledge and staff attitudes towards cue based feeding and current unit practices.

### **Focus Groups**

Focus groups were conducted to gather information from a wide variety of participants. I developed guided questions with the support of the feeding therapy team, which focused on eliciting specific feedback regarding current feeding approaches and staff understanding of cue based methods. Ideas were also garnered regarding the development and implementation of a cue based protocol, given this group is instrumental in the day-to-day protocol implementation. The focus groups were also utilized to identify current issues on the unit regarding feeding to help prevent these from becoming issues during program implementation. A list of the questions utilized and a summary of all of results can be found in Appendix H. A total of six groups were held (N=35 participants).

The feedback from these focus groups was used to determine which protocol would be selected to implement, how to structure education and resources, and identify other potential unit challenges such as staffing, attitudes towards new protocols, and factors for day to day implementation to head off challenges to address prior to implementation to increase chances of program success. Through feedback, it was evident most nurses are using some tenets of cue based feeding when determining when infants may be ready to feed overall, but these same principles do not carry over when they offer each feeding. For example, when infants are nearing the age of beginning to

eat orally (34 weeks) they are looking for the infant to be waking up around care times or rooting. However, once feeding is initiated, if the infant has an order to eat eight times per day, they offer each feeding regardless of whether the infant is cueing. The team identified a wide variety of concerns on the unit regarding feeding that a standardized cue based feeding program would address including lack of understanding of developmental feeding, focusing on quality of feeding versus quantity only, and including RN input in feeding discussions during rounds. Feeding observations were also conducted to further understand current feeding practices on the unit.

### **Feeding Observations**

Feeding observations were conducted by trained OTs, SLPs, and two experienced RNs from the unit staff. A standardized form was developed by the feeding therapy team outlining ten different tenets of cue based feeding which guided these observations. Observation points included demonstration of feeding readiness, swaddling, active rooting, supportive interventions provided by the RN, infant engagement during feeding, stress and RN response to stress during the feeding, abortion of the feeding when stress was demonstrated, and techniques utilized during the feeding. A yes/no format was utilized with these items allowing for listing of interventions, signs of stress, and response of RN, as appropriate. Training was completed with each of the observers to ensure consistency in understanding of the items being measured. Ten observations were completed during pre- and post-implementation. The observation form and a summary of all observation results are in Appendix I.

Prior to program implementation, eight of the ten infants were demonstrating feeding readiness cues at the initiation of feeding. Despite two infants not

demonstrating readiness, feedings were nonetheless offered. Only 20% of infants observed were swaddled prior to the feeding, and both infants who were swaddled were eventually unswaddled when they became sleepy during the feeding. Seventy percent of the infants actively rooted for the nipple to start the feeding, and for three infants, the RN passively placed the nipple in the infants' mouth.

Chin and cheek support was utilized in five observations, despite not being specifically recommend by a feeding therapist for any of the infants. Six of the ten infants became disengaged during the feeding yet only in two observations did the nurse stop the feeding when disengagement occurred. Three infants demonstrated overt stress during the feedings. Stress cues included facial expression change, decreased alertness, coughing, and finger splaying. Nurses in all three observations where stress was demonstrated allowed a rest break, but only one completely ended the feeding. During five of the observations, feeding was not aborted if the infant demonstrated two or more stress cues or demonstrated a change in feeding readiness. Twisting and turning the bottle to re-engage the infant was demonstrated in 60% of the observations.

These observations provided information to guide our staff education as we implemented the cue based feeding protocol. Results indicated a large percentage of staff are currently utilizing techniques more in line with a volume driven feeding culture. Feeding readiness cues and supportive feeding techniques such as swaddling need to be introduced, with a rationale for use, and reviewed. The importance of active rooting to the nipple and discontinuing a feeding when the infant is no longer an active participant also needs to be addressed. Based on these observations, I decided to include video examples of stress cues and examples of supportive techniques to demonstrate these for staff so they could see them in 'real life' versus just a written

description. I also determined the need to include feeding readiness scoring practice and feeding quality scoring practice so staff could develop an understanding of when infants are ready to feed and how to assess the quality of feedings when they are offered. Based on all of these strategies discussed above, I was able to develop the protocol and guidelines for our cue based feeding protocol and guidelines.

### **Cue Based Feeding Protocol and Guidelines**

Based on the above data, a *Cue Based Feeding Guideline* and a specific decision-making protocol were constructed (see Appendix K). The *Cue Based Feeding Guideline* describes the purpose and goals of cue based feeding, and provides supporting information from the literature. Terminology related to cue based feeding is defined and discussed in terms of implementation on our specific unit. Supportive caregiver techniques are also described in detail, with examples of application in clinical practice. These techniques were chosen based on the review of current literature discussed above. Staff responsibilities are also outlined in these documents to help establish each team members' role in the cue based feeding program on our unit, based on feedback from focus groups regarding decreased recognition of RN input regarding feeding on the unit. The decision-making protocol includes the *Feeding Readiness* and *Feeding Quality* score charts from the IDF© model, reprinted with permission (Ludwig and Waitzman, 2014). The protocol outlines how to initiate feeding, which infants qualify for the protocol, and how to implement the protocol for infants who meet the criteria. The decision-making protocol is intended to assist bedside staff in implementing feeding practices, and guides decision making before, during, and after feeds. As discussed previously, we chose this framework as the basis for our model due to its support of infant development, changing the feeding culture,

and creating positive experiences. Once the protocol was developed, a staff education module was designed to address areas noted above in the knowledge-based surveys, focus groups, and observations, to improve utilization of cue based feeding strategies and support implementation of the new protocol.

### **Staff Education Module**

An education module was created to instruct staff on cue based feeding tenets, review the cue based feeding protocol and guidelines for implementation, view videos of supportive techniques, and complete scoring practice (see Appendix L). The module included information from the formalized IDF© program (Ludwig & Waitzman, 2014). This module was also personalized for our unit to include information garnered from the knowledge-based survey, feeding observations, and the focus group feedback, to ensure I targeted specific information our staff identified as areas of weakness.

From the knowledge survey I identified the need to focus on the identification of subtle stress cues, the importance of relationship building within the feeding framework, utilization of appropriate flow rate nipples, and identification of stress cues which should result in termination of feeding. From the observations, I was also able to hone in on the need for appropriate identification of feeding readiness, when to offer an oral versus gavage feeding, and appropriate strategies to support the infant while feeding. Volume driven strategies to avoid if the infant becomes disengaged were also reviewed. Finally, from the focus groups I was able to understand the importance of including medical staff in educational sessions to ensure they understand developmentally supportive feeding and the valuable input bedside RNs can provide in relation to feeding readiness and quality to drive decisions related to an infant's plan of care.

Once designed, over 25 sessions were held across shifts. Sessions were led by OTs, SLPs, and trained RNs. The rationale for movement to a cue based feeding program was reviewed. Expected outcomes of the new protocol were also discussed including feeding initiation consistency, focus on feeding quality, and consistent methods across caregivers. A description of cue based feeding was reviewed, highlighting vital IDF© components (Ludwig & Waitzman, 2014) including supporting development, unifying a team, changing the culture, and creating experiences. The UMMC protocol and guidelines were then reviewed, including how to initiate cue based feeding, and a review of scoring feeding readiness and quality. Video scoring practice of feeding readiness and feeding quality were provided to staff, to ensure scoring consistency and accuracy. Participants had to achieve a score of 80% or greater to pass the education session to certify they were competent in assigning feeding readiness and quality scores. Caregiver supportive techniques, including video examples, were reviewed. Scenarios were discussed regarding when to utilize reviewed techniques. Videos of infant stress cues were also included in the training to demonstrate what caregivers should look for, especially regarding more subtle stress cues. Handouts were provided for staff to reference, and a copy of the education module was accessible on the staff intranet page.

### **Staff Resources**

Staff resources were also created to assist staff in successful program implementation. A cue based feeding reminder sheet was constructed to review who to score, when to score, and how to score infants in the cue based feeding program. A handout reviewing feeding readiness and stress cues, utilizing a traffic light analogy, was created to assist staff and parents in recognizing when an infant is ready to feed,

and when a feeding may need to stop. A cue based feeding information sheet, including a brief review of oral feeding development, current evidence based literature with research outcomes, infant feeding readiness and quality scoring tools, and a sample list of infant stress cues was also provided. Two varieties of this document were created, one for staff and one for parents. A feeding strategy sign was also implemented in each infant's room to communicate to staff what bottle nipple to utilize and identify other supportive strategies for each infant, based on focus group feedback, to improve consistency between feeders.

A rounding script was also devised to help support staff in sharing feeding readiness and quality information during medical rounds. Signs including the feeding readiness and quality scores were also posted at each RN documentation station, to ensure accuracy and consistency in score assignment and documentation. These resources were created to help staff with successful program implementation. All resources were included in the cue based feeding handbook, provided at each nurses' documentation station throughout the unit, and posted on the staff intranet page.



## **Chapter 4**

### **IMPROVEMENT STRATEGY RESULTS**

The program was piloted over a period of two months after staff training was completed. For the most part, staff were very excited about implementing the program and I was pleasantly surprised how many shared the excitement I had about bringing this program to our unit. I was also impressed with my ability to bring together our unit over a common goal that touched multiple disciplines from medical staff, nursing staff, nutritionists, and therapy services, to work together to provide improved clinical services to our infants. After our initial implementation period, data was collected to assess program implementation.

I was interested in the change of staff knowledge and confidence with cue based feeding after development of the protocol and participation in staff education sessions, which I assessed with a post-knowledge survey to identify any areas of additional education needed to support ongoing program implementation. I was also interested in staff feedback regarding how implementation was going and roadblocks or challenges they faced, to problem solve to improve daily use of the protocols. Finally, I wanted to see if there was transfer of the skills into actual bedside practice which was assessed through feeding observations and cue based scoring audits. These additionally provided other areas of improvement as we continue refinement of our cue based feeding protocol.

### **Improvement in Staff Knowledge and Confidence**

The post-knowledge survey was conducted in a similar manner as the pre-knowledge survey; it contained the same twelve questions and was sent to staff via a Survey Monkey link in their email. After completing the survey anonymously, staff members could enter a drawing for a gift card for participating.

### **Participant Demographics**

Fifty of 165 staff members (30.0%) completed the post survey. Participants for the post-survey included 46 nurses, one doctor, two feeding therapists, and one nurse practitioner. These participants worked a variety of shifts including day shift, night shift, and mixed/rotating shifts. Years of experience in the medical profession and the NICU ranged from less than one year to over 30 years. Because the survey was optional, and because the identify of respondents was not known, there was no way to determine how consistent our sample was from pre- to post-survey. A chi-square analysis was completed to examine if there was a statistically significant difference in medical experience or NICU experience between groups. No significant differences were found between groups for medical experience ( $\chi^2 = 2.62, p=0.45$ ) or NICU experience ( $\chi^2 = 1.8415, p=0.60$ ).

### **Cue Based Feeding Knowledge**

From the post-implementation survey, staff demonstrated improvement in their recognition of more subtle stress cues including change in alertness (increased by 10%), loss of latch (increased by 5%), finger splay (increased by 30%) and turning away (increased by 10%) when compared to pre-implementation surveys. This demonstrates education modules and videos were successful in increasing recognition of a variety of stress cues infants may demonstrate during feeding experiences.

Information regarding important principles of cue based feeding was also reassessed. Ideally, staff would understand relationship building, assessment and response to stress cues, and supporting infant development are all hallmarks of a cue based feeding program. Focusing only on volume and weight gain is an example of volume driven strategies, which do not take in to account the infant's participation in the process. During education sessions, it was stressed that volume intake and weight gain are only part of the whole picture needing to be considered for successful oral feeding. Despite this focus, no change was noted in recognition of importance of relationship building within the cue based framework. However, decreased selection of only weight gain and only volume intake was noted.

### **Current Feeding Practices**

With respect to utilizing a fast flow nipple, education captured the importance of understanding faster flow nipples can increase workload for infants and may place infants at risk for increased discoordination. Education was effective because all staff correctly identified faster flow nipples do not support infants to eat faster, decrease energy required, and increase intake during the post-survey, demonstrating a 14% improvement from pre-implementation.

Education modules also explained the recognition of desaturation events as significant communication of stress, often precluded by other stress cues. By responding to earlier stress cues, these events can hopefully be circumvented. After education and protocol implementation, 86% of participants correctly respond it is not normal for premature babies to have bradycardia and desaturations during feeding. Although an increase of 15%, there is still room for improvement.

A question regarding chin and cheek support re-assessed recognition of this technique as a specialized intervention. Education sessions stressed chin and cheek support can negatively impact infants and should only be utilized if assessed by a trained feeding therapist, to ensure it does not increase the flow rate and overwhelm the infant. Eighty-six percent of respondents in the post-survey reported chin and cheek support was a specialized intervention, a 22% improvement from pre-surveys.

### **Cue Based Feeding Scenarios**

The survey also re-presented scenarios for participants to determine an appropriate response based on infants' cues. Staff were given a scenario for a 33-week-old infant who was initially awake and alert, but after five minutes started to become sleepy. During education modules, staff were instructed on cue based feeding principles, which recommended trying to reposition the infant, but if no change in alertness is demonstrated, the feeding should be stopped and gavage. Caregivers should not unswaddle the infant, or twist the nipple, because these are volume driven approaches, not recognizing the change in infants' engagement as a sign of stress.

Post-survey responses indicated 32% would twist or manipulate the nipple to re-engage sucking, an improvement of 29%. Fifty-four percent would stop and gavage the rest of the feeding, an increase of 28% from pre-implementation. Only 14% would use chin/cheek support, indicating an 11% decrease, and 56% would unswaddle the infant to re-alert them, indicating a 20% decrease. Overall, improvement in utilization of cue based strategies occurred as evidenced by an increase in the utilization of gavage feedings when the infant became sleepy. An overall decrease was also noted in utilization of volume driven strategies.

### **Staff Confidence in Cue Based Feeding**

The last question re-assessed confidence in determining an infant's readiness to feed, recognizing stress and instability, and responding to stress and instability during feeding. An increase in the number of staff members who identified full confidence in assessing readiness for feeding based on cues was demonstrated from pre- to post-survey. A chi-square statistic was run to determine if there was any statistically significant difference between the groups. Results indicated the change was statistically significant for the proportion of staff recognizing feeding readiness ( $\chi^2=16.278$ ,  $df=4$ ,  $p=0.0027$ ) and responding to stress ( $\chi^2=12.729$ ,  $df=4$ ,  $p=0.0127$ ), but was not statistically significant for the proportion of staff recognizing stress cues ( $\chi^2=8.8199$ ,  $df=4$ ,  $p=0.065762$ ).

Education modules and supportive materials were geared to help improve confidence. Post-implementation knowledge survey scores indicated an improvement in staff confidence across initiation of feeds, recognition of stress cues, and responding to stress cues. A 34% increase in those stating a level five for initiation of oral feeds with cues, 23% increase for recognition of stress cues, and a 22% increase for responding to stress cues demonstrated this improvement in confidence. The absence of scores of one, limited scores of two and three as compared to the pre-survey, are another indicator of improvement.

### **Summary**

Overall, there were improvements in knowledge of cue based feeding practices and principles and staff confidence when comparing responses from the pre- and post-implementation knowledge surveys. Although the post-survey had fewer participants, there was no statistical differences between the two groups. Staff demonstrated

improved understanding of more subtle cues indicating infant stress including finger splay, change in alertness, loss of latch, and turning away from the bottle. Staff indicated increased understanding of the detrimental impact of faster flow nipples, desaturation events being abnormal even for preemies, and specialized intervention of chin/cheek support; however, there is still room for improvement. Supportive response to a sleepy infant also improved, with less utilization of twisting/turning the nipple, chin/cheek support, and unswaddling, and increase in gavage feeding. Staff confidence levels in recognition of feeding readiness, recognition of stress cues, and appropriate response to stress cues did not show statistical improvement, although the number of staff with low confidence ratings dropped to zero.

#### **Improvement in Staff Attitudes Regarding Feeding Practices on the Unit**

Focus groups were conducted to again gather information from a wide variety of participants to re-assess feelings regarding feeding practices on the unit post-implementation of the cue based protocol. Five groups totaling 34 participants were completed. Focused questions were utilized to elicit specific feedback regarding protocol implementation and how the process could be improved.

Overall feedback from the post-focus groups indicated great improvement in our focus on cue based feeding practices and implementation of developmentally supportive care. Staff felt more confident initiating feeding, recognizing stress cues, and responding to stress cues, based on cue based feeding tenets. Medical providers are seeking information regarding quality of feeding and nurses feel more respected in their judgement regarding feeding overall however, continue to report a focus on volume among some members of the medical staff. Nurses are actively discussing feeding in terms of overall quality versus only quantity and are sharing this information daily

during shift report. Documentation of feeding readiness and quality has improved communication among staff and has allowed for a better understanding of infant feeding progression; however, many staff members reported differences in documentation between day and night shift. Staff also provided anecdotal evidence of infants demonstrating faster achievement of full feedings, more positive feeding experiences for staff and babies, and shorter length of stay for babies who may otherwise have not tolerated volume driven strategies resulting in increased time in the hospital.

All staff in attendance mentioned how user friendly the feeding website was, and how much information was available in an easy to read format. Staff mentioned they do not receive much information on developmentally appropriate feeding or feeding strategies to utilize with premature infants during their schooling, and how this information has informed and changed their practices. Over half of the unit's medical residents have commented on the usefulness of developmental information and the timeline for feeding progression. This website will continue to be provided to staff and will be updated with additional resources as appropriate. RNs also shared feedback regarding desire for a short in-service training during new staff orientation, with OT or SLP, regarding infant feeding practices, given they often do not have time to train new staff on these techniques during orientation, and know that this is also not targeted in RN coursework during school.

Post-intervention focus groups allowed for identification of areas for improvement for the cue based feeding program. Staff reported some members of staff are not recognizing the spectrum of stress cues which is resulting in continuation of feeds and increased volume intake and is resulting in decreased quality of feeding and increased negative events (desaturations) during feedings. Staff also felt the medical

team needs ongoing education regarding actual discussion at rounds, seeking out information from the nurses regarding readiness to initiate feeds, and quality of feeding, as opposed to a focus on volume. The medical team needs to be periodically reminded only infants greater than 33-weeks gestational age should participate, and infants need to show consistent readiness cues during their care times every three hours over a 24-hour period, prior to offering the first feeding. Staff also reported they felt pressure from parents to feed infants at all care times due to lack of understanding of the new cue based protocol.

### **Summary**

Overall there was improvement in staff attitudes and feelings regarding feeding on the unit with increased positive reports of feeling they are included in feeding decisions and that the bedside RN has an increased role in progression of feeding. There are still some concerns regarding consistent recognition and acknowledgement of all stress cues among staff. Discussion also surrounded the need for further parent education training due to increased pressure from families and parents who did not fully understand the new protocol. Concerns were also raised regarding consistency of documentation among all staff members. Finally, concerns were discussed about ongoing education for new staff members who arrive on the unit with little to no knowledge regarding developmental feeding.

### **Improvement in Staff Implementation of Cue Based Feeding Practices**

Feeding observations and cue based scoring audits were conducted to assess staff implementation of cue based feeding practices after participation in staff education and introduction of the standardized feeding protocol.



Ten observations were conducted. During these observations, seven infants were demonstrating cues and participated in feeds. The other three feeds were appropriately gavaged, because the infants were not demonstrating readiness for feeding. For the seven infants who participated in feeds, six of the infants were swaddled, and none were unswaddled if they fell asleep. This is an improvement compared to pre-implementation, as only 20% of infants were swaddled, and both infants were unswaddled when they became drowsy. All seven infants who were orally fed actively rooted for the nipple, also an improvement from pre-implementation, when only 70% actively rooted. Only one instance of twisting/turning of the nipple occurred, a 50% reduction from the pre-observations. Chin and cheek support were not utilized in any of the post observations, a 100% reduction from the pre-observations. In the ten observations, all but one was aborted if the infant demonstrated signs of stress not resolved with use of supportive techniques, which was a 50% increase compared to pre-protocol implementation.

These observations allowed us to assess improvement in utilization of cue based feeding and supportive development feeding practices. Improvement was noted as evidenced by a decrease in the utilization of volume driven strategies including twisting/turning the bottle, chin/cheek support, and unswaddling if the infant became drowsy. Improved active rooting, utilization of swaddling prior to feeding, and appropriate recognition of readiness for feeding with use of gavage when infants were not demonstrating appropriate cues occurred in examination of post observations.

Cue based feeding audits were also conducted to ensure consistency among staff in scoring infant feeding readiness and quality. Twenty-one audits were completed over a two-week period. The scores between the bedside RN and the auditing RN matched

for readiness in 81% of trials. Discrepancies were always between scores of one and two, where a feeding would be offered in either case, versus discrepancies where one RN scored the infant as ready and appropriate to offer a feed, and another scored as inappropriate for a feed. Quality scores matched in 86% of audits. Differences in quality were often between scores of two versus three, and usually demonstrated a misunderstanding that if an infant received more than two specialized supports, they could automatically not score above a three for quality. No significant differences in quality scores were noted. Re-education provided during the audits included importance of swaddling infants prior to feeding for physiological stability, appropriate external pacing techniques, and appropriate quality scores given amount of supports provided.

### **Summary**

These results demonstrate improvement in focus on quality of feeding versus quantity, and focusing on the infants' feeding experience, to ensure the infant is an active participant. The results also demonstrate staff are respecting infants' readiness cues to determine whether to offer a feeding and are utilizing stress and stability cues to guide continuation of feedings. These results are interesting in comparison to the knowledge survey because despite continued reports of ongoing identification of certain volume driven strategies during the knowledge survey scenarios, complete elimination of most of these methods was noted during the observations. Cue based scoring audits showed a high level of agreement between scores for readiness and quality with subtle differences in scoring not impacting whether or not infants are offered feedings, and differences in understanding number of supports relating to level of quality scoring.

## **Overall Conclusions**

Our entire staff have been so excited to implement this protocol and many asked daily when it would be ready for roll out prior to implementation. I can honestly say I am pleasantly surprised with how well staff have worked together to implement this protocol during our initial implementation period. Feeding has become quite the buzz on the unit and anyone who takes a stroll around can hear RNs conferring on scoring infants. RNs, doctors, and nurse practitioners can be heard discussing feeding readiness and quality during rounds, and even discussion with parents about why an infant is not ready to feed at a given care time can frequently be heard. Anecdotally I have heard nurses report improvement in allowing infants to decide when they are ready to eat and have also seen improvements in babies having fewer events during feeding, because we are waiting until they are ready developmentally to start feeding, resulting in faster achievement of positive, full oral feedings. Decreased feeding related events, time to full oral feeds, and length of stay are measures I hope to research during the next phase of this clinical project. These results have informed us about areas of strength and areas of improvement needing to be addressed as we continue to refine our program.

## **Chapter 5**

### **REFLECTIONS ON IMPROVEMENT EFFORTS**

The implementation of the cue based feeding program was a success overall and has been highly regarded by our entire staff. Our objectives for this project were assessment of knowledge among our staff regarding cue based feeding and implementation of a standardized feeding protocol to support transition to developmentally supportive cue based feeding techniques on our unit. A different culture regarding feeding has been noted on the unit. Staff can be found discussing feeding daily and are working collaboratively to problem solve regarding infants who are having difficulty. Staff are referencing educational and support materials when they are unsure of how to proceed, and are more frequently seeking input from OT/SLP early on if problems arise, versus waiting until the infant has struggled with feeding for a while. During daily rounds, multiple therapists have observed discussions between the medical team and nursing regarding feeding, with collaborative discussion regarding quality versus solely quantity. Cue based feeding terminology has become the language of the unit, and all staff are trying to implement techniques consistently. During daily chart reviews therapists have also commented on improved documentation of feeding quality and improved documentation of feeding related events.

#### **Intended Objectives**

Our first objective included assessment of staffs' current knowledge regarding cue based feeding. Through the utilization of pre-knowledge surveys and pre-implementation focus groups, we were able to assess staffs' prior knowledge of cue

based feeding. We were able to understand important concepts in which the staff lacked knowledge and were able to incorporate these into our staff education.

Our next objectives were to implement a standardized feeding protocol, and to improve the use of supportive and developmental feeding techniques. Through the utilization of the strategies previously discussed above, a standardized guideline and protocol were created and implemented. Using feeding observations and post-focus groups, staff were able to demonstrate improved consistency of documentation regarding feeding, improved communication regarding feeding readiness and quality, and improved attentiveness to infants' readiness cues. Further, observations allowed us to view an improvement in the utilization of supportive and developmental feeding strategies versus volume driven strategies. Focus groups also allowed us to obtain feedback about how staff felt this protocol was supporting infant development, and how staff were more aware of infant participation (or non-participation) in feeding. Improvement in RN communication and documentation regarding feeding readiness and quality were also highlighted by multiple staff members.

### **Areas of Improvement Identified**

Areas for improvement were identified to determine ways our program could continue to grow. These include further unit education, ongoing observations, and scoring audits to ensure adequate program development, review of protocol guidelines and medical team education, and consistency with feeding protocol orders.

### **Ongoing Staff Education**

Further unit education should be conducted to target areas of weakness to improve overall protocol implementation. These modules should emphasize subtle stress cues as indicators of a need to make a change in feeding technique to prevent

more obvious stress or overt desaturation events. Additional video examples of subtle stress cues should be shared with staff to assist in identification of these stress cues. Other examples of supportive techniques should also be captured to further reinforce techniques to prevent desaturation events versus respond to events during feeds.

The need to abort feedings if overt signs of infant stress continue, despite efforts to resolve them with supportive techniques, will also be reviewed. In most of the observations, feedings were continued when infant stress occurred, with only breaks offered, instead of recognizing ongoing stress and terminating the feeding. Although present in fewer feedings during formal observations, twisting and manipulation of the nipple was still present in observations and has also continued to be noted intermittently by this writer during unit visits. Volume driven responses will be captured on video to demonstrate the differences in an engaged infant, versus a non-engaged infant (i.e., one who is being prodded with these strategies to continue feeding when they are no longer actively participating in feeding). The rationale for not continuing to pump and twist the nipple will be reviewed to help staff understand the infant may be utilizing the break in sucking as a time to catch up on breathing or may be signaling they are too fatigued to continue. Because sucking is reflexive, some infants will continue to suck when stimulated by the twisted or turned nipple even if they are not physiologically ready to continue to participate in feeding.

Our unit should continue to focus on the importance of relationship building with the infant during feeding versus viewing feeding as a task to be done to the baby. This will help support developmentally supportive interactions each time the infant is able to participate in feeding.

### **Creation of Parent Education**

A parent education module is also being developed to explain the cue based feeding protocol in family friendly language, to help families understand why a nurse may not offer their baby a feeding at a particular care time, and to decrease pressure on the nurses. Even though we had a parent handout available, I think a condensed training with videos would have helped parents truly understand the tenets of the program, and reduce staff stress during program roll out, so parents did not pressure nurses to continue to feed babies who were not demonstrating cues and parents would understand why this is not developmentally supportive for their infant.

### **New Staff Feeding Training**

A new staff RN training program will also be established with the RN Clinical Educator to offer new RN meetings with an OT or SLP to review feeding practices and cue based feeding techniques, to allow hands-on practice and observation with feeding experts, to address the lack of experience they receive during formal schooling and unit orientation.

### **Ongoing Observations**

Observations will continue to occur on a quarterly basis to ensure adequate protocol implementation and identify any areas of re-education needed. Quarterly feeding scoring audits will also be conducted to ensure agreement of scoring between nurses and consistency of implementation. Anecdotally, the therapy staff have noticed some differences in the appropriate scoring of infants when they reach the appropriate developmental age, adherence to the 50% rule within 24-hours prior to initiating feeding of the infant, and only offering feedings when an infant demonstrates a

readiness score of a one or two. These are currently being monitored and will be addressed once data is collected.

### **Review of Protocol Guidelines and Medical Team Education**

Conversations will occur with medical team representatives to review the protocol guidelines. These conversations will emphasize the importance of waiting till infants are 33-weeks to begin scoring and to ensure we are waiting until infants score adequate readiness scores for 50% of their feeding opportunities within 24-hours prior to offering the first feeding to ensure infants are demonstrating developmental appropriateness for feeding. RNs are being tasked to ensure infants are achieving readiness scores of one or two for a minimum of 50% of their feeding opportunities in 24-hours prior to be offered a feed. RNs were empowered as the staff member to request the order once the infant has achieved this percentage, or to have a discussion with the attending if they were feeling pressured to feed an infant who has not yet met this milestone.

Medical staff also need to undergo further training regarding developmental feeding progression and infant cues, to further understand and appreciate why RNs are determining not to offer feeds when babies are not demonstrating readiness cues, versus questioning the skill level of the RN caring for the baby. Providers receive very little information regarding developmental feeding progression in their schooling, which impacts their ability to understand how this progression impacts daily feedings offered by RNs on the unit. I am in the process of partnering with representatives from both the nurse practitioner team and the resident team to identify the best way to present this information to each team so that it is useful and informative for them and helps them support the implementation of the protocol. I feel this will further help providers



understand why infants under 33-weeks are not appropriate to participate, why it is essential for infants to be demonstrating cues for a minimum of 50% of their cares in a 24-hour period, and how to frame questions/discussions regarding feeding readiness and quality to come from a place of understanding versus questioning of RN judgement for not feeding an infant. For example, they may reframe their question to “When you assessed the infant, were they not demonstrating cues or where they breathing too rapidly?” from “I don’t understand why you didn’t feed this baby at their last feeding.”

### **Ongoing Scoring Audits and Monitoring of Documentation**

A review of documentation standards will be reviewed with all nurses on day and night shifts to address the perceived differences in day and night shift documentation to improve consistency of practices. A documentation tool was constructed to support consistent documentation of feeding readiness and quality, including caregiver techniques, so caregivers are implementing consistent techniques to support the infant each time they feed.

Ongoing scoring audits also need to be conducted to further improve scoring consistency among staff members. This will also ensure staff are scoring infants appropriately, and that this information is being adequately interpreted by the medical team. Our target will be to conduct audits on all staff members going forward. Our feeding therapy team is currently performing analysis on infants who are scored prior to 33-weeks, infants who are not being scored at every care once they initiate the cue based protocol, and infants who are scored for readiness and receive scores of greater than two, but are fed regardless.

A feeding therapist will confer with specific nurses when they notice they are feeding babies despite giving them readiness scores of more than a two to determine

rationale for why this is occurring. If repeated protocol violations are noted, the RN manger will be informed.

### **Communication among Team Members**

The value of RN input regarding feeding needs to be re-iterated to the medical team, and they need to seek out feeding readiness and quality information, versus only asking for quantity. To further support ongoing communication among staff regarding feeding, a script was devised to support nurses in sharing information, and to support providers in understanding information regarding infant feeding readiness and quality to facilitate communication between nurses and the medical team.

### **Consistency with Feeding Protocol Orders**

A consistent feeding order also needs to be created and implemented to address standardization between providers, so there is no confusion about which infants are appropriate for the cue based feeding protocol. The clinical nutritionist was identified as a point person to recommend initiation of the protocol once the infant reaches 33-weeks to avoid infant's slipping through the cracks. An alert is also being devised in our medical documentation system that would cue providers to recognize the infant is approaching developmental age for scoring based on the cue protocol.

### **Reflections on Changes to Methods**

In the future, I would want to include individuals from a wider variety of disciplines in the focus groups including the medical team, so that members of different disciplines could hear each other's feedback about feelings regarding feeding on the unit. I do not feel like the medical team understands how the nursing staff felt prior to this program roll out in terms of being respected with their specific knowledge of the infants in their care. I feel like these types of discussions could be helpful as we

continue with our program to determine where there are additional areas for improvement, so the issues can be understood from a wide variety of perspectives within the same discussion, versus having separate focus groups with different disciplines at each.

I would also recommend inclusion of pre-implementation video scoring during knowledge surveys to further measure baseline knowledge in readiness and quality scoring for other units considering initiating a cue based feeding protocol. Pre-implementation observations were essential in identifying current feeding strategies and practices. The only change I would have made looking back is allowing for a larger number of observations given the number of staff and the number of opportunities there are to feed on any given day.

I would also add more hands-on components of training for staff with infants on our unit. I would extend the training to include sessions where the RNs would practice scoring feeding readiness and quality on infants after they viewed the videos. I think this would extend their exposure, and the practice of scoring with live infants affords additional means of verifying competence. This would also allow for the opportunity to practice hands-on supportive techniques in real time with real infants versus seeing the techniques in videos or with dolls.

Finally, I would complete a larger number of pre- and post-implementation observations to allow for a greater sample size when considering feeding trends on the unit. Similarly, I would increase the number of scoring audits completed post-implementation to further ensure consistency and competent scoring among all staff on the unit.

### **Success Factors**

There were many factors leading to success of this program. The first was having the backing of evidence-based research outcomes, given the focus at UMMC on these practices. The research shows this is what is best for babies, and providers understood these tenets, so it was just finding a way to implement them into daily practice. Another factor that increased the probability of success was getting everyone at the same table and making sure all members of the team felt invested. By having all team members invested, people took responsibility for implementing the new protocol and guidelines. This also allowed us to build a stronger protocol, because multiple viewpoints and perspectives were considered from various lenses, allowing for all angles to be addressed.

### **Looking Forward**

Through this project our unit was able to make great headway in the utilization of cue based feeding and we have begun the journey of practicing supportive developmental feeding practices. Outcomes identified in our logic model which have not yet been addressed include: improving the length of stay, decreasing time to full feeds, and decreasing re-admission rates, as well as improving the overall feeding experience of patients, family, and staff. Moving forward, our next feeding improvement project will assess whether the utilization of a cue based feeding model results in decreases in the overall length of stay, the time it takes an infant to ingest full oral feeds from the time of the first oral feed, and the number of re-admissions. A research protocol is currently in process for IRB approval. Additional measures and surveys will be undertaken to assess improvement in the feeding experience for patients, families, and staff, which was not within the scope of this project. Finally,

additional education will be provided to families to support their knowledge of cue based feeding practices, so they can understand the rationale for practices on the unit, and support their infants in developing into successful feeders.

## **Chapter 6**

### **REFLECTIONS ON LEADERSHIP DEVELOPMENT**

The process of completing my educational leadership Ed.D has helped me grow in a multitude of ways. Through completion of coursework and then preparing my ELP project, I have been challenged to develop in many facets. My skills as a leader have changed across dimensions, including my skills as a scholar, problem solver, and partner.

#### **Growth as a Scholar**

School has always come naturally to me, and I have always had a natural love for learning. However, completing my ELP has challenged my skills as a scholar, and resulted in growth to another level of scholarly work. I have learned to appreciate literature and evidenced-based practice. Through coursework and preparation of my ELP proposal, I grew in my analysis and interpretation of research, and how to take multiple viewpoints and perspectives, and utilize them to support my ideas to further my vision and goals.

Before enrolling in this program, I read a multitude of articles regarding a subject and knew the basics of determining whether it was good research. However, I was missing the deeper analysis of the questions and research techniques utilized. I have learned how to critically reflect on ideas presented in the research, and how to identify high quality results and apply them to my practice. During my research methods class, I was introduced to a wider range of analysis for research articles which helped with my critical analysis of the research. This also increased my ability to read

articles, and utilize critical thinking and analysis, to generate additional questions and research ideas. I also grew in my ability to have critical conversations about research, to further form my perspective regarding critical issues in my field and understand others' perspectives. This was crucial in being able to come to the table with doctors, nurses, occupational therapists, and nutritionists, to critically analyze information regarding infant feeding from their respective disciplines, tie in research from my field, understand how they differ but complement one another, and how to tie this all together to form the protocol we ended up utilizing. By having this deeper level of understanding, I was able to have more beneficial conversations with a wider range of professionals.

### **Growth as a Problem Solver**

My journey through the Ed.D program and completion of my ELP project has significantly changed my skills as a problem solver. I have learned how to analyze a problem to truly determine root causes of an issue, and to generate potential avenues for addressing the issue. I have honed my skills to look at problems logically and generate thought-oriented processes to address the problems, including identification of inputs, processes, projected outcomes, and potential external factors. By completing my Principles of Evaluation course, I was introduced to the world of program evaluation. This was an area to which I had not previously been exposed in my other educational programs. A project I completed during that course regarding our NICU cuddler program was what really inspired me to endeavor to conquer this feeding protocol project. I learned methods of assessment and the variety of ways you can gather information from different groups. During this class I also learned about logic models

which was essential in guiding my understanding of the multiple components involved in my ELP project.

This program has also taught me skills to examine problems from a variety of viewpoints, to further critically analyze problems, and determine potential methods for addressing the problems. In addition, I have learned the importance of considering these multiple perspectives to fully understand the potential issues and external factors.

My work on this project has also furthered my skills in handling unexpected problems without becoming flustered, and learning to face problems as they arise, versus letting them build into larger problems. During the first few weeks of my project, I was approached by the Director of Nursing for the NICU and told I absolutely could not continue with my project because she had two RNs who were currently looking at cue based feeding for their Senior Clinical Nursing projects. Prior to this program, I probably would have told her that was fine and chosen a different project. However, because of the problem-solving skills I learned, as well as the ability to think through problems logically, I was able to present a mutually-beneficial alternative: I could collaborate with the RNs and we could work together to make the program even stronger given the interplay between nursing and feeding therapy in the NICU in regards to feeding. Through discussions with the two RNs and the nursing director, I discovered the tool they had chosen was not appropriate for our unit and supported this decision with the research I had completed.

Being an active participant in problem solving has also improved my conflict resolution skills, mediation skills, and taught me skills to facilitate understanding of multiple viewpoints in a larger group. This allowed our team to come together as a cohesive group to tackle problems jointly, versus working in silos. I feel these problem-



solving skills helped me to accomplish the outcomes of my project, as there was significant conflict regarding feeding on the unit and many told me initially I would be unsuccessful, due to previous attempts. Even members within the feeding therapy team could not previously agree on the important tenets of a cue based feeding program, something we as therapists should be promoting. I had to do a lot of groundwork and have a lot of difficult conversations to tackle these issues, something that prior to this program I do not feel I would have been able to accomplish. The techniques I learned in my program evaluation course also helped me to step out of the center of the issue and observe from the periphery to be objective in some of these discussions versus making them personal. Further, my understanding of logic models allowed me to consider all the stakeholders in the project, to assess their potential viewpoints, and brought them all to the table to problem solve as a group, unlike previous attempts, where only one discipline attempted to address the issue at any given time.

When problems arose in implementation, I addressed them with all parties, another factor I think was beneficial in ensuring greater success. Prior to this, I would have fled from conflict. However, by having these evaluation and analysis tools, I was able to look at problems multi-dimensionally and help facilitate discussions to help solve the problems.

### **Growth as a Partner**

Finally, this coursework and project allowed me to develop skills as a partner. Through this work I was able to hone my interpersonal and collaboration skills. I improved my ability to communicate directly, clearly, and efficiently, to improve transfer of information. I also improved my confidence in addressing issues head on. I increased my ability to be the lead of a project rather than behind the scenes. In my

lead role, I had to not only lead others, but bridge the gaps between multiple groups. My confidence in working with others and being comfortable in a lead role has grown ten-fold. I was also impressed with my ability to bring together our unit over a common goal that touched multiple disciplines from medical staff, nursing staff, nutrition, and therapy services, to work together to provide improved clinical services to our infants.

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## **Appendix A**

### **IMPLEMENTING A CUE BASED NICU FEEDING PROTOCOL**

#### **Overview**

This proposal addresses the need for a cue based feeding protocol and staff training program within the Level Four Neonatal Intensive Care Unit (NICU) at the University of Maryland Medical Center (UMMC). As a Speech-Language Pathologist within this unit, there is significant interest and need to address the growing concern regarding consistent feeding practices, aligning with currently accepted evidenced-based best practice, in targeting the oral feeding development of premature infants. Currently, a wide variety of approaches are utilized on the unit, with no consistent practices among nursing and medical staff, often leading to confusion among nurses, therapists, doctors, and parents, impacting the patients' ability to feed effectively and safely, sometimes prolonging discharge from the facility. Previously, NICU practices have focused more on volume driven feeding, with the sole goal of a certain amount of intake each day, regardless of how the infant consumed the amount. However, research has now demonstrated the importance of cue based or infant-driven feeding, encompassing not only the quantity the infant consumes, but also the quality of the feeding (Shaker, 2013; Wellington & Perlman, 2015; Thoyre, Hubbard, Park, Pridham, & McKechnie, 2016). The goal of this project is to develop a formal cue based feeding protocol and staff training program for implementation within the unit to develop standardized practices concerning developmental feeding.

## **Organizational Context**

The University of Maryland Medical Center (UMMC) is in the heart of Baltimore, Maryland. The mission of the hospital includes delivering superior healthcare, while training the next generation of healthcare professionals, and discovering ways to improve health outcomes not only in Maryland, but worldwide. The vision is to provide high value and compassionate care, improving health in Maryland and beyond, educating future health care leaders, and discovering innovative ways to advance medicine worldwide. Specifically, the Children's Hospital's focus includes providing state-of-the-art medicine with family-centered care. There is understanding children are not merely small adults, which is why at UMMC they are treated as unique individuals. Aligned with this mission and vision, a brand new state of the art NICU was opened in 2015. The unit is a 52 bed, Level IV NICU, targeting care for the most critically-ill babies. The NICU medical team of doctors, nurses, and support staff provides care for a wide range of problems from premature birth and congenital heart defects, to breathing issues and kidney problems. The facility cares for twice the number of babies as most community-hospital NICUs, with the experience needed to help even the most critically ill babies survive and thrive. A specialized transport team helps bring babies via air or ground ambulance to the Children's Hospital for the complex care they need, with babies traveling from all over the Delmarva Peninsula.

Due to the complexity of patients at this facility, they often remain as patients for an extended time, encompassing the period of learning to orally eat. Often, feeding is the last developmental milestone achieved prior to the infant being able to discharge home. Research-based evidence has changed over the years from a volume driven

culture, where the sole focus of feeding was the amount of intake, or quantity of feeding, to an infant driven culture, focusing more on the quality of the feeding, including physiological stability and infant communication cues, to gauge the success of the feeding. Although the research has demonstrated and supported these findings, the transfer to consistent clinical practice has been much slower to take root.

Our unit has utilized a mixture of approaches centering around the various physicians' theoretical treatment philosophies, and differing methods of implementation by nurses, with wide ranges of clinical experience. These varying treatment practices often leave nurses, staff, and families confused, as treatment approaches or methods may change once a doctor is rotated off service, or when shift change occurs. This can lead to multiple changes in plans of care, ultimately impacting length of stay and discharge. The pediatric feeding team, consisting of Occupational and Speech Therapists, has previously attempted to construct a feeding protocol utilizing current best practices, focusing on infant driven, cue based feeding. However, the team has faced multiple issues involving consistent physician support, staff turn-over leading to inability to focus on protocol development, and lack of therapists' availability to focus on the vast amount of program development and training for physicians, staff, and parents, to allow for adequate protocol implementation.

In May 2017 a meeting was held with the medical director of the NICU, the feeding therapy team, and most of the unit's neonatologists. A suggestion to develop and implement a cue based protocol to align with current best practice, as well as to match more closely what other area NICUs are implementing, was endorsed by those in attendance. One of the attending physicians agreed to be the medical supervisor of this project, with me as the primary designer/developer.

## **Problem Statement**

Oral feeding is one of the most complex behaviors required for infants. Feeding is especially difficult for babies who are born prematurely or who have medically complex conditions. Feeding requires integration of multiple body processes, including the coordination of sucking, swallowing, and breathing, while maintaining physiological stability, to prevent adverse events (Bertoncelli et al., 2012). Premature babies demonstrate difficulty with oral feeding due to differences in muscle tone, state regulation, endurance, and coordination of suck, swallow and breathe behaviors when compared to full-term babies. Often, preemies lack the ability to coordinate these systems, and may communicate stress during feeding. Babies utilize a variety of behaviors and cues to communicate their stability or stress during these types of high level tasks. Cues indicating stability can include rooting, eye contact, rhythmical sucking bursts, and stable respiratory rate. Stress cues can include finger splaying, head turning, arching, or overt desaturation events (Shaker, 2013). Some of these cues are overt while others are subtle; however, recognition of these cues is vital to consider while making decisions to proceed or halt an oral feeding. To promote positive feeding experiences, we want infants to demonstrate stability cues while limiting stressful experiences.

Due to the complexity of oral feeding, babies rely on alternative tube feeding, often delaying the discharge of infants from the NICU, resulting in longer length of stay, increased medical costs, and extended time away from the parents, a critical factor for infant development (Lau & Hurst, 1999). Despite the complexity of oral feeding, and the critical role this tasks plays in overall development and health, especially in pre-term infants, many NICUs lack consistency in oral feeding practices. Units often rely

on trial and error approaches, rather than implementing research-based best practices (Jones, 2012). This often leads to inconsistencies in both approach and practice, causing confusion for nurses and caregivers. It may also impact the development of safe and efficient feeders. Given the increased pressure to discharge infants, both from a financial and parental perspective, units have often relied on volume driven strategies.

Volume driven feeding includes focus on the infants' ability to ingest a prescribed volume by mouth within a certain time-frame, with the sole outcome measure of weight gain (Shaker, 2013). This method of feeding often leads to encouragement to eat when the infant may be demonstrating fatigue, physiological instability, or lack of hunger cues/interest. The goal is to get the volume into the baby, with sole focus on quantity of feeding versus quality of feeding. Therefore, the ultimate goal of volume driven feeding is to empty the bottle at each feeding. These practices are often based on historical customs of each unit and/or the personal judgement of bedside nurses, and lead to inconsistencies each time the infant is fed (Premji et al., 2004). The decision to initiate oral feeding is often guided only by gestational age and weight, with weight gain as the only indicator of success. Feeding practices may utilize strictly scheduled feedings every three hours, or only allow the infant the opportunity to orally feed a prescribed number of times per day, regardless of whether the infant shows feeding readiness cues or a desire to eat.

The whole goal in the volume driven culture is to get the infant to eat, with whatever method necessary, to empty the bottle. In this approach, the best nurse is the one who gets the baby to empty the bottle. This often leads to well-intentioned strategies such as manipulating the bottle or encouraging the infant to continue sucking, feeding when the infant is trending into a sleepy state, providing a faster flow nipple,

unswaddling the baby to re-alert them, or providing chin/cheek support to ‘help’ the infant consume additional volume faster (Shaker, 2013). Even when infants may display stress cues or changes in physiological stability, the feeding continues in an effort to get the patient to consume the entire volume. The sole indicator of a successful feeding is the volume intake and an empty bottle, regardless of the infant’s physiological stress.

While it is vital for infants to ingest a certain volume to maintain calories and gain weight, focusing solely on the volume ingested does not consider the context of important developmental feeding milestones and maintenance of physiological stability. During this critical developmental period, the baby is devising and making permanent motor and sensory pathways (Shaker, 2013). These pathways become permanent as time progresses. Volume driven methods of feeding may cause the establishment of negative pathways and responses, leading to development of maladaptive behaviors, potentially leading to longer term negative or aversive feeding behaviors. Enough negative experiences through utilization of volume driven practices leaves the infant at higher risk for long term altered oral sensitivity, facial or oral defensiveness, oral feeding delays, food refusals, dysphagia, and failure to thrive (Dodrill et al, 2004). Some issues may persist throughout childhood for some of these infants, an alarming consideration given the regularity with which these strategies are still present in NICUs today.

These techniques may result in significant food aversions, often resulting in the need for alternative and supplemental nutrition due to complete food refusal or significantly restricted intake. Due to these significant refusals and restricted intake, some children experience failure to thrive because once home, they are not able to

adequately maintain or gain weight along the normal growth curve expectations. This may result in the need for extensive feeding therapy or in some cases hospitalization, requiring additional time from home or school, further disrupting the family unit. Given the significance of food in our culture, disruptions in family mealtimes with a child who has significant aversions or restricted intake can result in high stress environments and further pressure on eating, often resulting in significant distress for both the child and the parents. These issues also result in further increased medical costs including feeding therapy, supplements, and in some cases feeding tubes.

Mounting evidence warrants a shift in thinking and practice towards cue based feeding, also known as infant-driven feeding (Ludwig & Waitzman, 2007; Shaker, 2013; Browne & Ross, 2013). Cue based feeding utilizes each infant's developmental level and maturity to guide decisions before, during, and after feedings. Ludwig and Waitzman (2007) stressed the importance of utilizing behavioral cues to help guide feedings, allowing the infant to communicate self-regulation and physiological stability, leading to more efficient feedings. In this model, the role of feeding in building relationships and communication is considered. The infant is observed in the moment, and the caregiver continuously modifies the approach through individual interventions to support the infant's stability (Shaker, 2013). Strategies utilized in this method to support developmental feeding practices include selection of a controllable flow rate, utilizing an elevated sidelying position, swaddling to optimize postural control, and avoiding prodding. The goal of the feeding is for the infant to be engaged without signs of distress, even if the session only lasts for a few sucks. Intake will then improve with development, if infants' needs are respected.

A hallmark of this method is recognition that the acquisition of feeding skills is development, and infants should not be pushed beyond their developmental capabilities (Browne & Ross, 2011). Protocols allowing the infant to drive the feeding through communication signals support their development toward becoming competent and efficient oral feeders, the ultimate goal for all infants. Allowing this communication to occur, and be respected, allows for increased self-regulation and coping skills. Through this communication, the caregiver anticipates and accommodates the infant's needs. This allows for avoidance of adverse events, because the caregiver acts proactively versus reactively. If an infant communicates he or she is finished with a feeding, the feeding stops, regardless of whether the bottle is empty. Intake is only viewed within the context of the infant's development, and is a byproduct of a quality feeding, versus the sole goal of a feeding (Shaker, 2013). Research has demonstrated utilizing cue based feeding decreases the amount of time between first oral feed and full oral feeds, provides consistency in feeding practices, increases confidence among caregivers, and lowers healthcare cost by decreasing length of stay and resource utilization (Kirk, Alder, & King, 2007; Ludwig & Waitzman, 2007; Newland, L'Huillier, & Petrey, 2013; Wellington & Perlman, 2015; Thoyre, Hubbard, Park, Pridham, & McKechnie, 2016).

Currently our NICU does not have an established standardized feeding protocol or training program to educate staff regarding cue based best practice; methods vary drastically from nurse to nurse, and a variety of feeding practices are implemented by physicians. Feeding is approached in the context of a volume driven culture, with the only indicators of success being empty bottles and weight gain. Despite therapists trying to educate and demonstrate cue based practices, nurses are often pressured to utilize more volume driven strategies such as faster nipples, chin/cheek support, and



feeding past distress cues, in a well-intentioned effort to empty the bottle. As discussed, these practices are not ideal, and our unit is looking to move towards a developmentally supportive model of cue based feeding to support our babies with the best evidenced-based clinical methods. Adoption of a protocol standardizing the approach to feeding will yield more consistent intervention practices. Using a standardized cue based approach aligns with the mission and vision of the hospital to provide evidence-based, state-of-the-art medicine to our most delicate patients. Development of a standardized protocol will also allow us to improve developmental and health outcomes for these patients.

### **Improvement Goal**

This project proposes the development of a standardized cue based feeding protocol and staff training program to be implemented in the NICU at UMMC. Research has demonstrated such protocols promote consistency among caregivers in the initiation and management of oral feedings (Thomas, 2007; Shaker, 2013). A multistep process will be required to develop this training program and standardized protocol. First, a thorough and complete literature review will be conducted to understand and evaluate current practices in cue based feeding protocols. Once types of protocols are identified in the literature, a comparison analysis will be conducted to further assess pros and cons of each approach to determine characteristics and tenets of each approach we may consider including in our protocol. A survey of other area NICUs will also be conducted to assess current practices in settings like those of our unit. This will allow us to understand what is working for other units in relation to cue based feeding interventions. Focus groups involving staff who engage in daily feedings will be

initiated with guided questions, to understand current feelings and motivations behind feeding on our unit, and the receptiveness to the initiation of a cue based protocol.

Based on the literature review, protocol analysis, NICU surveys, and focus group information, analysis will be conducted to identify current best practices, determine tenets of approaches to include in our protocol, understand what other settings are currently utilizing, and identify themes regarding feeding on our unit. Further data collection will then be conducted including: 1) a pre-implementation survey to assess current staff knowledge; and 2) feeding observations to identify current practices utilized. Staff will complete a pre-implementation survey and knowledge check, to assess their current understanding of cue based methods and stress cues. The results from this knowledge check will be utilized to gauge current understanding of cue based approaches, and will help to identify current feeding practices, as well as direction for staff education focusing on key tenets to educate staff on the missing elements of cue based feeding. Feeding observations by trained OTs and SLPs will be conducted to assess current feeding practices and use of infant cues in relation to daily feeding. These observations can be analyzed for themes that will inform the design of informational materials and training that promotes cue based feeding.

Once this data analysis has been completed, a formal protocol can be developed. When developing the protocol, the focus will include guiding caregivers in learning, recognizing, and responding to infant cues in order to implement individualized, developmentally appropriate feeding methods in which adults respond to infants' behavior and support the development of skills that enable infants to become efficient and skilled feeders. The protocol will be based on a feeding approach grounded in dynamic systems theory, including constant observation, monitoring for stress versus

stability, modifying the feeding approach, and providing individualized interventions to maintain or regain stability (Shaker, 1999). Dynamic systems theory explains infants must utilize multiple systems within their cortex to organize themselves to complete tasks (Thelan, 1989). These systems include autonomic, motor, state, and regulatory. Each of these subsystems must work together and interact in a very specific way to efficiently complete tasks. If one of these subsystems is not working efficiently, this can cause the infant to be unable to organize to effectively participate in feeding. Our protocol will prioritize the development of skilled feeders versus sufficient feeders, with focus on consistent and stable feeding skills across multiple days and multiple feeders. Once the protocol is complete, it will be presented to the medical team and approved for implementation.

Data analysis will also inform the development of appropriate staff training modules, including both self-study and hands on training, to target areas of knowledge necessary for successful protocol implementation. Staff training will include videos and images to help staff visualize and identify both stability cues and stress cues to improve staff ability to reliably interpret infant cues, a hallmark of the cue based feeding approach. Staff will also be required to demonstrate competency with a trained observer in assigning feeding readiness scores and determining quality of nipping.

A bedside resource packet will also be developed to include bedside cards and badge reels that offer a variety of resources and reminders, including a summary of stress cues, a quality of nipping scale, a feeding readiness scale, a flow sheet/decision tree outlining the protocol steps, and a cue based informational brochure for new staff. Once education has been completed, the protocol will be implemented on the unit for a trial period of two months.

During the two months of implementation, observations will be undertaken by OTs and SLPs to document implementation of the feeding protocol. These observations will be guided by a feeding observation checklist developed by the feeding team, guided by the infant driven feeding materials. Documentation of these observations will be analyzed to reveal consistency of practices. Staff will complete a post implementation knowledge check to re-assess knowledge regarding cue based feeding and stress cues, and confidence in feeding based on infant cues. At the conclusion of the two months, findings of both the observations and the knowledge check will be analyzed to determine retention and application of knowledge from training and implementation of the information into practice. A poster will be displayed on the unit summarizing the process and outcomes related to implementation of the cue based protocol.

The implementation of this staff training program and cue based protocol will enhance the consistency of targeted feeding practices, which in turn are expected to increase positive feeding outcomes for our infants and families. A standardized approach encompassing readiness cues, disengagement cues, and developmentally supportive techniques (Comrie & Helm, 1997; Shaker, 2013) will allow focus on delivering developmentally supportive care. These techniques will allow our infants to rely on consistent feeding practices, instead of having to re-learn the practices of each different feeder they may encounter during their stay. It is hoped this protocol will also prevent utilization of practices supported by volume driven culture, which may impact infant experiences and development, leading to potential long-lasting feeding aversions.

### **Organizational Role**

I currently serve as a Pediatric SLP within the children's hospital at UMMC. One of my primary roles is as a feeding specialist in the NICU, assessing and treating

oral motor and feeding deficits in premature infants. I work on a team of other feeding specialists including SLPs and OTs. At my prior place of employment, the feeding team utilized a cue based approach, and I saw great improvement in patient outcomes and decreased prevalence of aversive feeding behaviors with movement away from volume driven feeding practices. During my time as a therapist at UMMC, the feeding team has tried to integrate cue based feeding into our assessments and treatments, as well as provide nursing and family education regarding the importance of evaluating and responding to infant cues in relation to feeding. We have also communicated with the medical team regarding these practices. However, these practices need to occur on a unit-wide basis, with a more standardized approach, for there to be widespread impact.

I have not been involved in previous attempts to develop and implement a standardized cue based feeding protocol on this particular unit, as I have only been employed in this setting for a year. However, I work closely with other members of the feeding team who have previously attempted implementation of a cue based protocol. Going forward, however, I plan to assume a lead role in the development, implementation, and evaluation of a cue based protocol on the unit. The feeding team will share the responsibility of implementing the staff training and new protocol, and nurses and doctors on the unit will also have critical roles in the project. Doctors will need to approve the protocol for implementation, and be supportive of the practices for infants in their care. Staff training will focus on education for day-to-day implementation. Parents will also serve as feeders, as one of the tenets of cue based feeding includes training parents in co-regulation so infants can continue to be efficient and successful feeders at home following discharge.

This project will serve as the springboard for a much larger project regarding infant cue based feeding. The program will be expanded to include parent training to establish safe discharge plans for infant feeding encompassing quality feedings with understanding of stability and stress cues. Performance improvement projects will be undertaken to evaluate and compare traditional feeding methods with cue based methods for outcome measures such as length of stay, length of time to full feeds, and prevalence of feeding difficulties post discharge. This project will develop the foundation for the remainder of the scope of the much larger infant feeding and nutrition project.

This project will support my professional growth in a variety of ways. First, it will allow further establishment of my role as a critical member of the feeding team on the unit. It will foster further relationship building with nurses and doctors, yielding a more collaborative approach to feeding. The project will support more involvement in potential quality improvement and research projects on the unit, a significant interest. This project will also serve as a foundation for my application for Board Certification in Swallowing and Swallowing Disorders. Board Certification in this specialty area is a high honor and distinction of practice for an SLP. Part of this application process involves completing a project involving swallowing, including disorders of feeding. By completing this project, I will have satisfied one requirement for certification.

### **Planned Artifacts Narrative**

To understand, address, and assess the problem identified above, a series of artifacts will be completed. The table in the Appendix provides information regarding each artifact; however, each is also elaborated in the following pages to describe how each artifact links to the problem and goals of this project.

The first artifact will involve an evidence-based literature review. This review will include a search through currently respected online research search engines, including PubMed, to identify peer-reviewed research and information regarding cue based feeding, including former volume driven practices, NICU statistics, and current evidence regarding outcomes with volume driven and cue based methods. By completing this literature review, I will better understand prior volume-driven practices, current methods utilized involving cue based feeding, and outcomes utilizing this form of feeding intervention. This review will also allow examination of other protocols utilized in other units to help inform the author and medical team of potential information to include in our protocol, as we develop the procedures for our unit. This artifact will inform all other artifacts to be included in this project because it will drive the direction the project takes from design to assessment.

The next artifact will include a detailed comparison of different cue based protocols and approaches identified during the literature review. This artifact will allow for the analysis of the different protocols to identify discrete elements of each approach, their pros and cons, and what tenets are important for us to consider during development of our own protocol. This will also allow identification of key characteristics to include in our personalized protocol to best suit our specialized population of infants' needs.

The third artifact will include a survey of other area NICUs regarding cue based feeding. This artifact will allow us to determine what practices other similar settings are utilizing to guide development of our protocol. These surveys may also shed light on successes and potential problems identified in other units, which will help us in structuring our protocol in a way to support the successes and avoid problems. This

will also provide opportunities for continuum of care, as some patients travel between facilities and if we are utilizing protocols with the same elements, breakdowns in plans of care can be prevented.

The next artifact will be generated by a focus group activity in which staff discuss current feeding practices. Focus groups will identify current practices utilized and feelings regarding implementation of a cue based protocol. Focused questions will be utilized to elicit specific feedback regarding current feeding approaches and understanding of cue based methods. Ideas can also be garnered regarding development and implementation of the protocol, given that this group will be instrumental in the day-to-day program implementation. These focus groups will identify current issues on the unit regarding feeding to help prevent these from becoming issues during program implementation. The discussion will be recorded and further analyzed for key themes. These themes will be analyzed to further understand changes needed in current feeding practices, as well as where focus of staff education needs to be in relation to cue based feeding. Staff can feel invested in the project if their ideas and opinions are solicited and incorporated into the protocol as appropriate. This information will inform the development of the protocol/policy as well as the education module

Another artifact will reflect the analysis of feeding observations completed by current OT/SLP staff. These observations will focus on identification of current feeding practices through use of a feeding observation checklist developed by the feeding team. Observers will note whether the infant is demonstrating feeding readiness at the onset of the feeding, the presence of volume driven strategies in feeding sessions, and how staff monitor/respond to infant stress cues throughout the feeding. The analysis will reveal practices that need to be curtailed via staff education.



The next artifact is a staff pre-implementation knowledge survey involving cue based feeding. This survey will be utilized to understand knowledge regarding feeding readiness cues and stress cues, both hallmarks of the cue based feeding protocol. By understanding what information staff already have or lack regarding these methods, we can design appropriate educational modules, hands on training session, and bedside resources to ensure that all members of the team have the same baseline knowledge and are utilizing the same approaches during feedings.

Another artifact will be the cue based protocol the unit will use for implementation during this project. This protocol will lay out the procedures for implementing cue based feeding on our unit. As mentioned above, this standardized protocol will address varying feeding practices, and ensure all staff are on the same page with methods, techniques, and decisions regarding developmental feeding on our unit.

A formal staff education module and hands on training will be designed based on the information from the pre-test and observations, so they are individually designed for our unit versus utilizing a commercially available training. This will allow us to focus on the information most pertinent to our unit and our specific protocol. These education modules and trainings will be completed prior to protocol implementation to ensure that all members of the team are prepared to implement the protocol with reliability and consistency. Videos and images will be utilized to enhance learning and ensure inter-rater reliability among staff. Staff will also be required to demonstrate competency involving scoring feeding readiness and quality of nipping alongside a trained OT and SLP.

Bedside resource packets will also be included as an artifact to ensure all members of the team have access to information regarding the protocol and important tenets of cue based feeding. These resources will be guided by information identified during the literature review, staff pre-tests, feeding observations, and our developed protocol to ensure they address the necessary information. Types of resources may include bedside posters or badge reels addressing stress cues, quality of nipping scales, and feeding readiness scales. This will allow staff to have the information they need to successfully implement the cue based feeding approach.

The final artifacts will address assessment of the project including a post-implementation, feeding observations, a post-implementation focus group, and a poster presentation. The survey will be administered to re-assess staff knowledge regarding feeding readiness cues and stress cues; results will indicate whether our training approach was successful. These surveys will also address confidence in feeding utilizing the cue based feeding method. This will help our team to determine if we were successful in educating staff to independently identify feeding readiness cues, identify stress cues during feeding, and how to respond to these cues with appropriately trained strategies. The feeding observations will reveal whether the protocol is implemented with fidelity and identify any roadblocks or changes needed in the protocol to better serve our population. The post-implementation focus group will allow us to have guided discussion regarding implementation and potential improvements for the program in the future. Finally, a poster presentation will be designed to explain this project, including the protocol development and implementation, to educate staff on the value of cue based feeding. All artifacts are intended to support successful protocol implementation and assessment of utilization of cue based feeding on our unit, to allow

staff to see the value of utilizing standardized approaches to developmental feeding of premature infants. By utilizing these approaches, we can help infants develop into safe and efficient feeders utilizing current evidence based best practice to improve our patient outcomes.

Table A.1

*Description of Planned Artifacts*

<b>Artifact</b>	<b>Type</b>	<b>Audience</b>	<b>Description</b>	<b>Action Steps</b>
Evidence Based Literature Review	Understanding the Problem	Feeding Team Medical Team	Completion of a thorough evidence based literature review to further examine and understand current practices regarding cue based feeding in the NICU setting.	1. Complete thorough search in PubMed and other online databases  2. Review references of all articles found for additional sources  3. Critically appraise the literature and write findings in document
Protocol Comparison Analysis	Understanding the Problem	Feeding Team Medical Team	Analysis of the different protocols to determine pros and cons of each approach, and what tenets are important for us to consider during development of our own protocol	1. Review literature for different currently utilized protocols  2. Complete characteristic analysis to compare approaches  3. Identify pros/cons of approaches  4. Determine characteristics to include in our final protocol
NICU Cue Based Feeding Survey	Understanding the Problem	Feeding Team Medical Team	Design and carry out staff survey regarding current cue based feeding in other area NICUs. Goal is to survey a minimum of	1. Design survey questions  2. Identify NICUs to survey

			3 other units.	3. Identify contact person at each site 4. Send survey to contact 5. Analyze survey results
Staff Focus Group: Current Feeding Practices	Understanding the Problem	Nurses  Medical Team	Develop and complete focus groups with nurses and doctors to assess and understand current feeding practices and willingness to implement a cue based protocol. Ideas will also be accepted regarding protocol development and implementation.	1. Develop focus group questions 2. Identify times most staff can attend – ensure adequate representation from both shifts 3. Perform focus groups 4. Identify themes and analyze information received
Feeding Observations	Understanding the Problem	All	Observers will note whether the infant is demonstrating feeding readiness at the onset of the feeding, presence of volume driven strategies in feeding sessions, and monitoring/response to infant stress cues throughout the feeding.  Minimum of 10 observations	1. Construct observation data collection tool 2. Complete observations 3. Analyze observations for feeding practice themes
Staff Pre-Test Knowledge Survey	Understanding the Problem	Feeding Team	Develop and complete a pre-protocol implementation survey to assess knowledge re: feeding readiness cues and stress cues to inform feeding team areas of education and training need to increase chances of successful program implantation.	1. Design staff pre-test 2. Distribute to staff 3. Analyze survey results
Cue Based Protocol and Policy	Addressing the Problem	All Staff  Parents	Develop a complete protocol of feeding procedures and steps for implementation outlining hallmarks of	1. Utilize literature review, NICU survey, and focus group results to construct protocol

			<p>cue based feeding and how this protocol will be implemented on our specific unit.</p> <p>(samples – SOFFI, Kirk et al., IDF Ludwig, Newland article)</p>	<p>2. Gain approval from medical team</p> <p>3. Implement protocol for 2 months and assess outcomes</p>
Staff Education Module and Hands on Training	Addressing the Problem	Unit Staff	<p>Design and implement a training module for staff to complete prior to protocol implementation. This module will be guided by information discovered in the pre protocol survey to address needed areas of education. Hands on training will include videos and images to target identification of readiness and stress cues. Staff will have to complete a competency with a trained OT/SLP/RN to ensure reliability.</p>	<p>1. Informed by survey results, create educational module for staff to complete prior to implementing the protocol</p> <p>2. Complete trainings during both shifts to maximize number of staff reached</p> <p>3. Have staff complete competencies</p>
Bedside Resource Packet	Addressing the Problem	<p>Staff</p> <p>Medical Team</p> <p>Parents</p>	<p>Development and distribution of bedside cards and badge reels to summarize information including stress cues, quality of nipple scale, and feeding readiness scale to provide ‘at your fingertips’ information during protocol implementation.</p> <p>Distribution of a copy of the decision making tree will also be placed in each room to further assist in consistent protocol implementation.</p>	<p>1. Design bedside cards and badge reels based on protocol</p> <p>2. Distribute to all staff and place in all rooms</p>
Staff Post-Test and Knowledge Survey	Assessing the Problem	Feeding Team	<p>Develop and complete a post implementation survey to re-assess knowledge re: feeding readiness cues and</p>	<p>Distribute to staff</p> <p>Analyze results and compare to pre-test</p>

			stress cues to inform feeding team of whether or not education was successful. Also will assess confidence of staff in feeding infants based on these methods	
Feeding Observations (Evaluation)	Assessing the Problem	All staff	Feeding observations will be conducted by members of feeding team to assess consistency with which protocol is implemented throughout the intervention period.	1. Design evaluation checklist based on protocol  2. Complete observations from Mar-May  Analyze observations for themes/trends
Post Focus Group	Assessing the Problem	All	Complete post implementation focus group with guided questions to determine successes of implementation, further refinement of protocol/practices, etc.	1. Determine guided questions for group sessions 2. Conduct focus groups  3. Analyze themes
Poster Presentation	Assessing the Problem	All staff  Feeding Team  Parents	Design a poster to display on the unit to explain the process of protocol development and results of implementation.	1. Design poster with results from protocol  2. Present to medical team and display on unit  3. Consider presenting at professional conference

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## **Appendix B**

### **LITERATURE REVIEW AND STAFF WEBSITE**

Feeding and growing is essential to all human life. This is especially true for newborn babies, and critical for those babies who are born prematurely. Receiving and maintaining appropriate nutrition is essential for these babies to grow, thrive, and develop. Achieving this goal of appropriate nutrition is difficult with this population, due to immaturity of bowel function, difficulty with development of sucking and swallowing, risk of necrotizing enterocolitis, and complex medical illnesses interfering with eating, such as respiratory distress syndrome or patent ductus arteriosus (UCSF, 2004). These infants often require specialized feeding interventions to demonstrate adequate intake and growth. This literature review examines prior utilization of volume driven strategies versus newer, cue based, infant driven strategies.

#### **Current NICU Statistics**

Within the U.S. each year, almost 10 percent of babies from live births are born prematurely (National Center for Health Statistics, 2017). In Maryland specifically, 1.8 percent of all live births were extremely pre-term, and 8.3 percent were moderately pre-term. This resulted in one in 10 babies born during live births being pre-term. From 2009-2011, a range of 11.9-14.4 percent of all live births resulted in admission to the Neonatal Intensive Care Unit (NICU) in Maryland (National Center for Health Statistics, 2017). Babies are demonstrating increased survival rates with improvements in medical technology and resources. Improved survival rates of these very low birth weight and critically ill infants have increased risk of nutrition, growth, motor, and

sensory issues related to feeding in this population (Shaker, 2012). Babies who are born prematurely often demonstrate significant difficulty learning to eat, grow and thrive, secondary to interruption in development of complex motor and sensory processes.

### **Oral Feeding Development**

Learning to eat is a complex process involving the coordination of multiple subsystems. Oral feeding is the most complex process the infant will learn, due to the need to integrate these subsystems, and develop the motor coordination required for sucking, swallowing, and breathing (Bertoncelli, et al., 2012). This process is also reliant on neurodevelopment, maturation, and ability to maintain physiological stability. Eating is also co-dependent on behavioral state, all while sucking, swallowing, and breathing, in a carefully timed manner, to prevent adverse events (McGrath & Braesch, 2004). Feeding is additionally influenced by environmental factors and caregiver actions (Jones, 2012). These factors impact the ability of the premature infant to develop skills necessary to efficiently and safely feed.

### **Oral Feeding in the Premature Infant Population**

According to recent literature, high risk infants born prematurely, and babies born with complex medical conditions, demonstrate higher levels of feeding problems. They demonstrate difficulty with taking in, processing, digesting, and absorbing all the nutrients needed, which further impacts their development (Schmid et al., 2011). These higher rates are likely related to prolonged tube feeding via orogastric or nasogastric tubes, exposure to noxious stimuli around the mouth, or prolonged endotracheal intubation, all factors which can lead to oral aversions, impacting willingness to accept oral intake (Hawdon et al., 2000). This often results in an extended time for babies to learn and accept all their nutrition via the oral route.

Feeding is the most frequent reason for prolonged hospitalization in this population (Bakewell-Sachs et al., 2009). Other factors complicating transition to oral feeding can include differences in muscle tone, state regulation, endurance, and hunger cues (Lubbe, 2017). These differences impact the length of time for premature infants to achieve oral feedings when compared to full term infants. Transition from tube to oral feedings has been shown to average 10-14 days for healthy preterm infants (Pickler, 2004). This does not include babies born with complex medical conditions. Babies often rely on tube feedings for lengthy time periods, impacting hospital discharge and time away from parents, resulting in higher medical cost, potential impact on development, and further stress on the family unit (Lau & Hurst, 1999). Even with longer length of stay, infants are also at risk for failing to thrive once they are home from the hospital. Poor feeding is a common reason for re-admission within two weeks of discharge from the NICU, especially for late preterm infants, aged 34 to 37 weeks (Lubbe, 2017). These risk factors are further compounded by feeding practices and techniques utilized in NICUs.

### **Historical Infant Feeding Approaches**

NICUs often utilize a variety of feeding approaches and methods, usually impacted by physician treatment philosophies, and bedside experience of nursing staff. Feeding practices are often driven by tradition, history, or trial and error approaches (Sidell & Froman, 1994; Daly & Kennedy, 2000; Eichenwald et al., 2001). Variability in practices could include scheduling feedings every three hours, or only allowing the infant to feed a prescribed number of times per day. Variability in strategies can also exist between doctors, nurses, and caregivers of the infant, depending on who carries out the feeding. This often results in inconsistencies in practice during assessment and

intervention with feeding difficulties (Dodrill et al., 2008; Nationwide Children's, 2016). Due to lack of standardization, these actions often result in inconsistent feeding practices and strategies, ultimately resulting in longer time to transition to oral feeds, and may contribute to increased longer term feeding problems in this population (Premji et al., 2004). Emphasis is often placed only on weight gain and empty bottles, with the only success measure being growth.

These types of methods do not foster adequate skill development of the infant or development of the caregiver into a competent feeder. Initiation of feeding also usually focuses on gestational age and/or weight. Howe et al. (2008) recommended this decision should be individualized for each infant, and should include factors such as infant readiness, feeding cues, oral motor skills, weight, and age. Jones (2012) also added factors such as level of alertness, physiologic stability, and display of hunger cues. By utilizing factors other than gestational age and weight, including individualizing decisions relative to feeding each infant, there is a greater chance each infant will be ready to purposefully engage in feedings.

### **Volume Driven Feeding Practices**

One common characteristic among most NICU feeding environments is the volume driven culture. This culture stresses only the amount of intake the infant achieves, and measures of success are weight gain and empty bottles. Most times these units utilize strictly scheduled interval feedings, where the infant is pressured to feed at set intervals, regardless of their alertness level or engagement (Hay, 2008). This often results in infants being fed in a sleepy state, or when they are not communicating hunger cues. This culture promotes the mentality that the best nurses are the ones who can get the baby to take the most at each feeding.

Pressure is placed on nurses and caregivers to do whatever is necessary to get the infant to empty the bottle, and the focus is not on the feeding relationship or quality of feeding, but rather the quantity of volume consumed (Shaker, 2013). Although driven by good intentions to get the infant discharged, the strategies utilized to achieve empty bottles is often not developmentally supportive and does not help the infant to gain functional skills. Some of these strategies may include manipulating the bottle when the baby ceases sucking, continuing the feeding when the infant is asleep and no longer engaged, choosing a fast flow rate bottle to increase amount provided with each suck, prodding the infant to elicit sucking, and unswaddling to re-alert the baby (Shaker, 2013). These methods may cause the infant to continue feeding despite physiologic stress, including continuing to attempt to suck and swallow without stopping to breathe.

### **Infant Stress within Volume Driven Culture**

Infants' signs or symptoms of physiologic stress are often misread or ignored within the volume driven culture to ensure adequate volume is ingested. Signs of stress may include drooling, gulping, arching, pushing the nipple out of the mouth, and changes in alertness level (Shaker, 2013). This is critical because stress impacts infants' development of sensory neuropathways. Because of stress, these pathways may be mislaid or altered, establishing feeding as a 'bad' experience.

Each time infants feed, they have an opportunity to establish a new feeding experience, and if they demonstrate stress during these experiences, this may lead infants to demonstrate aversive feeding characteristics (Shaker, 2013). Although the unit may be able to achieve full feedings and discharge the infant home, these infants are often not able to sustain this feeding practice and are then re-admitted due to dehydration or failure to thrive (Lubbe, 2016). Volume driven methods may create

sufficient feeders for a period of time to achieve successful discharge. However, these sufficient feeders are only able to take in adequate volume sporadically and are not skilled feeders. Skilled feeders can consistently feed across the day with multiple caregivers, and in multiple environments (Thoyre, 2007). Babies who are forced to feed through volume driven practices are often not able to continue these practices at home.

### **Long Term Impacts of Volume Driven Feeding**

Volume driven strategies often result in stress and instability, making feeding unpredictable for babies, potentially resulting in long term effects on feeding as they impact not only the ability to eat, but also the desire to eat, due to repeated negative experiences (Thoyre, 2007; Ross, 2008). Research has also demonstrated long term effects on feeding development. Hawdon et al. (2000) reported over 50 percent of parents of preterm infants commented their child had persistent feeding difficulties after 18 months. The impact is especially true for extremely low birth weight infants, with 62 percent of babies born below 600 grams demonstrating problematic feeding after two years of age; of these, 29 percent required alternative feeding methods (Sweet et al., 2003). Therefore, NICUs should examine feeding practices, and attempt to change the culture of feeding to be more developmentally supportive of infants, and make feeding a positive experience each time the infant is presented with a bottle or breast.

### **Changing Feeding Culture**

Changing current feeding methods requires an examination of the language and culture regarding feeding. Although it is important for the infant to intake a certain volume to receive enough calories, focusing on quantity alone does not consider overall developmental progression of the infant (Thoyre & Brown, 2004). Feeding must

involve concern both for quantity and quality of feeding. Eating should be viewed as a highly skilled process involving multiple factor versus a normal mundane task (Premii et al., 2004). Medical staff need to understand the importance of utilizing continuous assessment of infants throughout feedings, and respect infants' communication regarding stability and stress.

Feeding is often perceived as a mundane task, not requiring complex knowledge, and it may be delegated to assistants or aides, or even nurses, who have not received appropriate instruction in feeding critically ill, premature babies (Shaker, 2013). This lack of knowledge and instruction often leads to inconsistent feeding practices, ultimately impacting sensory experiences and overall feeding development, as the infant is required to re-learn methods depending on the particular caregiver at each feeding. Methods utilized during early infancy can ultimately impact developmental outcomes later in the infants' life (Briere et al., 2014). To make this change in thinking towards a more developmentally supportive protocol, interdisciplinary collaboration is essential to ensure success. This collaboration must occur among the medical team, nurses, parents, and the therapy team, to ensure all members of the infants' care team are on the same page when discussing and implementing feeding practices. The focus should be the establishment of co-regulation between the infant and the caregivers, where the infant drives the feeding.

### **Cue Based Feeding**

A newer method being explored in the literature and in NICUs around the U.S. is cue based feeding. Cue based feeding is a process of utilizing the infants' developmental maturity level to drive feeding (Cormier, 2015). Utilizing cue based feeding supports the infants' developmental progression into an efficient and safe

feeder. Cue based feeding requires recognition of feeding as a developmental process, in which there is a continuum of skills.

Infants' current developmental level must be respected when approaching feeding attempts and infants should not be pushed further than current skill allows (Browne & Ross, 2011). Also known as infant driven feeding, these methods rely on the infants' communication of readiness and stability to drive each feeding (Ludwig & Waitzman, 2007). This process involves utilizing the infants' ability to self-regulate and to communicate with the feeding partner the desire to initiate and continue oral feedings. The goal of feeding is infant stability and engagement without distress, not an empty bottle. Feedings are structured around the infant, and are considered successful, even if they only last a few sucks (Shaker, 1999). The focus is on relationships and skill development, as intake will improve as the infants' skill improves.

### **Cue Based Feeding and Developmental Theory**

Cue based feeding is linked back to early theories of development, including the synactive theory developed by Als (1982). This theory involved consideration of the environment, and the infant's abilities, along with interaction between the infant and the feeder, with the development of skills overtime. One important tenet of this approach is respect for development as a continuous process. This theory also discussed how the infant interacts with the environment through four systems: autonomic, motor, behavioral, and attention. These systems are hierarchical, and therefore a breakdown in one system can impact the rest. If an infant cannot maintain self-regulation throughout feeding, then likely the feeding will not be successful. The environment and interaction with the caregiver are keys to successful oral feeding experiences.



### **Goals of Cue Based Feeding**

Goals of this approach include increasing infant stability, supporting feeding skill development, safe intake of nutrition, supporting caregiver development and confidence in implementing feeding strategies, and promoting knowledge of infant readiness and stress cues, in support of successful and safe feedings (Shaker, 2012). Cue based protocols rely on infant readiness and stress cues to guide the feeding and support implementation of support strategies. These protocols involve constant observation of the infant throughout the feeding for indicators of stress and stability. The feed is modified based on this communication with utilization of individualized interventions to support the infant, in re-gaining or maintaining stability. The goal is for the caregiver to act proactively to prevent instability from happening rather than reactively when it does. (Shaker, 1999). By preventing instability, decreased stressful experiences will result, hopefully eliminating chances of long term feeding aversions. Promoting infant stability reduces the stress associated with feeding which in turn reduces the likelihood of long-term feeding aversions.

### **Importance of Relationships**

Each feeding is recognized as a relationship experience. The caregiver reads the signs of self-regulation to determine appropriate actions during the feeding. By recognizing the infants' behavior as communication signals, regarding stress or stability, the caregiver can respond with strategies to improve self-regulation skills, development of feeding skills, and coping skills, during periods of stress (Shaker, 2013). This constant two-way communication between infant and feeder is essential to cue based feeding, to ensure positive, developmental feeding experiences.

## **Reading Infant Cues**

Multiple studies have demonstrated the link between infant feeding performance and behavioral readiness cues (Pickler, 2004; Thoyre, Shaker, & Pridham, 2005). By reading the infants' cues, allowing them to communicate throughout the feeding, and providing the supports responsive to this communication, infants develop the skills required for further self-regulation and development of feeding skills. Individualized strategies may include providing catch up breaks to allow the infant to breathe, choosing a slower flow nipple to control amount of milk received per suck, and pacing the infant by providing only a certain number of sucks prior to instituting a break (Shaker, 2013). This enables the infants to develop skills to self-regulate the feedings, while protecting their airway and remaining physiologically stable.

The process of cue based feeding involves utilizing the infant as the driver of the feeding, versus utilizing strategies forcing them to continue to eat, as previously discussed in volume driven feeding. Infant readiness is a hallmark of this approach. This readiness is defined relative to when the infant is ready to initiate feeds for the first time, as well as when the infant is ready for each specific feeding event (Jones, 2012). When the infant drives the feeding, and his or her communication signals are respected, feedings are safer, less stressful, and often result in more consistent volume intake, compared to other feeding methods (Shaker, 2012).

Cue based feeding relies on communication through behavior. These behaviors can include actions such as rooting, sucking on fingers, and tongue sucking (Shaker, 2013). Caregivers must be trained and knowledgeable about these cues to effectively provide cue based feeding experiences. Feeding should be a relationship between the infant and the caregiver, with back and forth communication, and response to what is

communicated by both parties. Without utilization of these cues, feeding is task based rather than relationship-based.

### **Recognizing Stress Cues**

Caregivers need to be acutely aware throughout the entire feeding of potential stress and changing stability, as evidenced by the infants' behavior. Signs of disorganized behavior can be represented across the hierarchy of subsystems discussed earlier from Als (1982) syntactic theory. Break down in the autonomic system may be represented by respiratory pauses, tachypnea, color changes, gagging, spitting up, coughing, and yawning. Disorganization in the motor hierarchy can be evidenced by loss of tone or frantic activity. Behavior disorganization is noted by eye floating, staring, gaze aversion, irritability, and crying (Als, 1982). These signs of disorganization may be subtle or fleeting, yet are important for the caregiver to recognize and respond to in order to prevent negative experiences.

By recognizing where the breakdown is occurring, the feeding partner will be able to respond using an appropriate, individualized strategy rather than a generic one, which may impact the infants' own internal coping mechanisms (Shaker, 2013). When a relationship is established with ongoing communication and assessment, the experience for the infant transforms from the infant 'being fed' to the infant being 'supported in feeding', changing from something *done to the infant* to a process *done with the infant* (Shaker, 2013). Many studies have examined outcomes of cue based approaches.

### **Outcome Studies utilizing Cue Based Feeding**

Multiple authors have examined the outcomes of utilizing cue based feeding practices and the impact on transition to oral feedings. Kirk et al. (2007) utilized a

prospective study with comparison to a previous control co-hort. A total of 51 infants were included, and all demonstrated complex medical issues. The intervention group received cue based feeding methods, and the historic control group received individual physician implemented feeding methods. Results demonstrated cue based feeding resulted in full oral feeds six days earlier than those with physician directed methods. Weight gain was also increased in the intervention group. Infants in the intervention group were able to be discharged four and a half days sooner than control group infants. These study results are limited by small sample size, lack of randomization, and lack of standardization in the protocol implementation. This impacts the ability to generalize results and impacts the strength of the outcomes data.

McCain et al. (2001) completed a study of 81 infants utilizing a semi-demand feeding method, focusing on infant cues, compared to a standard feeding method of gradual increases in feeding attempts, regardless of cues. The intervention group demonstrated achievement of full oral feeds five days sooner than the standard feeding method. No significant differences in weight gain were noted between groups. A limitation of this study included exclusion of critically ill babies. This is important in terms of our unit because we take care of some of the most critically ill babies and need to consider the exclusion of them in terms of outcome results.

Drenckpohl et al. (2009) examined two feeding protocols, one involving cue based feeds, and the other based on set feeding times. Infants in the cue based group initiated oral feeds one week sooner than the scheduled feeding group. No statistical differences were found between groups in regard to weight status, feeding therapy consults, or length of stay. Limitations of this study included retrospective analysis, and exclusion of medically complex infants. Retrospective analysis impacted information

available and exclusion of critically ill infants impacts generalization to our population as mentioned above.

Thorye and Brown (2004) observed bottle feedings of 22 preterm, low birth weight infants. They were examining engagement with the feeding partner, which in all cases in this study was the mother of the infant. The authors utilized multi-level linear regression to examine characteristics including role of feeder as co-regulator, birthweight, post-conceptual age, and baseline oxygen saturation, and episode characteristics including readiness at onset, baseline oxygen saturation, mean oxygen saturation, maternal feeding behaviors, and phase of feeding. The authors found engagement was more likely to occur early during the feeding, during episodes with high levels of infant readiness cues, and during episodes with higher mean oxygen saturation throughout the episode. Feeding episodes with reduced nipple manipulation by the caregiver had increased levels of engagement. These results indicated infants' ability to maintain participation with bottle feeding is not solely explained by characteristics about them or about their baseline condition prior to feeding. Limitations of this study included small sample size and wide variability in birth weight, post-conceptual age, and respiratory status.

Werner and LeSage (2013) reported outcomes of a standardized cue based feeding protocol on their unit. By utilizing a cue based approach, days to consuming a full oral feed decreased from 8.2 to 6.5 days, days to nipping all feeds decreased from 17 to 12.3 days, and length of stay decreased from 24.5 to 20.9 days. Limitations of this study were lack of randomization, and lack of a control group, as comparisons were only made from time periods, without consideration of the infant characteristics. However, this is still valuable information to guide further research and investigation

into cue based feeding outcomes, and impact on days to full oral feeds, days to nipple all feeds, and length of stay.

White-Traut et al. (2005) completed a study looking at frequency of feeding readiness cues and feeding efficiency, with 21 pre-mature infants born between the ages of 29 and 35 weeks gestation. Infants were assigned to a control group, who received routine care, or an experimental group, who received auditory tactile visual vestibular intervention (ATVV). Feedings were video recorded to examine behavioral state and demonstration of feeding readiness cues. Feeding efficiency was calculated by dividing total intake by duration of the feeding. Authors found behavioral state was not a predictor of the number of feeding readiness cues demonstrated. The number of feeding readiness cues was significantly related to feeding efficiency, with increased readiness cues equating to improved feeding efficiency. This is important to consider because infants who are demonstrating cues for readiness are able to be more efficient with feeding than those who are not demonstrating readiness. No significant difference was found between the control or experimental groups in terms of feeding readiness cues or feeding efficiency. Limitations of this study included small sample size, research design and implementation flaws, and exclusion of critically ill infants, impacting ability to generalize the data to our population.

Davidson et al. (2013) examined the utilization of cue based feeding, specifically with infants who had bronchopulmonary dysplasia (BPD). A total of 115 infants were included, 60 in the control group, and 55 in the study group. Infants in the cue based group achieved full oral feedings in significantly less time than those in the baseline group (8 vs. 19 median days), even across levels of severity of BPD. Overall weight gain was less for the cue based group (350 g vs. 461 g). Limitations of this

study included retrospective analysis, and inability to generalize findings to other NICU populations.

Chrupcala et al. (2015) completed a study involving baseline data collection, and then implementation of a cue based protocol in their 85 bed NICU. Baseline data was collected on 20 infants and demonstrated mean total length of stay of 43 days. Post cue based protocol implementation data was collected on 150 neonates and demonstrated a mean total length of stay of 36.4 days. This finding is important because most physicians feel cue based feeding may extend length of stay, when it significantly decreased length of stay. Limitations of this study include lack of equal control and implementation groups, and the wide diversity of populations included within the samples.

Puckett et al. (2008) examined utilization of a cue based protocol within a NICU in Canada. One hundred eighty infants were screened, however only 79 were enrolled. Infants were randomly assigned to a control or intervention group, with 33 healthy premature infants, and 46 medically complex infants included in the sample. Infants in the intervention group were discharged home 4.5 days earlier, a significant difference when compared to the control group. Boys in the intervention group went home significantly earlier than either gender in the control group (6.3 days). The number of adverse events experienced by infants was significantly less in the intervention group when compared to the control group (3.5 vs. 12.8). These findings support the positive impact of cue based feeding on accelerated discharge, frequency of adverse events, and workload demands did not increase, with utilization of cue based methods. Limitations of this research included lack of blinding, and lack of consistency of caregivers throughout implementation.

Kish (2014) evaluated the implementation of a cue based feeding protocol utilizing a quasi- experimental design with historical controls. Infants were included if they were born at less than 35 weeks, had no ongoing oxygen needs, and were medically stable for introduction of oral feedings. The final intervention sample (due to discharges, medical instability, etc.) consisted of 28 preterm infants, and the historical control group had 43 infants. No significant difference was found in time of achievement of exclusive oral feeding, although the intervention group did reach this milestone one day sooner. No significant difference was found in length of stay, yet infants in the intervention group were discharged on average three days sooner. Despite no statistically significant differences, clinically relevant findings related to length of stay, and achievement of full oral feeds were observed. Limitations of this study include unblinded investigators, use of historical controls, and loss of healthy, stable infants from the intervention group due to discharge to other facilities. Ongoing research is needed to address limitations in these studies to allow for more highly regarded research outcomes with stringent randomized control trials to allow for generalization to other populations, however they demonstrated significant clinical implications.

### **Impact of Cue Based Feeding Approaches**

Cue based feeding has been shown to decrease number of days from first oral feed to full oral feeds, decrease length of stay and resource utilization, minimize variability in feeding practices, provide consistent documentation of feedings by staff, and increase feeding confidence of parents and caregivers (Newland et al., 2013; Thoyre et al., 2005; Kirk et al., 2007). All of these factors are crucial for realizing the impact of utilizing standardized, cue based approaches.



These methods have also been shown to increase weight gain and result in fewer significant adverse events (Lubbe, 2017; Puckett et al., 2008). In addition, improved nutrient intake and improved physiological outcomes have also been noted (Crosson & Pickler, 2004; Kirk et al., 2007; Law-Morstatt et al., 2003; Thoyre et al., 2016; McCormick et al., 2010). Improved weight gain and intake is supposedly one of the reasons physicians choose the volume driven methods, so this evidence is important in refuting mistaken assumptions. Finally, cue based feeding did not increase staff workload, contrary to the belief of many nurses who think regularly scheduled feeding every three to four hours is more efficient (Puckett et al., 2008; Kirk et al., 2007; McCormick et al., 2010).

All the studies discussed above provide evidence for utilization of cue based feeds to support infants in development of efficient and safe feeding skills. Further research in this area, including randomized clinical trials is needed. Future research should involve utilization of blinded implementers, to truly understand the outcomes of cue based feeding approaches. Long term studies should also examine utilization of these approaches, and rates of persisting feeding difficulties, to see if there is any difference in prevalence compared to traditional volume driven methods. Standardized, commercial tools are available to units to support the implementation of cue based feeding practices. Currently available tools are discussed below along with outcomes research for these studies.

### **Current Assessment Tools for Cue Based Feeding**

When implementing cue based feeding, standardized assessment tools help provide consistency among team members to ensure they are observing and assessing the same behaviors. Several tools are currently available yet Howe et al. (2008) found

current assessment tools have not been appropriately validated, and thus should be utilized cautiously. Crowe et al. (2012) also completed a systematic review of instruments for assessing readiness to start oral feedings, and the impact of tool choice on establishment of full oral feedings. They were unable to discover any randomized or quasi-randomized studies evaluating the utilization of formal tools, despite reviewing over 900 articles. In addition to limitations in psychometric properties, Jones (2012) discussed other limitations: inability to score breast and bottle feeds, inability to score term and pre-term infants, and the extensive training required to utilize the tools with validity. Objective measures and resources specifically designed for each unit may result in adequate standardization of assessment, until further establishment and review of standardized tools.

Bedside feeding plans can also help guide caregivers in identifying and recognizing the individualized cues an infant may demonstrate. Each feeding will be different; however a pattern of behaviors can be established for each infant, and these can help guide caregivers, especially parents, learn how to read and respond to their babies' communication cues (Shaker, 2011). This will reduce the variation between caregivers, and the infant can learn to predict the response of caregivers, versus having to re-learn each caregivers' response methods at each feeding. Documented feeding guidelines provide objective recommendations for caregivers to follow. This consistency among caregivers, and continuity of care, limits variability experienced by the infant (Thomas, 2007). Greater consistency and continuity contribute to improved feeding outcomes for infants and support development of skilled feeders.

### **Current Commercially Available Cue Based Feeding Protocols**

There are currently a few commercially available cue based feeding protocols to help guide units in establishing cue based feeding programs. Each of these protocols utilizes different pathways to establish their version of cue based feeding, but all reflect the tenets of cue based feeding discussed above, and address identification of readiness cues, constant monitoring for stress cues, and ongoing focus on the feeding relationship between the infant and caregiver. These tools will be discussed below, along with currently available research regarding outcomes utilizing these protocols.

#### **Support of Oral Feeding for Fragile Infants (SOFFI)**

SOFFI is a method of cue based bottle feeding developed by Philbin and Ross (2011), guiding development of each infant into a competent feeder without direct focus on volume intake. This method defines an efficient feeding as one where the infant self-regulates, remains stable throughout the feeding, and the caregiver supports the infant through monitoring of cues and supports with utilization of strategies. The protocol lays out step by step decision making for caregivers.

The protocol starts with changing the environment and monitoring baseline stability. The infant is then assessed for readiness cues and is picked up by the caregiver. Stability is then assessed again, and if stable, the infant is offered non-nutritive sucking on a pacifier or gloved finger. Stability and readiness is then re-assessed. If still alert and demonstrating readiness cues, a bottle is offered. Stability is continually assessed throughout the feeding. The caregiver monitors for participation, efficiency, and self-pacing. If major desaturations or distress is demonstrated, caregivers provide supports as indicated. The infant may continue feeding if these supports resolve the issue; however, if negative events continue, further feeding is

deferred. The feeding is also stopped if the infant stops actively participating in nipping, has significant oral spillage, or has noisy breathing not resolved by the support strategies. Algorithms are also provided to the caregiver to assess efficiency and determine the most appropriate nipple for the baby. A pacing technique algorithm is also available to support caregivers in determining when to utilize pacing to help the infant coordinate sucking, swallowing, and breathing, and how to determine if pacing is an effective strategy for an individual infant.

**Outcome studies with the SOFFI method.** Horner et al. (2013) completed a longitudinal study to assess the impact of implementing the SOFFI method on outcomes such as length of stay, growth, and oral motor outcomes at discharge. Longer-term outcomes were also assessed at three to five months post NICU discharge. The study utilized a convenience sample of 81 infants during a six-month period to assess traditional feeding method outcomes. The intervention group participated in a three-month implementation utilizing the SOFFI method, and contained 75 infants. This sample included medically complex infants.

Results demonstrated infants born prior to 37 weeks gestation in the intervention group achieved full oral feedings in significantly less time than those in the control group. No statistical difference was found for infants born at or above 37 weeks. Length of stay was also decreased by four days, yet this was not found to be statistically significant. Weight gain was not found to be statistically different between groups. Post-discharge phone interviews conducted three to five months after discharge indicated infants in the intervention group demonstrated statistically significant differences with fewer feeding problems, less arching and less spitting, and fewer were treated by feeding therapist. Limitations of this study included convenience sampling,

loss of infants to follow up at the post discharge interview, and no validated tool for assessment of parent reports during interviews.

### **Infant Driven Feeding**

The Infant Driven Feeding (IDF) method is a neurodevelopmental approach to supporting oral feeding developed by Ludwig & Waitzman (2007). Tenets of this model include supporting development, unifying the team, changing feeding culture, creating positive experiences, establishing standardized feeding systems, strategizing interventions, and sustaining progress. IDF focuses on allowing the infant to drive the initiation and continuation of feeding, with caregivers providing support versus directing the feeding. Multiple scales are provided to assess the infants' ability to participate in the feeding.

The first scale measures readiness with a score of one to five, with one indicating alertness and rooting behaviors, and five indicating significant changes in stability with routine care. The next scale provides caregiver techniques to support the infant during feeding including modified sidelying position, external pacing, specialty nipple, cheek support, frequent burping, and chin support. Finally, the last scale measures the quality of the feeding, also on a scale of one to five, with one indicating coordinated suck, swallow, breathe coordination, and a five indicating inability to coordinate and demonstrating significant changes in physiological stability throughout the feeding.

**Outcomes of IDF.** A study completed by Wellington and Perlman (2015) examined the utilization of IDF with infants born at less than 34 weeks gestation. The infants were split into a control group, utilizing traditional feeding methods, and an experimental group utilizing the IDF method. The infants in the IDF group overall

demonstrated significantly lower post menstrual age at time of full oral feeds, and at discharge, compared to the traditional methods group. Infants born at less than 28 weeks demonstrated achievement of full feeds 17 days sooner, 28 to 31 week olds, 11 days sooner, and 32 to 33 weeks, three days sooner than the traditional method. Infants were discharged from those groups nine days sooner, nine days sooner, and three days sooner, in those same age groups respectively, compared to the traditional methods.

Chrupcala et al. (2015) also examined Infant Driven Feeding. Baseline data collected on 20 infants revealed a mean total length of stay of 43 days. Post cue based protocol implementation data was collected on 150 neonates and the mean total length of stay was 36.4 days. This finding is important because most physicians feel cue based feeding may extend length of stay, yet these data reflect a significantly decreased length of stay. Limitations of this study include lack of equal control and implementation groups, and the wide diversity of populations included within the samples.

### **Early Feeding Skills Assessment**

The Early Feeding Skills Assessment (EFS) is a tool developed by Thoyre, Shaker, and Pridham (2005). The EFS involves 36 observational measures of feeding skills divided into readiness, skill, and recovery. Oral feeding readiness includes examination of five indicators of preparedness for feeding, including examining body posture, flexion, and attempts to suck/root. If the infant is not demonstrating appropriate scores, the caregiver can provide support interventions, such as nonnutritive sucking and swaddling, and then re-assess the infant.

Oral feeding skill examines 25 items across four domains of infant feeding skill including feeding engagement, organization of oral motor functioning, coordination of swallowing and breathing, and maintenance of physiological stability throughout the

feeding. Each of the areas is scored individually as part of the assessment, however they are all co-dependent and interrelated. Oral feeding recovery includes items assessed for five minutes after the feeding, to observe behavior and physiological recovery, through measurement of alertness, energy level, and physiological measures, such as heart rate and oxygen saturation.

There is also a place to track feeding descriptors including maintenance of feeding skills across the feeding, amount of supplemental oxygen needed, and type of bottle/nipple utilized. There is also notation for the caregiver to indicate any supportive strategies provided during the feeding, such as resting, co-regulated pacing, and swaddling. This tool allows for tracking of skill development, planning of intervention strategies, and evaluation of effectiveness of supportive interventions. The EFS also allows for identification of areas of strength, and areas in need of support, for efficient and safe feeding.

**Outcomes of EFS.** Unlike the other measures, the EFS does not necessarily guide the caregiver in how to respond to the infant, like IDF and SOFFI. Limitations of this tool include lack of outcome data. The authors reported content validity had been established and reliability is acceptable, yet no specific results have been published regarding these measures. No other outcome studies were found during this literature search.

### **Comparison of Tools and Selection for UMMC**

Our team examined the three tools and the research supporting each to determine how to construct the protocol our unit would utilize for cue based feeding implementation. Both the SOFFI and IDF protocols had research studies demonstrating achievement of oral feedings in significantly less time than those utilizing traditional

feeding methods (Horner, et al., 2013; Wellington & Perlman, 2015). SOFFI had very laid out decision making tools however, there were so many that utilizing them in daily practice was decided to be cumbersome by our nursing and therapy staff. In addition, SOFFI only addressed bottle feeding and our unit is also currently working on increasing breastfeeding, whereas the other tools allowed for examination of both methods of feeding. Our team did not want to limit staff by choosing a tool not also allowing for the examination of breastfeeding. Components of SOFFI our team decided to include in our program include continually assessing the infant throughout the feeding and stopping the feeding if the infant stops actively participating in nipping.

The team decided against utilizing EFS given the length of the tool requiring scoring of 36 measures, the specific training required to administer, and the lack of supported decision making during feeding provided by other tools examined. Additionally, the EFS does not currently have any validated research to support effectiveness or reliability of the tool. IDF had great program tenants including supporting development, changing the feeding culture, and positive experiences our team resonated with. Our team also liked the scoring scales to assess feeding readiness and feeding quality. The scales allow for scoring of both breast and bottle feeding, and provide guidance for supporting non-nutritive sucking experiences if the infant is not appropriate for oral feeding. The one downside to the IDF protocol identified by our team was possible subjectivity of some of the ratings and scorings. The team decided to address this by providing ample education during our hands on sessions and providing additional scoring practice to ensure consistency with scoring.



### **Relation to the Problem**

Currently our NICU at UMMC does not have an established standardized feeding protocol, methods vary drastically from nurse to nurse, and feeding practices are implemented by physicians with varying methods. Feeding is approached from a volume driven perspective, with the only indicators of success being empty bottles and weight gain. Despite therapists trying to educate and demonstrate cue based practices, nurses are often pressured to utilize more volume driven strategies such as faster nipples, chin/cheek support, and feeding past distress cues, in a well-intentioned effort to empty the bottle. As discussed, these practices are not ideal, and our unit is looking to move towards a developmentally supportive model of cue based feeding, due to the benefits demonstrated in the research, and to support our babies with the best evidenced based clinical methods. This protocol will allow for a standardized approach allowing more consistent intervention practices. A standardized cue based approach will help the unit to align with the mission and vision of the hospital, including providing evidence based, state of the art medicine to our most delicate patients. Development of a standardized protocol will also allow us to improve developmental and health outcomes for these patients.

### **Conclusion**

Decisions regarding feeding should include individualized assessment of each infant, with consideration of feeding skills development, readiness cues, and signs of stress/stability. Ongoing assessment should be completed to continually examine the infants' skill development and tolerance of feedings, and communication of stress should be respected (Jones, 2012). Feeding interventions should be individualized for each infant and should support development of safe and efficient feeders. Intake should

not be the sole factor of success and should only be viewed within the context of skill development and as a by-product of a quality feeding (Thoyre & Brown, 2004). By utilizing an individualized approach, each infant can be met at their developmental level, to support the transition and maturation of their skills. There should be continuity of care to decrease variability and support consistent communication between the infant and caregivers (Als, 1982). This will help support development of the infant, and lead to successful, organized feeding experiences.

The implementation of a cue based protocol at UMMC will allow consistent implementation of feeding practices to improve outcomes for our infants and families. A standardized approach encompassing readiness cues, disengagement cues, and developmentally supportive techniques (Comrie & Helm, 1997) will allow focus on delivering developmentally supportive care. Our team will likely utilize a variety of resources to develop our protocol including guidance from SOFFI, IDF, and EFS. These techniques will allow our infants to rely on consistency of feeding practices, instead of having to re-learn the practices of each individual feeder they may encounter during their stay. It is hoped this protocol will also prevent utilization of practices supported by volume driven culture, which may impact infant experiences and development, leading to potential long-lasting feeding aversions.

Website: <https://sites.google.com/view/jenhoodpedfeedingandswallowing/nicu-risk-factors/infant-development>

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## Appendix C

### LOGIC MODEL

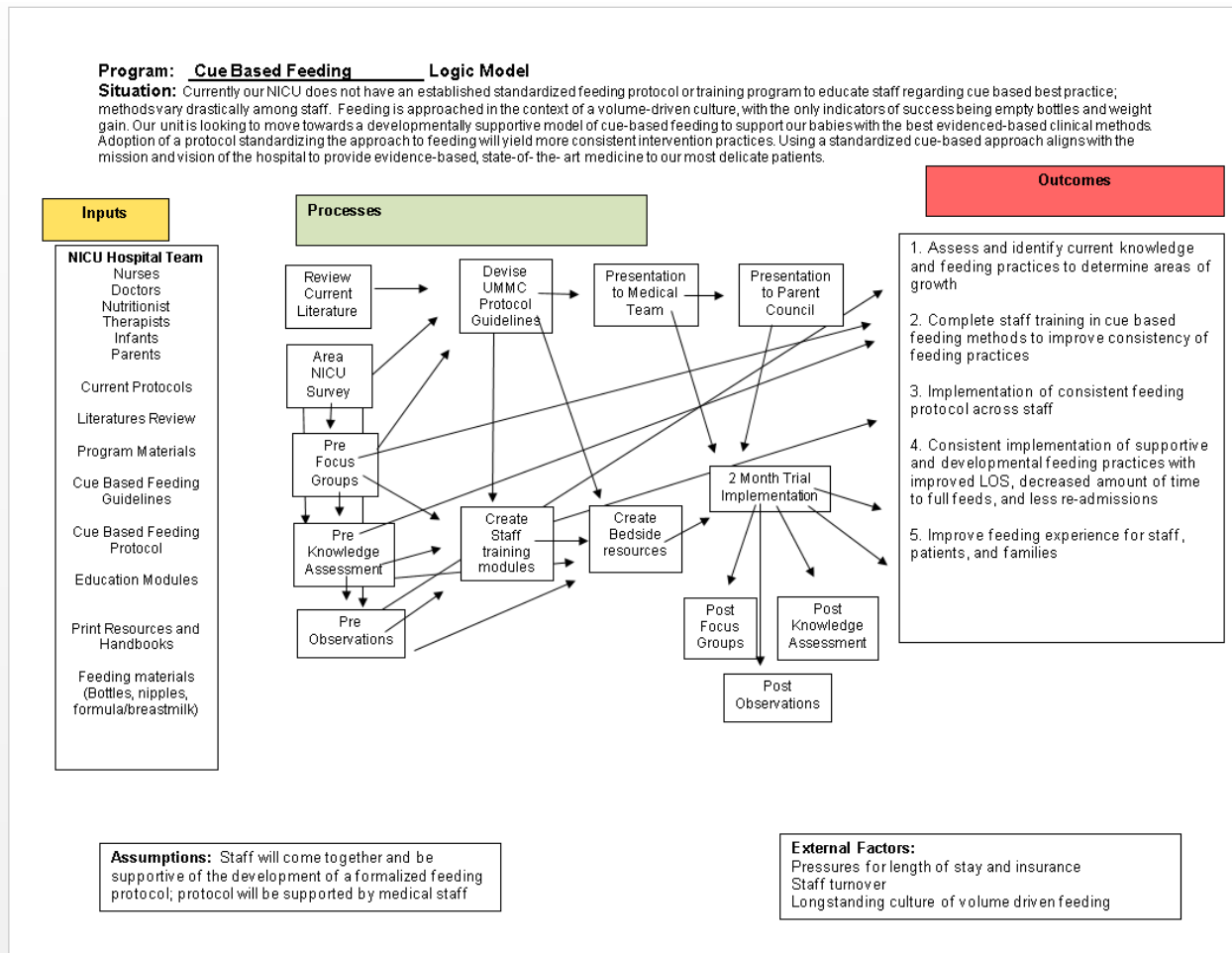


Figure C1. Logic Model

## **Appendix D**

### **ORGANIZATIONAL CHART**

The organizational chart was created to assist the writer in identifying key stakeholders who would need to be involved in the discussions regarding construction and implementation of the cue based feeding protocol. Discussing the protocol with these parties was essential to gain their support, and to determine critical details of the protocol, that would ensure their approval. By designing this chart, the writer was able to identify parties not initially considered, and who to contact as a representative, for each of these groups. These parties also served as resources to further develop the tenets of our cue based approach from a medical, nursing, nutritional, and rehabilitation perspective. By including all members of the team, each group within our unit was represented and felt they had a voice at the table.

The medical team including the division director, NICU medical director, neonatologists, fellows, residents, and nurse practitioners, were essential to include given they write the feeding orders for our infants. Educating them on the research outcomes was vital for them to understand the role of cue based feeding, and how it promoted development of skills, while not prolonging discharge. Inclusion of the nursing director, unit nursing manager, and nursing team was important given they are the day-to-day implementers of all feeding practices, and we needed to ensure the protocol developed was feasible to implement. The nursing teams' feedback was highly sought after during our focus groups, as well as during assessment of pre and post education knowledge regarding cues, given they implement the protocol daily. The

nutritionists were included to ensure our protocol would support the growth and nutrition goals of our infants alongside their development as efficient feeders. Finally, the pediatric rehabilitation team was essential given their specialized knowledge in infant feeding development.

By identifying these key stakeholders, the process of developing and implementing a new cue based protocol, was able to become a reality. This allowed consideration of the issue of infant feeding from a multitude of lenses to analyze all potential impacting factors. By having all parties and voices represented, it was ensured all would be on board with implementation with the new protocol and guidelines, given feedback was sought from all groups, and included in the creation of the program.

Organizational Chart Cue Based Feeding Project: UMMC NICU

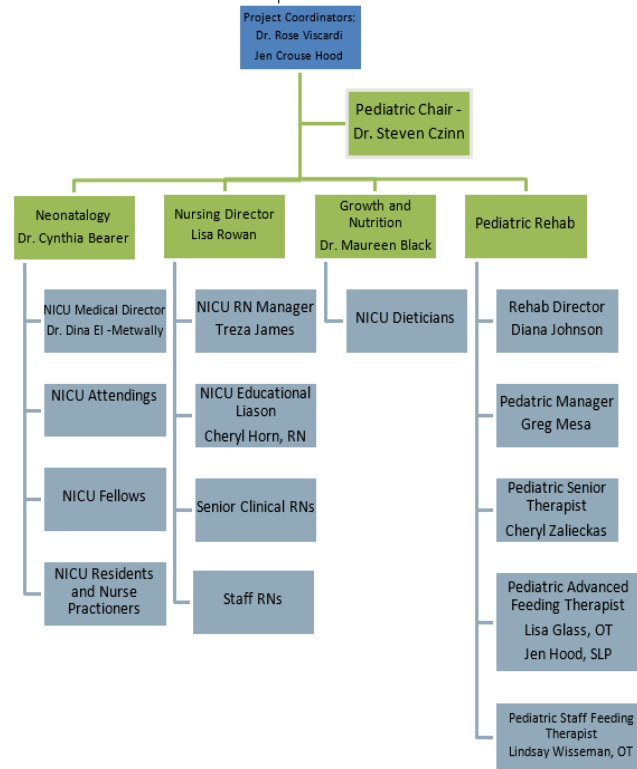


Figure D1. Organizational chart UMMC.

## **Appendix E**

### **CUE BASED FEEDING PROTOCOL COMPARISON CHART**

A protocol comparison chart was utilized to examine currently available cue based/infant driven feeding protocols identified during the literature review. Three protocols were examined including *Support of Oral Feeding for Fragile Infants* (SOFFI) (Philbin & Ross, 2011), *Infant Driven Feeding* (IDF) (Ludwig & Waitzman, 2007), and *Early Feeding Skills Assessment* (EFS) (Thoyre, Shaker, & Pridham, 2005). Both the SOFFI and IDF protocols had research studies demonstrating achievement of oral feedings in significantly less time than those utilizing traditional feeding methods (Horner, et al., 2013; Wellington & Perlman, 2015). SOFFI had very laid out decision making tools however, there were so many that utilizing them in daily practice was decided to be cumbersome by our nursing and therapy staff. In addition, SOFFI only addressed bottle feeding, and our unit is also currently working on increasing breastfeeding. Our team did not want to limit staff by choosing a tool not also allowing for the examination of breastfeeding. Components of SOFFI our team decided to incorporate into our program include continually assessing the infant throughout the feeding and stopping the feeding if the infant stops actively participating in nipping.

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Additionally, the EFS does not currently have any validated research to support effectiveness or reliability of the tool.

IDF had great program tenets our team resonated with including supporting development, changing the feeding culture, and positive experiences. Our team also liked the scoring scales to assess feeding readiness and feeding quality. The scales allow for scoring of both breast and bottle feeding, and provide guidance for supporting non-nutritive sucking experiences, if the infant is not appropriate for oral feeding. The one downside to the IDF protocol identified by our team was possible subjectivity of some of the ratings and scorings. The team decided to address this by providing ample education during our hands on sessions and providing additional scoring practice to ensure consistency with scoring. We also implemented cue based feeding audits, to validate scores between nurses during the first few weeks of implementation, with discussion and education if scores did not agree to further ensure consistency among staff. Completing this protocol comparison chart allowed our team to analyze the strengths and weakness of currently available protocols to determine the structure and foundation of our cue based feeding guidelines.

Table E1.

*Cue Based Feeding Commercially Available Tools Comparison Chart*

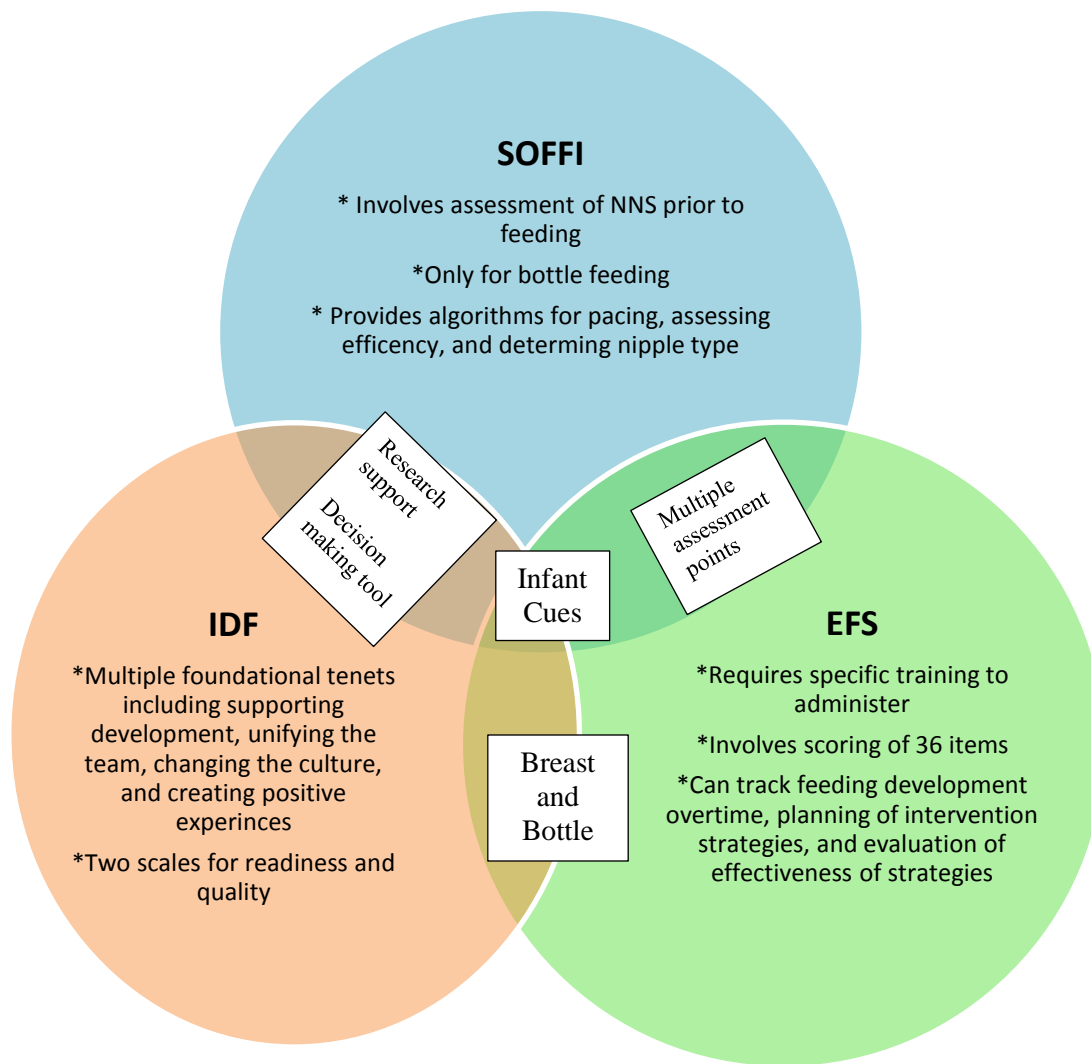
<b>Protocol</b>	<b>Summary</b>	<b>Pros</b>	<b>Cons</b>	<b>Research Support</b>
Support of Oral Feeding for Fragile Infants (SOFFI)  Philbin and Ross (2011)	Focuses on development of each infant into a competent feeder, without direct focus on volume intake. Defines an efficient feeding as one where the infant self-regulates, remains stable throughout the feeding, and the caregiver supports the infant through monitoring of cues and makes adjustments with utilization of strategies.	Lays out step by step decision making for caregivers, to guide them through the process of how to conduct feedings. Infant is first assessed for readiness and stability prior to the feeding and then again prior to initiation of the feeding. Non-nutritive assessment is conducted first, and then if stable continues to nutritive feeding. Stability is continually assessed throughout feeding. Caregiver monitors for participation, efficiency, and self-pacing. The feeding is stopped if the infant stops actively participating in nipping, has significant oral spillage, or has noisy breathing,	Lots of different algorithms for the caregiver to refer to while performing feeding. Not necessarily intuitive. Only examines and provides instructions for bottle feeding with no guidance for breastfeeding.	Horner et al. (2013) completed a longitudinal experimental design research study utilizing SOFFI. Utilized a convenience sample of 81 infants during a six-month period to assess traditional feeding method outcomes. Intervention group participated in a three-month implementation utilizing the SOFFI method, and contained 75 infants. Results demonstrated infants born prior to 37 weeks gestation in the intervention group achieved full oral feedings in significantly less time than those in the control group. No statistical difference was found for infants born at or above 37 weeks. Length of stay was also decreased by four days, however this was not found to be statistically significant. Weight gain was not found to be

		<p>not resolved by the support strategies.</p> <p>Algorithms are also provided for:</p> <ul style="list-style-type: none"> <li>Assessing efficiency</li> <li>Determining the most appropriate nipple</li> <li>Implementing pacing technique</li> </ul>		<p>statistically different between groups.</p> <p>Post-discharge phone interviews conducted three to five months after discharge indicated infants in the intervention group demonstrated statistically significant differences with fewer feeding problems, less arching, less spitting, and fewer were treated by feeding therapist.</p> <p>Limitations of this study included convenience sampling, loss of infants to follow up at the post discharge interview, and no validated tool for assessment of parent reports during interviews.</p>
<p>Infant Driven Feeding (IDF)</p> <p>Ludwig &amp; Waitzman (2007)</p>	<p>Tenets of this model include: supporting development, unifying the team, changing feeding culture, creating positive experiences, establishing standardized feeding systems, strategizing interventions, and sustaining progress.</p> <p>Focuses on allowing the infant to drive</p>	<p>Two scales including <i>Infant Feeding Readiness</i> and <i>Quality of Feeding</i> scored on a numerical scale of 1-5.</p> <p>Easy to understand descriptions for staff and parents.</p> <p>Allows for bottle and breastfeeding attempts.</p> <p>Provides guidance for offering non-nutritive sucking opportunities if</p>	<p>Some subjectivity to ratings and scoring</p>	<p>Wellington and Perlman (2015) examined the utilization of IDF with infants born at less than 34 weeks gestation.</p> <p>Infants were split into a control group, utilizing traditional feeding methods, and an intervention group utilizing the IDF method.</p> <p>The infants in the IDF group overall demonstrated significantly lower post menstrual age at</p>



	the initiation and continuation of feeding, with caregivers providing support versus directing the feeding.	infants are not appropriate for oral feeding.		<p>time of full oral feeds, and at discharge, compared to the traditional methods group.</p> <p>Infants:</p> <p>Less than 28 weeks demonstrated achievement of full feeds 17 days sooner</p> <p>28 to 31 week olds, 11 days sooner</p> <p>32 to 33 weeks, three days sooner than the traditional method</p> <p>Infants were discharged from those groups nine days sooner, nine days sooner, and three days sooner, in those same age groups respectively, compared to the traditional methods.</p> <p>Chrupcala et al. (2015) also examined IDF.</p> <p>Baseline data was collected on 20 infants, and demonstrated mean total length of stay of 43 days.</p> <p>Post cue based protocol implementation data was collected on 150 neonates, and demonstrated a mean total length of stay of 36.4 days. This finding is important because most physicians feel cue based feeding may extend length of stay,</p>
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				<p>when it significantly decreased length of stay.</p> <p>Limitations of this study included lack of equal control and implementation groups, and the wide diversity of populations included within the samples.</p>
<p>Early Feeding Skills Assessment (EFS)</p> <p>Thoyre, Shaker, and Pridham (2005)</p>	<p>Contains 36 observational measures of feeding skills divided into readiness, skill, and recovery. Caregivers can track feeding descriptors including maintenance of feeding skills across the feeding, amount of supplemental oxygen needed, and type of bottle/nipple utilized. Allows indication of supportive strategies provided during the feeding, such as resting, co-regulated pacing, and swaddling.</p>	<p>This tool allows for tracking of skill development, planning of intervention strategies, and evaluation of effectiveness of supportive interventions. Allows for identification of areas of strength, and areas in need of support, for efficient and safe feeding.</p>	<p>EFS is a lengthy tool requiring scoring of multiple items. EFS requires specific training course to administer. EFS doesn't specifically help caregivers make decisions during the feeding.</p>	<p>No research studies have been completed examining the effectiveness of the EFS.</p> <p>The authors reported content validity had been established, and reliability is acceptable, however no specific results have been published regarding these measures.</p>



*Figure E1.* Venn diagram protocol comparison.

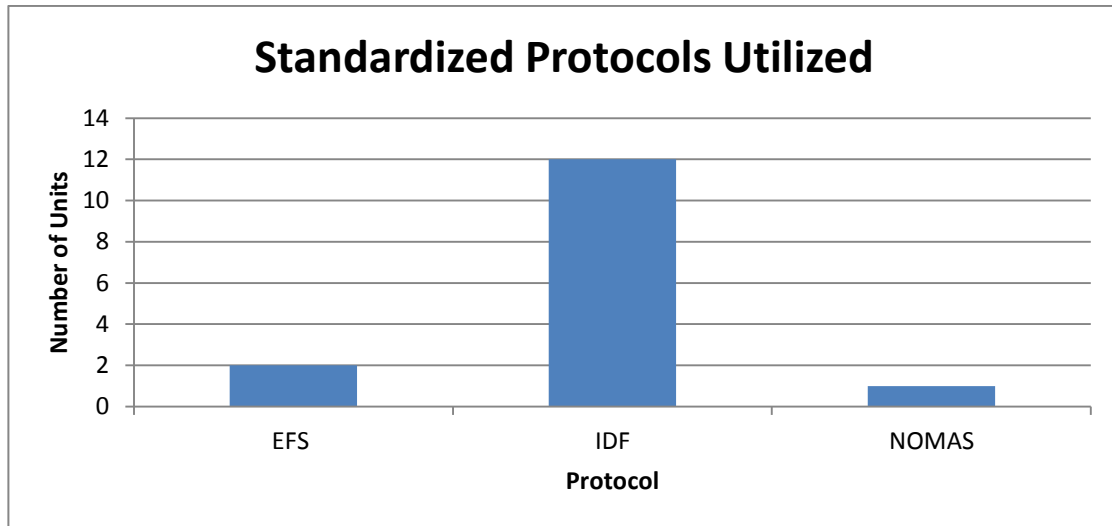
## **Appendix F**

### **AREA NICU SURVEY**

An online survey was conducted to further assess the treatment trends in other NICUs around the country, specifically regarding feeding practices on their units. The survey contained 11 questions regarding feeding practices and utilization of standardized feeding protocols. The survey was posted on multiple Facebook groups of feeding professionals, as well as sent to four local NICUs in MD including GBMC, Hopkins, Mercy, and Sinai. The intent of this survey was to gather more information about what practices other similar NICU settings are utilizing for cue based feeding, to help shape and guide our protocol and guidelines at UMMC.

A total of 38 surveys were returned; however only 33 surveys were entirely completed. Surveys not entirely completed were removed from analysis. NICUs ranged from 10 beds to 100 beds. The units ranged in Level from Level II to Level IV. There were three Level II, 17 Level III, 10 Level IV, and three units marked as “Other”. Feeding and swallowing disorders were treated by OT on three units, SLP on 17 units, a mixture of OT/SLP on 11 units and on two units, these issues were also treated by PT.

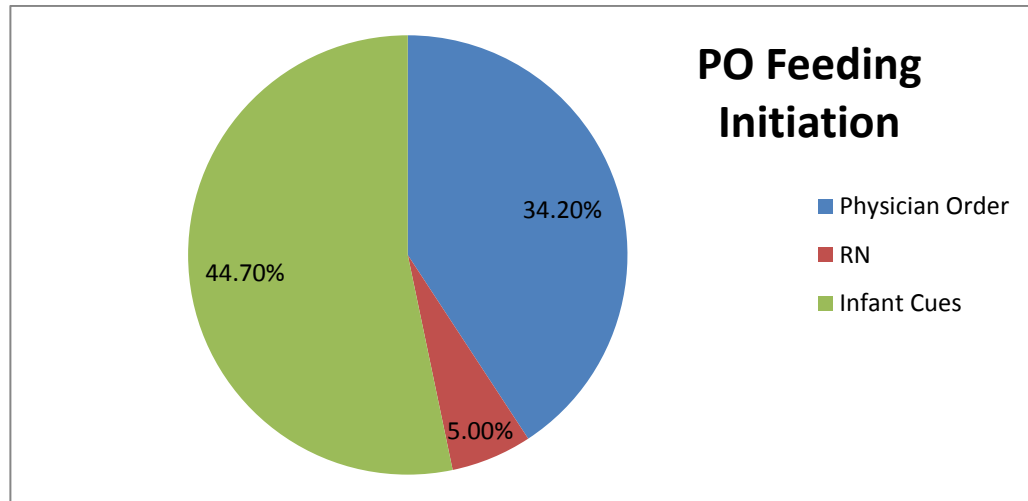
Of the 33 units, 45% currently utilized a standardized protocol/guideline for implementation of infant feeding. Figure 1 illustrates the protocols currently utilized.



*Figure F1.* Standardized protocols utilized on units surveyed.

Of these 14, two units utilized the Early Feeding Skills (EFS) tool, 12 used Infant Driven Feeding (IDF), and one used the NOMAS. Of the units implementing a standardized protocol, three implemented between 2011-2014, five units implemented in 2015, and five units implemented between 2016-2018. A cross tabulation compared the Level of NICU with use of a standardized protocol. This comparison demonstrated there was no significant difference ( $p=0.44$ ) between the Level of NICU (which indicates acuity of care) and the use of a standardized feeding protocol.

The units surveyed varied on who determined when to initiate PO feeding. Figure 2 demonstrates who determines feeding initiation on the units surveyed.



*Figure F2. PO feeding initiation determination.*

Physician order determined when infants feed on 34.2% of units, the RN on five percent of units, and the infant based on cues on 44.7% of units surveyed. A cross tabulation with utilization of a standardized protocol and who determines when the infant feeds revealed a significant difference ( $p=.03$ ) between who determines and utilization of a protocol, with 11 of the 17 units utilizing a standardized protocol allowing the infant to choose when to feed, and 10 out of 13 units where MD order determines feeding, not utilizing a standard protocol.

This indicates units who utilize a standardized protocol are allowing infants to drive feeding, versus the provider making an arbitrary decision based on other factors such as gestational age or weight, to allow infants to start feeding. Cross tabulation revealed no significant difference ( $p=.06$ ) between Level of NICU and who determines initiation of feeding. This indicates the level of acuity of the unit does not impact who

has control of determining initiation of feeding; the author hypothesized units with higher acuity would have higher levels of providers determining initiation of feeding.

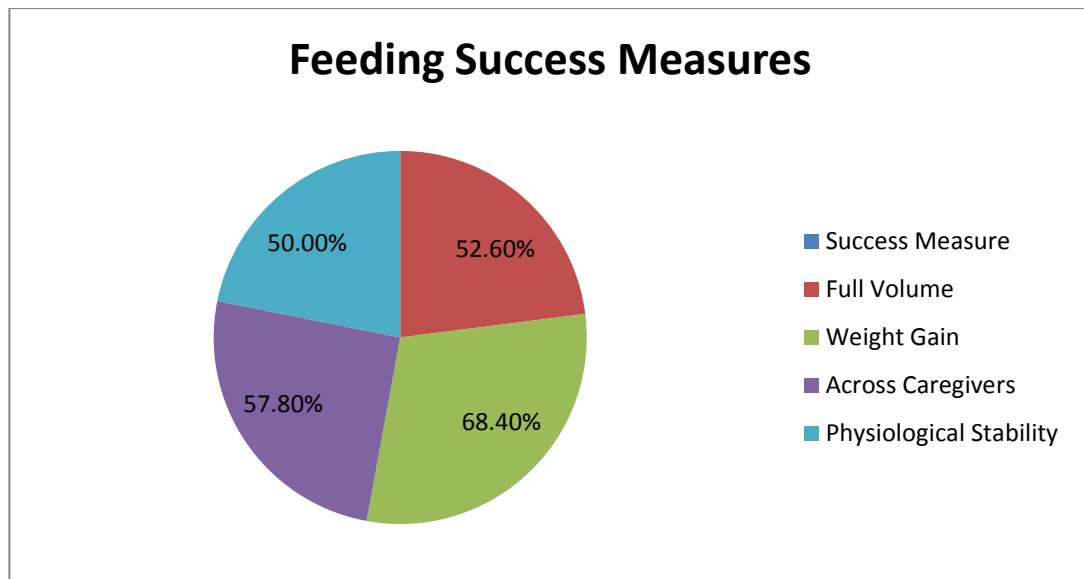
The age at initiation of feeding was 32-weeks on six units, 33-weeks on two units, and 34-weeks on 11 units. The other 11 units surveyed selected 'other' and included answers such as 'whenever the infant begins cueing', 'breast introduced first and bottle not till 35-36 weeks', and 'depends on who the attending physician is on rotation.' A cross tabulation demonstrated no significant difference between age of feeding implementation and utilization of a standard protocol.

Units reported RNs start feeding premature infants with a slow flow on 50% of units, a standard flow on three units, eight units use a combination of both depending on the RNs' judgement, and two units use the Dr. Brown Preemie nipple. A cross tabulation revealed no significant difference ( $p=0.22$ ) between use of a standardized protocol and type of nipple utilized. This indicates that use of a standardized protocol does not necessarily preclude individualized selection of a nipple to start the feeding progression with infants.

Twenty-one percent of units only feed infants on low flow nasal cannula and 36.8% of units feed on low or high flow nasal cannula. For those units who reported utilizing only low flow, the range of support was from 1.0-3.0 liters. Only one unit reported feeding on three liters, four units on two liters, and three units on one liter. For high flow nasal cannula, 31.5% of units reported allowing infants to feed on up to two liters, one unit on 2.5, and one unit on 1.5.

Infants on one unit can feed for 10-15 minutes, 14 units reported allowing infants to feed for 20-25 minutes, and 16 units reported allowing infants to feed for greater than 25 minutes. A cross tabulation revealed no significant difference ( $p=.17$ ) between allowed feeding times and utilization of a standard protocol.

Feeding success is defined in different ways across units. Figure 3 demonstrates how feeding success is determined on the units surveyed.



*Figure F3.* Feeding success measures.

Determining infant success in feeding included taking the full prescribed volume at every feed on 52.6% of units, consistent weight gain on 68.4% of units, feeding across caregivers on 57.8% of units, and infant physiological stability on 50%. A cross tabulation demonstrated no significant difference in utilization of a standardized



protocol and what determined a successful feeder. Even though not a significant difference, more units reporting that they do not use a standardized protocol consider taking full prescribed volume and weight gain as determinants of successful feeders. Those with a standard protocol consider infants feeding across caregivers and physiological stability as indicators of success.

### **Conclusion**

These results were utilized to help shape the protocol and guidelines developed for our unit. Many units were Level IV units like our unit, so appropriate conclusions can be drawn from this information based on similar environments. The survey revealed 45% of units surveyed are utilizing standardized protocols to help drive infant feeding and the infant decides when to initiate feeding on these units. Eight-five percent of units utilizing a standard protocol are utilizing the IDF program. Based on these results, our team decided it would be appropriate to develop and implement a standardized feeding protocol. We also decided to utilize major components of the IDF program to build our program, based on the high percentage of units also utilizing this program.

Most of the units initiated feedings between age 33 and 34-weeks, so we determined we would start scoring infants at 33-weeks, and once they are demonstrating cues for 50% of cares, we would initiate feeding. Based on the number of units starting with a slow flow nipple, our team was also in agreement to start our infants with a slow flow nipple when cue based feeding is initiated. The medical team was also in agreement to not allow infants to feed on greater than three liters of oxygen, based on

the results from other units. Our team however decided to continue to not allow infants to feed on high flow nasal cannula as a general practice, and instead decided these infants could be considered on an individual basis for appropriateness to initiate feedings.

Finally, based on the survey, our team decided to utilize a variety of information to consider if an infant is a successful feeder including weight gain, volume at each feeding, physiological stability, and feeding across caregivers. The IDF model we selected as the basis for our protocol includes most of these factors; however, we chose to include additional information about infant stress and disengagement cues in to our protocol to further guide staff on when to continue or abort feedings based on infant response. This survey was extremely helpful in allowing us to understand the feeding practices of other similar units. The responses assisted our team in developing and choosing important tenets of our cue based feeding program.

### NICU Feeding Culture Survey

Number of Beds in NICU: \_\_\_\_\_ Number of RNs in NICU \_\_\_\_\_

Who handles feeding therapy on your unit: OT SLP MIX

Does your unit currently utilize a standardized protocol/guideline for implementation of infant feeding?

YES NO

What PCA age does your unit implement oral feeding?

32 Weeks 33 Weeks 34 Weeks Over 34 weeks

Does your unit utilize a published cue based feeding protocol?

YES NO

If YES, which program? EFS SOFFI IDF Other: \_\_\_\_\_

If YES, when did you implement your cue base feeding protocol? \_\_\_\_\_

What nipple do your RNs start with when implementing oral feeding?

SLOW FLOW DISPOSABLE STANDARD FLOW DISPOSABLE SPECIALITY BOTTLE

Does your unit feed babies on oxygen? If so, what is the maximum amount an infant may be on to orally feed?

1 L 2L 3L

Are infants on your unit allowed to feed if they are on vapotherm/high flow nasal cannula?

YES NO

If so, is there a maximum amount of vapotherm/high flow allowed to be appropriate for oral feeding?

1 L 2L 3L

How long are infants allowed to PO feed prior to gavaging a feed on your unit?

10-15 minutes 20-25 minutes Greater than 25 minutes

Who determines how often the infant feeds?

The infant (Based on cues) The RN (based on intake) MD order

What determines if an infant is a successful feeder on your unit and ready for discharge (check all the apply)

Taking full volume

Weight gain

Infant physiological stability and stress cues

Caregiver competence with feeding

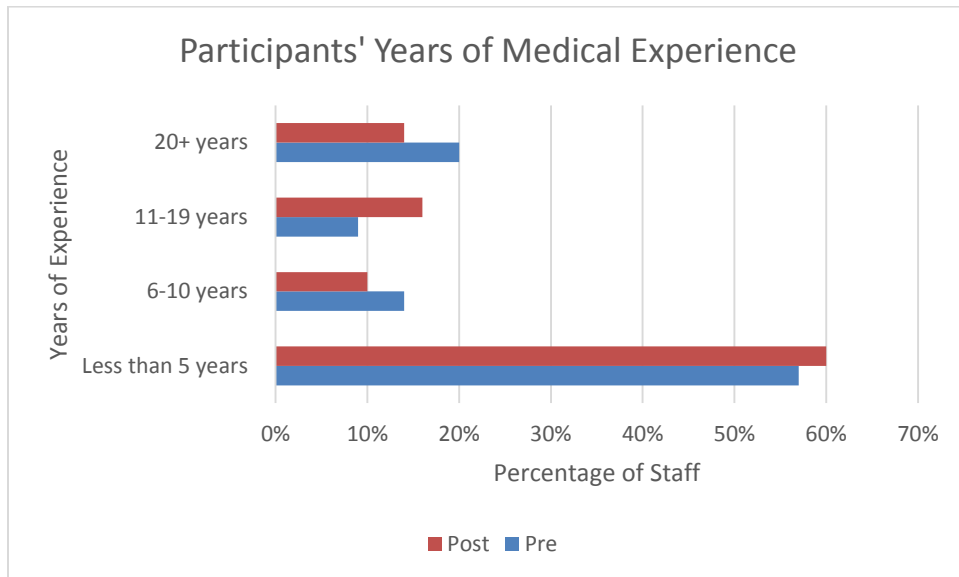
## **Appendix G**

### **PRE- AND POST-CUE BASED FEEDING KNOWLEDGE SURVEY**

A knowledge and confidence survey was completed to assess our staffs' knowledge and confidence in cue based feeding techniques. The survey was completed at the initiation of this project in March 2018 and re-administered at the completion of education modules and two months of protocol implementation. The results from the pre-implementation survey were utilized to help design our education module and resources, to personalize information for what our staff specifically needed to learn, and to improve knowledge to increase skill level regarding cue based feeding. The survey included twelve questions, and was sent to staff members including nurses, physicians, and therapists, via a Survey Monkey link in their email. After completing the survey anonymously, staff members could enter a drawing for a gift card for participating.

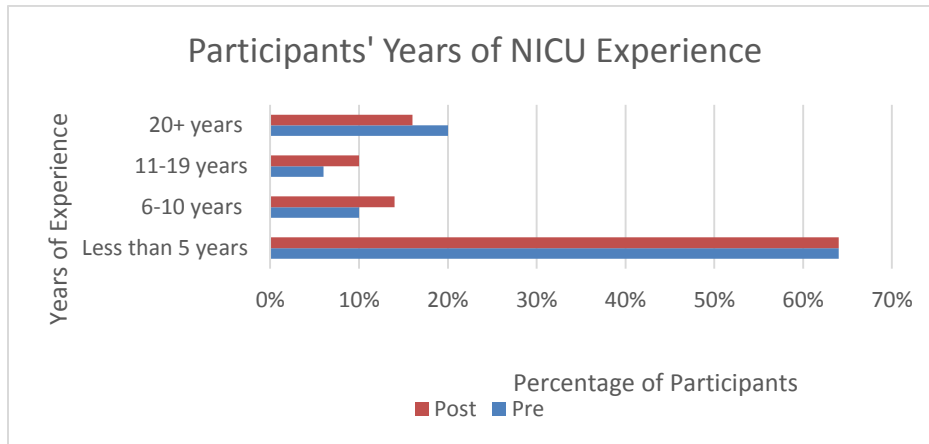
#### **Participant Demographics**

Ninety staff members out of 165 completed the pre-survey, and 50 staff members completed the post survey. Participants for the pre-survey included 77 nurses, 10 doctors, two feeding therapists, and one nurse practitioner. For the post survey, participants included 46 nurses, one doctor, two feeding therapists, and one nurse practitioner. These participants worked a variety of shifts including day shift, night shift, and mixed/rotating shifts. Figure 1 displays the years of medical experience of staff completing the survey.



*Figure G1. Years of medical experience of UMMC NICU staff.*

Years of experience in the medical profession spanned less than one year to over 30 years. For the pre-survey, 51 participants had less than five years, 13 with six to ten years of experience, eight with over ten but less than 20 years, and 18 with over 20 years of experience. For the post survey, 30 had less than five years, five had six to ten years, eight had over ten years but less than 20 years and seven had over 20 years of experience survey. Figure 2 displays the NICU experience of staff who participated in the survey.

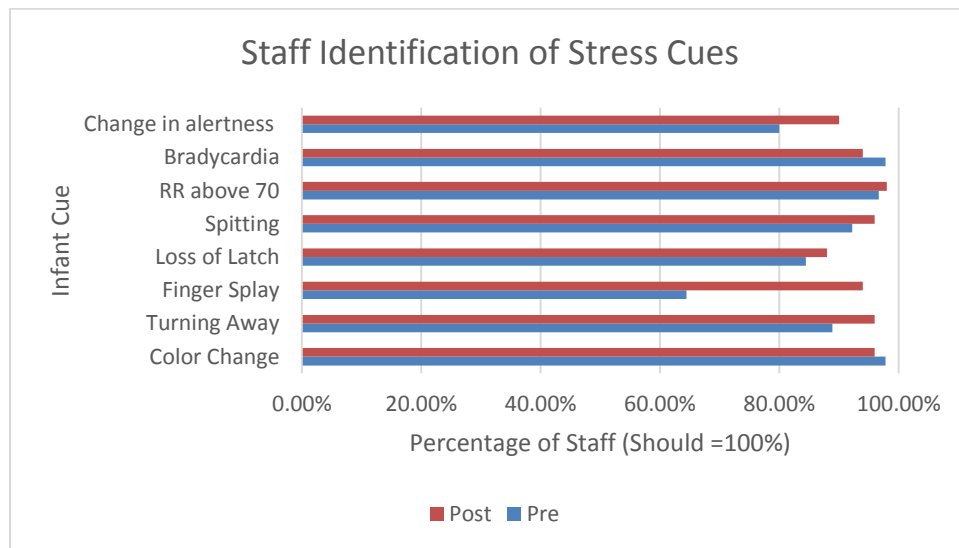


*Figure G2. Years of NICU experience of UMMC NICU staff.*

Years of experience in the NICU also ranged from less than one year to over 30 years. For the pre-survey there were 58 participants with one to five years' experience, eight with six to ten years, five with ten to up to 20 years, and 18 with greater than 20 years of experiences. Participants in the post-survey included 32 with less than five years, seven with six to ten years, five with 10 years up to 20 years, and eight with greater than 20 years of experience. Experience in the NICU was similar to that noted from the pre-survey however, the biggest reduction was noted in the 20 to 30 years of experience range. Chi square analysis was completed to examine similarities between groups. No significant differences were found between groups for medical experience ( $\chi^2 = 2.62, p=0.45$ ) or NICU experience ( $\chi^2 = 1.8415, p=0.60$ ).

### Cue Based Feeding Knowledge

All participants were able to identify the purpose of cue based feeding by selecting true for the statement “Cue based feeding is an individualized feeding plan utilizing physiological stability and readiness cues to determine how often and how long an infant attempts an oral feed.” Recognition and identification of stress cues was also assessed. Figure 3 demonstrates the percentages of staff who identified possible stress cues.

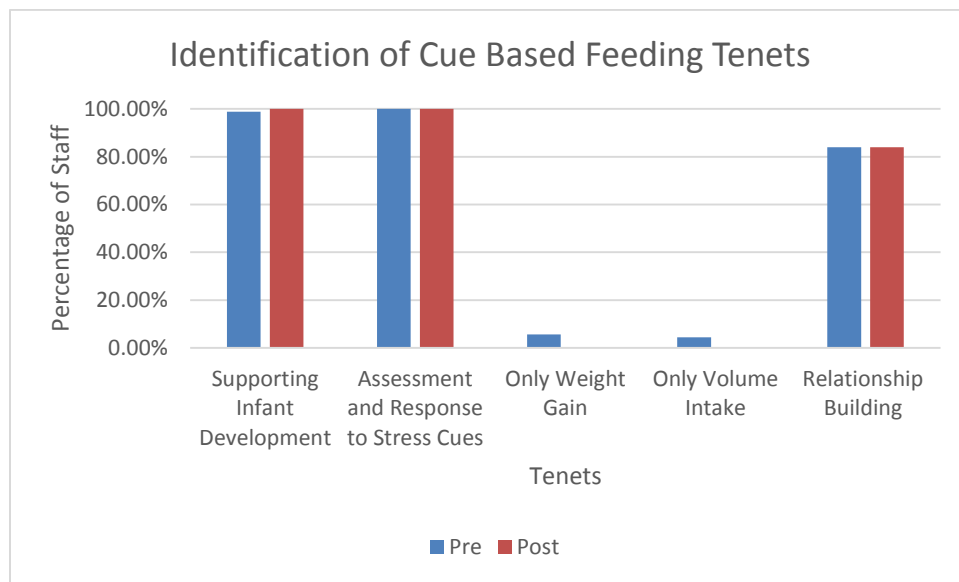


*Figure G3.* Percentage of staff identifying indicators of stress.

Results of the pre-implementation survey indicated staff education was needed to target identification of change in alertness, finger splaying, and loss of latch, as significant stress cues during feeding which may be more subtle than other cues.

From the post-implementation survey, improvement in recognition of more subtle stress cues by staff including change in alertness (increased by 10%), loss of latch (increased by 5%), finger splay (increased by 30%) and turning away (increased by 10%) when compared to pre-implementation survey was noted. This demonstrates education modules and videos were successful in teaching staff to recognize the variety of stress cues infants may demonstrate during feeding experiences.

Information regarding important principles of cue based feeding was also assessed. Figure 4 demonstrates staff identification of important tenets of cue based feeding.

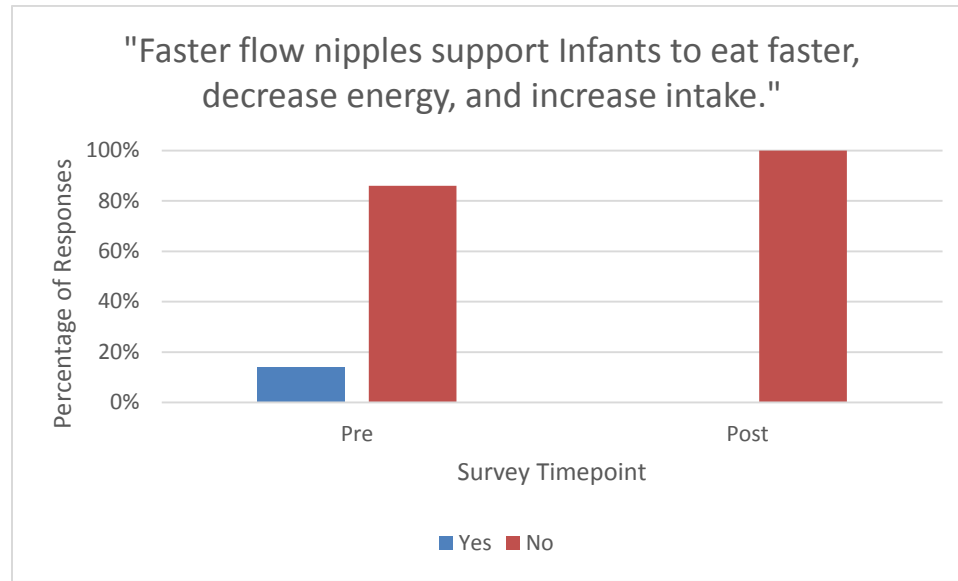


*Figure G4.* Cue based feeding tenets.



Ideally, staff would understand relationship building, assessment and response to stress cues, and supporting infant development are all hallmarks of a cue based feeding program. Focusing only on volume and weight gain is an example of volume driven strategies, which do not take in to account the infant's participation in the process. During education sessions, it was re-iterated volume intake and weight gain are only part of the whole picture needing to be considered for successful oral feeding. Despite this re-iteration, no change was noted in an increase in recognition of relationship building. However, a decrease in selection of only weight gain and only volume intake was noted. Ongoing education will continue to focus on the importance of relationship building within the feeding framework, to support the development of experiences between infants and caregivers.

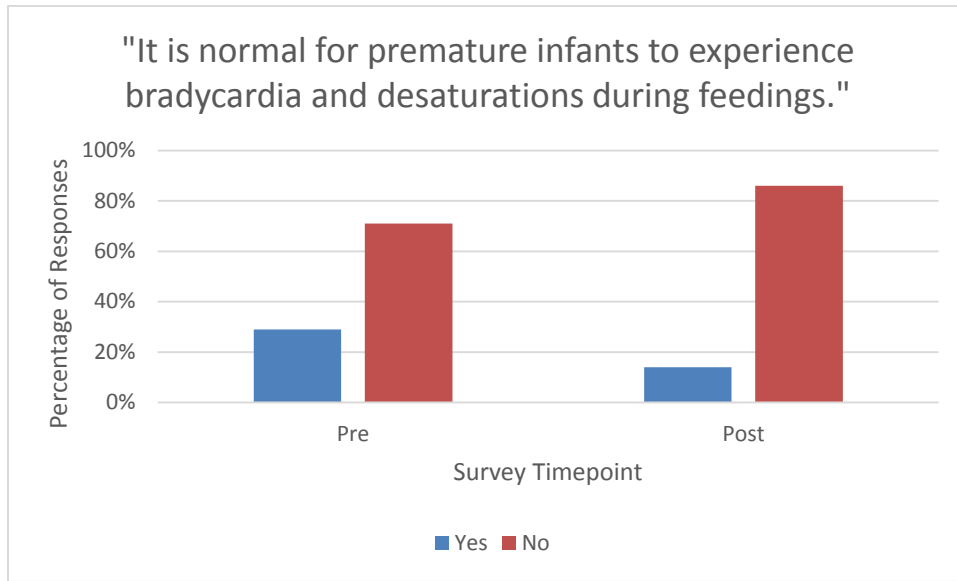
Feeding techniques and staff beliefs were also addressed in the survey. Figure 5 displays responses regarding utilization of faster flow nipples.



*Figure G5. Faster flow nipple utilization.*

With respect to utilizing a fast flow nipple, 86% of respondents in the pre-survey correctly identified that faster flow nipples do not support infants to eat faster, decrease energy required, and increase intake. Education re-iterated the importance of understanding faster flow nipples can increase workload for infants and may place infants at risk for increased discoordination. This education was effective because all staff correctly identified faster flow nipples do not support infants to eat faster, decrease energy required, and increase intake during the post-survey, demonstrating a 14% improvement from pre-implementation.

Presence of desaturation events during feeding was also discussed in the survey. Figure 6 displays responses to this question.

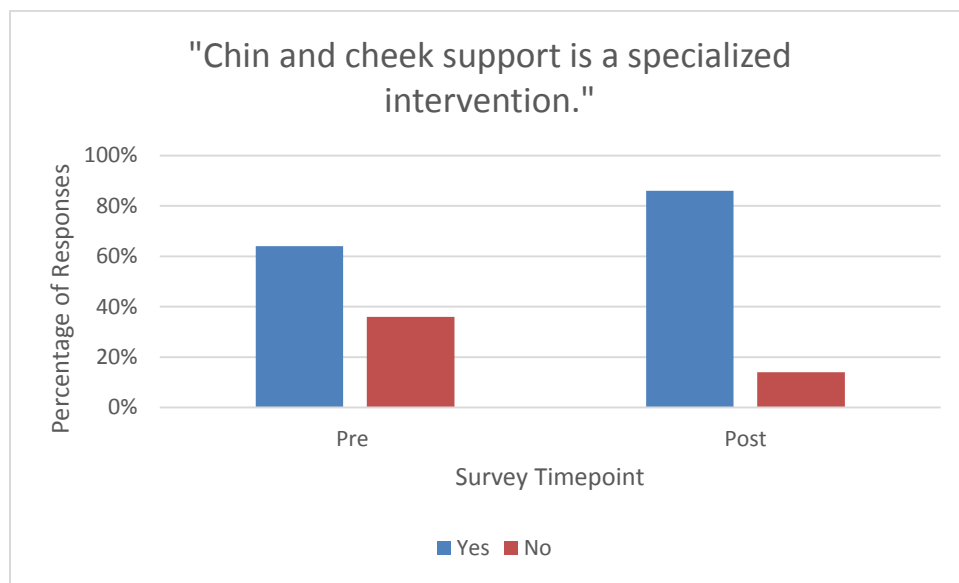


*Figure G6.* Staff understanding of infant events during feedings.

During the pre-survey, 71% of participants correctly responded it was normal for premature babies to have bradycardia and desaturations during feeding. Even though premature, if supported with the proper techniques, premature infants should not demonstrate desaturation events during feeds. Education focused on the recognition of these events as significant communication of stress, often precluded by other stress cues. By responding to earlier stress cues, these events can hopefully be circumvented. After education and protocol implementation, 86% of participants correctly respond it is not normal for premature babies to have bradycardia and desaturations during feeding. Although this demonstrated an improvement in understanding that these events are not developmentally appropriate, further education is needed to reinforce the identification

of earlier stress cues to prevent these events and that these events, are not developmentally appropriate just because of prematurity.

A question regarding chin and cheek support was also included. Responses to this question are displayed in Figure 7.



*Figure G7. Staff understanding of chin and cheek support.*

Sixty-four percent of respondents from the pre-implementation survey felt chin and cheek support was a specialized intervention and could result in a faster flow rate or impact infant stress. Education sessions stressed chin and cheek support can negatively impact infants and should only be utilized if assessed by a trained feeding therapist, to ensure it does not increase the flow rate and overwhelm the infant. Eighty-six percent of respondents in the post-survey reported chin and cheek support was a specialized

intervention, a 22% improvement from pre-surveys. Despite this reduction, further education needs to target the complete elimination of utilization of chin/cheek support due to its nature as a volume driven strategy, which can inadvertently put the infant at higher risk for events of distress.

### Cue based Feeding Scenarios

The survey also included scenarios for participants to determine an appropriate response based on infants' cues. Staff were given a scenario for a 33-week-old infant who was initially awake and alert, but after five minutes started to become sleepy.

Figure 8 displays staff responses to this question.

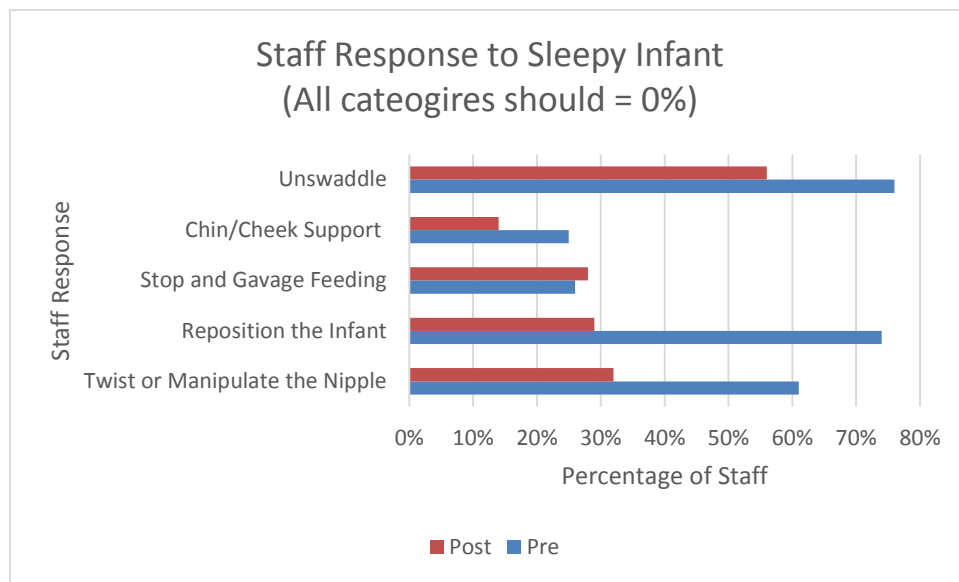
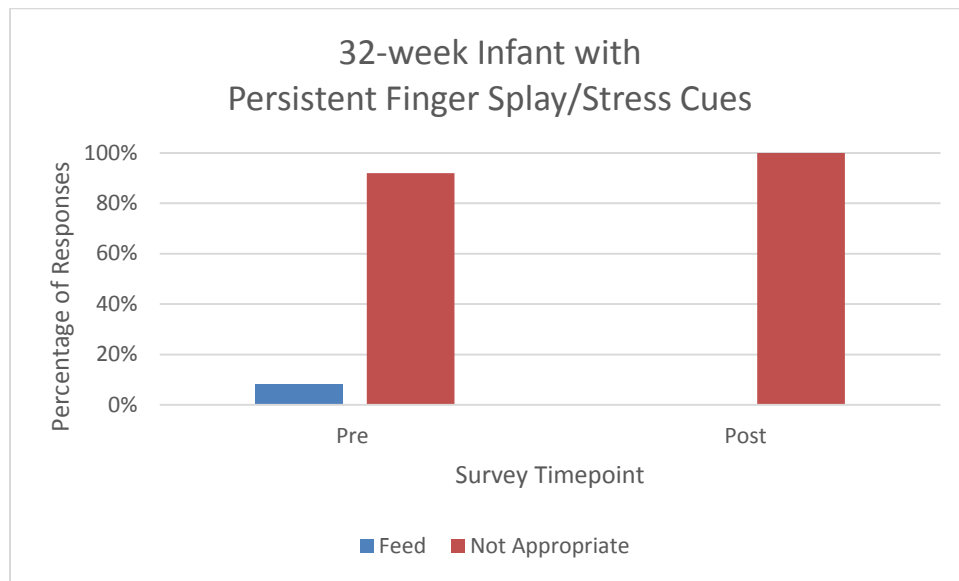


Figure G8. Staff response to 33-week old sleepy infant.

During the pre-survey, 61% responded they would twist or manipulate the nipple to re-engage sucking, 74% reported they would reposition the infant, 26% reported they would stop and gavage the rest of the feeding, 25% reported they would use chin/cheek support, and 76% reported they would unswaddle the infant to re-alert them. During education modules, staff were instructed on cue based feeding principles, which recommend trying to reposition the infant, but if no change in alertness is demonstrated, the feeding should be stopped and gaviged. Caregivers should not unswaddle the infant, or twist the nipple, because these are volume driven approaches, not recognizing the change in infants' engagement as a sign of stress.

Post-survey responses indicated 32% would twist or manipulate the nipple to re-engage sucking, an improvement of 29%. Fifty-four percent would stop and gavage the rest of the feeding, an increase of 28% from pre-implementation. Only 14% would use chin/cheek support, indicating an 11% decrease, and 56% would unswaddle the infant to re-alert them, indicating a 20% decrease. Overall, improvement in utilization of cue based strategies occurred as evidenced by an increase in the utilization of gavage feedings when the infant became sleepy. An overall decrease was also noted in utilization of volume driven strategies. Additional education sessions and bedside resources will continue to stress the volume driven nature of twisting/manipulating the nipple, chin/cheek support, and unswaddling the infant, and recognition of a change in alertness as a potential time point to gavage the remainder of the feeding.

The next scenario involved evaluating the readiness of a 32-week infant demonstrating persistent finger splaying and stress cues during cares just prior to what would be a feeding time. Figure 9 displays responses to this scenario.

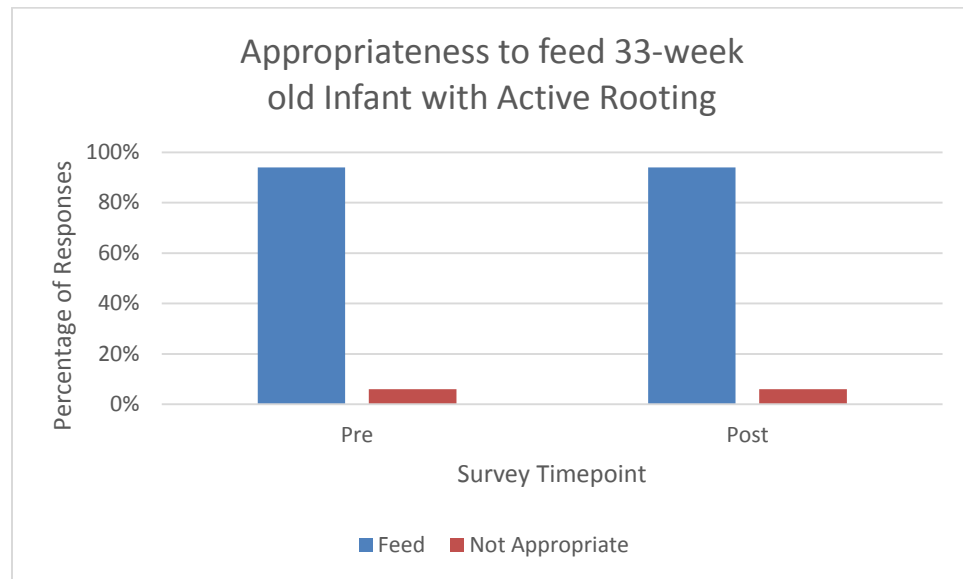


*Figure G9.* Feeding appropriateness for 32-week infant with stress cues.

Eight percent of respondents reported this infant was appropriate to try to feed during the pre-survey, but all respondents in the post survey recommended not attempting to feed this infant. Education modules reinforced this infant is demonstrating stress cues during cares and is not demonstrating the appropriate alertness and stability to feed.

Another readiness scenario involved a 33-week-old infant who opened his mouth when his lips were touched and demonstrated active rooting during cares. Figure

10 demonstrates staff responses to whether it would be appropriate to attempt to feed this infant.

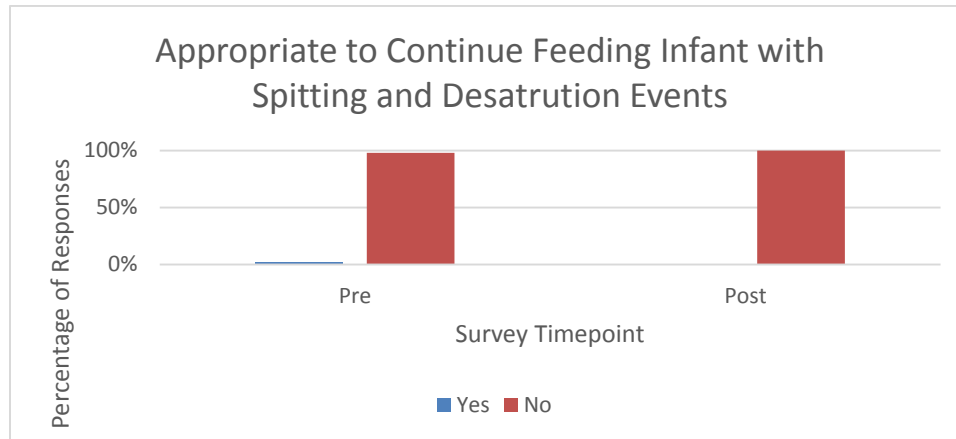


*Figure G10.* Appropriateness to feed 33-week old with active rooting.

Ninety-four percent of participants from both the pre- and post -implementation survey reported they would attempt nipple feeding with this infant, which is appropriate.

The last scenario involved a quality of an infant's feeding. Figure 11 displays staff responses as to whether they would continue to feed an infant who initially opened his mouth and rooted. However, after eight minutes demonstrated spitting, hiccups, and desaturations.



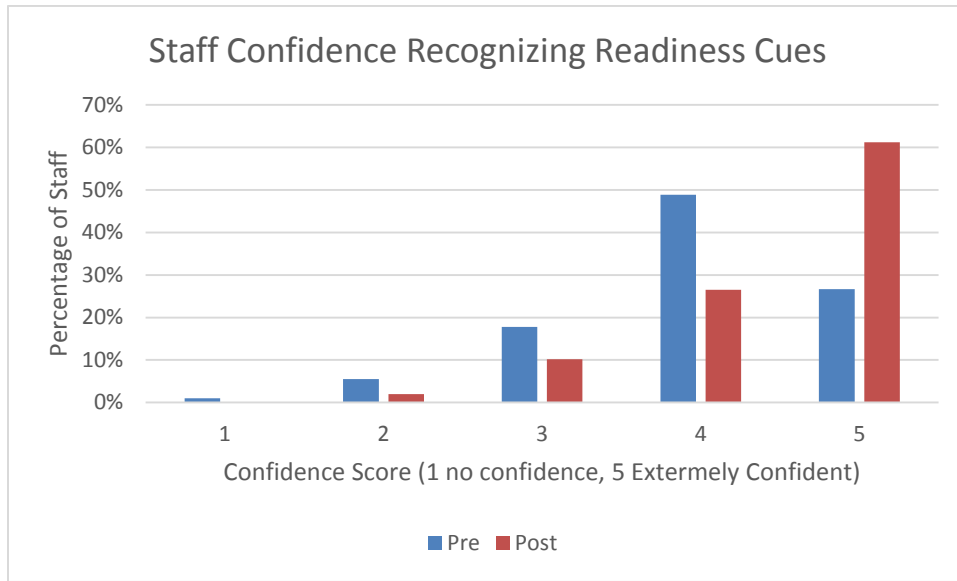


*Figure G11.* Appropriateness to continue feeding with stress cues.

Ninety-eight percent of participants from the pre-survey and all participants from the post-survey appropriately responded they would stop feeding this infant.

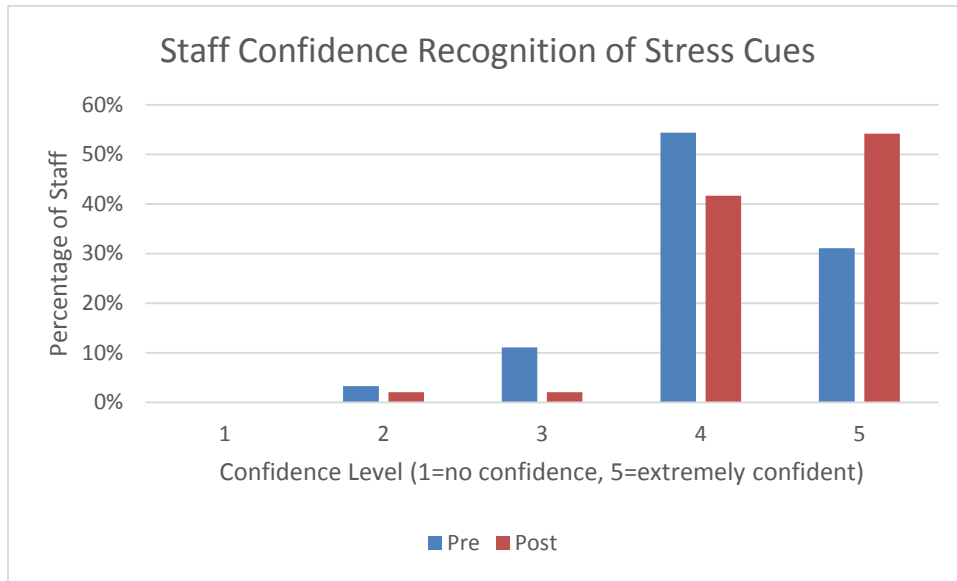
### **Staff Confidence in Cue Based Feeding**

The last question involved confidence in determining an infant's readiness to feed, recognizing stress and instability, and responding to stress and instability during feeding. Participants were asked to select a number one to five indicating their confidence with one being no confidence and five being extremely confident. Figure 12 displays staff confidence for assessing readiness.



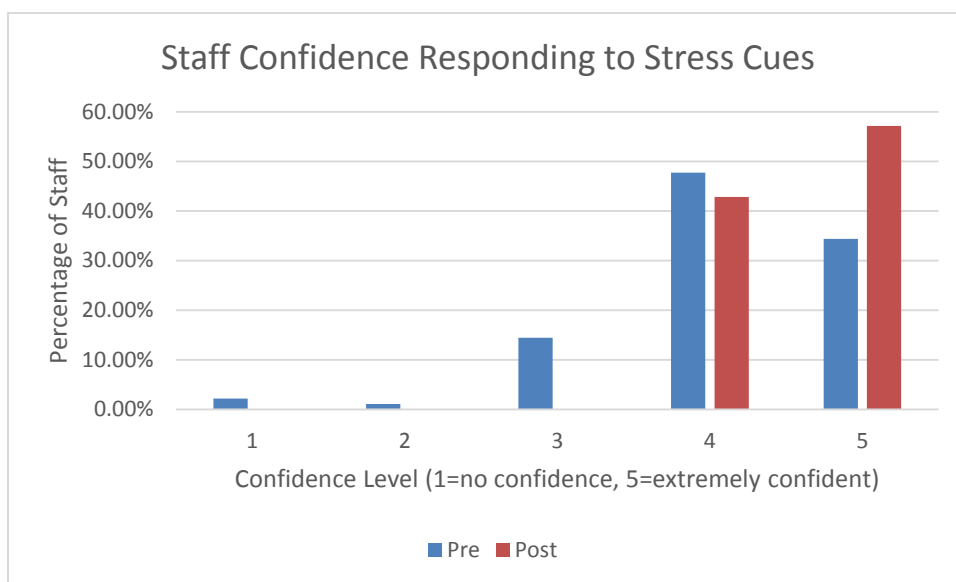
*Figure G12.* Staff confidence level assessing readiness for cue based feeding.

These data demonstrated an increase in the number of staff members who identified full confidence in assessing readiness for feeding based on cues. A chi-square statistic was run to determine if there was any statistically significant difference between the groups. Results indicated the change was statistically significant ( $\chi^2=16.278$ ,  $df=4$ ,  $p=0.0027$ ). Figure 13 displays staff confidence for recognizing stress and instability based on cues.



*Figure G13.* Staff confidence level in recognizing stress and instability.

These data also demonstrated an overall increase in staff confidence in recognizing infant stress cues during feeding. A greater number of staff members indicated full confidence in recognizing these cues during post surveys. Despite no statistical significance, these results still indicated an increase in overall staff confidence. Figure 14 displays staff confidence for responding to stress and instability based on cues.



*Figure G14.* Staff confidence level in responding to stress and instability.

These data also demonstrated an overall increase in staff confidence for recognizing infant stress cues during feeding. A greater number of staff members indicated full confidence in recognizing these cues during post surveys.

Pre-implementation confidence scores indicated staff were not fully confident in initiating PO feeds based on cues, recognizing stress and instability during feeds, and responding to stress and instability during feeds. Education modules and supportive materials were geared to help improve confidence. Bedside scoring audits were also utilized to reinforce scoring tools and feeding decisions. Post-implementation scores indicated an improvement in staff confidence across initiation of feeds, recognition of stress cues, and responding to stress cues. A 34% increase in those stating a level five for initiation PO feeds with cues, 23% increase for recognition of stress cues, and a 22%

increase for responding to stress cues demonstrated this improvement in confidence.

An improvement was also shown by no indications of scores of one, and limited scores of two and three, as compared to the pre-survey.

### **Conclusions from Pre-Survey**

The results of the pre-survey indicated areas where we could target our unit-based education module and bedside resources, to improve understanding of cue based feeding, to increase effective implementation of our cue based protocol. Based on staff responses to the survey, our education module addressed infant stress cues, and made a point to explain desaturations and changes in vitals are not normal for even premature babies to demonstrate during feeding. Education addressed standard flow nipples increasing flow rate, and that this could cause increased stress, versus reducing the workload for the infant, and chin/cheek support is a specialized intervention which may increase flow rate and put the infant at risk for increased incoordination.

Scenarios were discussed for feeding readiness and appropriate response to infants during feeding based on cues. Education also addressed not twisting or manipulating the nipple, or unswaddling the baby if they fall asleep, and the importance of recognizing these as stress cues. Video modules/scenarios were included to address caregiver confidence in identifying infants' readiness to feed, recognition of stress cues, and how to respond to these cues with supportive techniques, as well as when to end the feeding. The results of the survey helped us identify areas of need for our unit regarding cue based feeding knowledge, to specifically tailor education to our staff.

## **Conclusions**

Overall, there were improvements in knowledge of cue based feeding practices and principles when comparing responses from the pre- and post-implementation survey. The post-survey had less participants however, they represented a similar demographic of experience in the medical and NICU setting, as compared to the pre-survey. Staff demonstrated improved understanding of more subtle cues indicating infant stress including finger splay, change in alertness, loss of latch, and turning away from the bottle. Importance of relationship building within the cue based framework needs to be re-iterated, as no improvement in recognition of this tenet within the cue based framework was noted. Staff indicated increased understanding of the detrimental impact of faster flow nipples, desaturation events being abnormal even for preemies, and specialized intervention of chin/cheek support however, there is still room for improvement.

Supportive response to a sleepy infant also improved, with less utilization of twisting/turning the nipple, chin/cheek support, and unswaddling, and increase in gavage feeding. Interestingly, almost complete elimination of these strategies occurred during post observations, with decreased utilization of volume driven strategies, despite some staff indicating these responses in the post survey. Staff confidence levels in recognition of feeding readiness, recognition of stress cues, and appropriate response to stress cues increased according to these responses, however differences were not statistically significant. Additional education and resources will be provided to

continue to reinforce cue based feeding tenets, and to support day-to-day implementation of developmentally supportive feeding strategies.

### Cue Based Feeding Survey

1. Cue based feeding is an individualized feeding plan that utilizes physiologic stability and readiness cues to determine how often and how long an infant attempts PO feeds.

- ☐ True
- ☐ False

**2. Check ALL cues which may indicate stress or instability.**

- ☐ Rooting
- ☐ Change in alertness/sleepy
- ☐ Coordinated suck
- ☐ Bradycardia
- ☐ RR above 70
- ☐ Quiet, alert state
- ☐ Spitting
- ☐ Loss of latch
- ☐ Finger splay
- ☐ Hands at midline
- ☐ Turning away from the bottle/breast
- ☐ Color change
- ☐ Coordinated suck, swallow, breathe

3. Important principles of cue based feeding include: (Select all that apply)

- ☐ Relationship Building
- ☐ Only volume intake
- ☐ Only weight gain
- ☐ Assessment and response to stress cues
- ☐ Supporting infant development of feeding skills



4. Faster flow nipples always help infants eat faster and decrease the amount of energy and time they spend eating resulting in improved intake.

- ☐ True
- ☐ False

5. It is normal for premature babies to have bradycardia and desaturations during feeding because they are still developing.

- ☐ True
- ☐ False

6. Chin and cheek support is a specialized intervention and may actually cause a faster flow rate and increase stress cues depending on the infant.

- ☐ True
- ☐ False

7. Premature babies do not always wake up to eat and it is okay to just put the bottle in their mouth. They will eventually start sucking.

- ☐ True
- ☐ False

8. A 33 week old infant was initially awake and alert for nipple feeding. After 5 minutes of nipping, the infant starts to become sleepy. Based on cue based feeding principles, how should you respond? (Select all that apply)

- ☐ Twist or manipulate the nipple to encourage sucking
- ☐ Reposition the infant
- ☐ Stop the feeding and gavage the remainder
- ☐ Use chin/cheek support to help the infant suck
- ☐ If swaddled, unswaddle the infant

9. You are evaluating the readiness of an infant to nipple feed. The infant is 34 weeks old. The infant is demonstrating persistent finger splaying and stress cues during cares. It is appropriate to trial breast or bottle feeding with this infant.

- ☐ True
- ☐ False

10. You are evaluating the readiness of an infant to nipple feed. The infant is 33 weeks old and opens their mouth with touching their lips, is alert and active, and demonstrates rooting. This infant is ready to attempt nipple feeding.

- ☐ True
- ☐ False

11. You are evaluating the quality of an infant's feeding. The infant is 35 weeks old. The infant initially opens their mouth and roots. After 8 minutes, the baby begins spitting, hiccuping, and demonstrating intermittent O2 desaturations not quickly resolved with a break. It is appropriate to continue feeding this infant.

- ☐ True
- ☐ False

12. Please select how confident you feel in determining the following with 1 being the least confident and 5 being extremely confident.

Determining an Infant's readiness to PO Feed  
Recognizing stress and instability during a PO feed  
Responding to stress and instability during a PO feed

13. Please enter the following demographic information.

Primary Role in the NICU  
Primary Shift  
Number of years practicing  
Number of years in NICU setting

## **Appendix H**

### **FOCUS GROUPS**

Focus groups were conducted to gather information from a wide variety of participants. Groups were utilized at the initiation of the project to further understand current feeding practices on our unit and feelings about potentially implementing a cue based protocol on our unit. After two months of implementation with the new protocol, focus groups were held again to assess how implementation was progressing and elicit feedback on areas of improvement.

#### **Pre-Implementation Groups**

At the initiation of this project, unit staff were invited to participate in focus groups to discuss current feeding practices and understand feelings towards feeding on our unit. Focused questions were utilized to elicit specific feedback regarding current feeding approaches and staff understanding of cue based methods. Ideas were also garnered regarding the development and implementation of a cue based protocol, given that this group is instrumental in the day-to-day program implementation. The focus groups were also utilized to identify current issues on the unit regarding feeding to help prevent these from becoming issues during program implementation. Based on discussion, changes needed in current feeding practices were identified, as were suggestions related to staff education. A total of six groups were held (N=35 participants).

RNs who participated in the pre-implementation focus groups reported utilizing a variety of principles to guide decisions about feeding. These included gestational age, developmental appropriateness, rooting, infant cues, and the ability of the infants to perform non-nutritive sucking on their pacifier. Clinical stability including respiratory rate and amount of oxygen support were also frequently mentioned. Finally, some nurses also reported utilizing MD orders as the indicator an infant is ready to feed.

With respect to feeding practices, nurses reported they usually start feeding infants with a slow flow nipple, unless the infant arrives to the unit as a transfer from the full-term nursery. They also reported utilizing a slow flow with all infants whose mothers planned on breastfeeding. Most nurses emphasized they also always utilized a slow flow for any ex micro premie (born prior to 28 weeks).

Team members expressed a variety of concerns regarding feeding on the unit. They reported physicians seem to have a lack of understanding of appropriate volume expectations, especially when infants are just starting to feed or felt they rushed to increase and increase it quickly. They also reported providers seem to expect the very early term premie to take full volumes at each feed, even though they are just starting to learn how to feed with a lack of understanding of developmentally appropriate feeding. Nurses reported feeling their input, as well as the documentation by therapists (OT/SLP), were not valued when sharing information about the readiness of an infant to feed or how infants were progressing with their feeding. Team members commented it feels as though providers only care about how much an infant takes and they feel pressured to feed babies whether they are ready/interested or not. Some nurses reported

an issue with consistent documentation of feeding practices, including how long infants can feed, when events occur during feeding, and the overall quality of feeding. They also reported a lack of consistency in when staff stopped feedings due to infant stress, as well as difficulty with training new staff, especially with an increase in the number of babies they are assigned each shift. Sometimes it appears feeding is a competition, and nurses who are able to get the baby to take full bottles are recognized. Nurses also reported some members of the medical team will restrict the number of times per day an infant can try to be fed based on whether they are emptying the bottle.

When discussing successful feeding, participants reported ensuring infants are demonstrating stable vitals and are not having desaturation events. Most participants commented successful feeding does not necessarily equate to an empty bottle, however others reported this was an important component. The length of the feeding was also reported as a characteristic to consider in successful feedings. Nurses also stressed respiratory stability during feeding, and infants should not demonstrate increased work of breathing or respiratory rate. In regard to stopping feeding, nurses commented they observe for tongue thrusting, significant desaturation events, emesis, falling asleep, increased work of breathing, and arching as indicators the feeding should stop.

All of the focus group participants reported they had not received formal training in cue based feeding. Nurses also expressed interest in receiving training during orientation on how to feed a baby in general, as they receive limited training in feeding in school, especially regarding how to feed premature babies. Most stated the

only exposure to infant feeding they had was during their preceptor training on the unit when they started.

When discussing confidence in feeding babies with cues, participants overall responded they were confident in using infants' cues to start feeding; however, most reported difficulty with determining the number of times a day the baby should feed or how much the baby should feed each time. They commented they often know when to stop if the baby shows stress, yet sometimes feel pressure to continue the feed, especially if the infant does not have an NG tube for gavage.

All focus group participants stated they feel pressured to feed babies who are not demonstrating cues or to continue feeding despite stress cues. Some providers will say "but so and so got them to take their full bottle" when they document decreased intake or not offering a PO feed. Participants reported events are not always documented so the team believes baby is feeding fine, and then when events are reported by other staff, they question whether these events are happening, or if it has to do with the skill of the feeder themselves. Nurses also expressed the medical team does not always understand why a baby did not nipple at a feed, even when RN explains they were not cueing. Some nurses feel so much pressure they will just allow the infant additional time to nipple to get the volume in the infant. They reported they feel the most pressure when an infant does not have an NG tube or family is against placing a tube, or when the census is high and there is pressure to get infants discharged home. Nurses reported they do not feel it personally reflects poorly on them if they are not able to get the baby to take their full volume, yet they feel providers have opinions about certain nurses

because other nurses report being able to get the infant to take their full bottles. When providing feedback on feeding during rounds, providers will often ask who the RN was for the infant during the previous shift.

When asked about the challenges our unit would face in implementing a new feeding protocol, all participants were concerned about medical team buy in and support. They also expressed concern that utilizing cues can be subjective for some and may not resolve some of the current problems on the unit in relation to feeding. Most participants also mentioned issues with resistance to change and the importance of re-education when the new protocol is introduced. Impact on length of stay and discharge time was also discussed. Facilitators shared the research regarding cue based feeding and the impact on decreasing length of stay when compared to other volume driven feeding methods. Finally, participants were concerned the medical providers would still not value their input and engage in conversation regarding cue based feeding readiness and progression.

Despite these concerns, participants reported they felt the unit needed to make a shift to cue based feeding practices. They felt it would improve patient outcomes and that the entire medical team will be supporting their development rather than pushing them to do something they are not ready to do. Participants reported they also feel it will be better for staff because there will be less pressure to force feed for volume intake if an infant cue feeding approach is utilized.

The feedback from these focus groups was utilized to determine which protocol would be selected to implement, how to structure education and resources, and other

challenges to address prior to implementation, to increase chances of program success. Through feedback, it was evident that most nurses are already utilizing tenets of cue based feeding in their practice and decision making regarding infant feeding. The team identified a wide variety of concerns on the unit regarding feeding that a standardized cue based feeding program would address including lack of understanding of developmental feeding, focusing on quality of feeding versus quantity only, and including RN input in feeding discussions during rounds. Comments regarding inclusion of nurses' feedback in rounds and supporting decisions for feeding infants when cues are not demonstrated were discussed with the medical team. A script was devised to support nurses in sharing information and the providers in understanding information regarding infant feeding readiness and quality to support communication between nurses and the medical team. A documentation tool was constructed to support consistent documentation of feeding readiness and quality, including caregiver techniques, so caregivers are implementing similar techniques to support the infant each time they feed. Feedback from these sessions guided our team to focus education on the developmental feeding progression, how to determine when to stop a feeding, and strategies nurses can implement to support infants during feeding to make them more successful. These focus groups provided crucial data related to how to implement a cue based feeding program.

### **Post Implementation Groups**

Two months after implementation of the new protocol, focus groups were again held to elicit feedback on the protocol and areas of improvement. Five groups with 34



participants were completed. Focused questions were utilized to elicit specific feedback regarding protocol implementation and how the process could be improved. Feedback from these groups was utilized to make changes to the protocol and guidelines, improve process implementation, and target performance improvement.

All participants expressed confidence in oral feed initiation based on cue based principles, offering an oral feed at a care based on cues, and stopping an oral feed based on stress cues. They expressed the numeric scoring charts are straightforward and help in determining when to offer an oral feed and the overall quality of a feed. This finding represents an improvement from feedback provided prior to the implementation of the cue based protocol, as some staff expressed concern over knowing when to feed and how much to push during a feeding. A quarter of the participants expressed some difficulty with consistently identifying more subtle stress cues, identifying stress cues which should result in a hard stop for feeding, and which supportive strategies may be beneficial to address certain stress cues. More than 75% of participants expressed that the medical team values their input more (compared to prior to implementation of the cue based protocol) and seeks out information regarding quality of feeding from the nurse. This is a drastic improvement from prior to protocol implementation as all participants expressed frustration regarding feeling unheard and their opinions not respected in terms of reports of feeding progression. The participants expressed they feel more autonomy in making clinical decisions regarding feeding. The other participants expressed concerns their input is not always valued, and some providers still want to push forward if baby is not demonstrating readiness cues, or resist putting

in an NG tube to support an infant who is not able to consistently finish their feedings. However, overall this is a significant improvement in the medical team seeking information and respecting RN input regarding feeding progression compared to pre-implementation of cue based feeding protocols.

All participants indicated they have seen great improvement in the medical team respecting infants' cues and offering feeds only when babies are cueing. There is still some pressure from the team when a baby is getting close to discharge to focus on quantity versus quality, especially after discontinuation of gavage support. Twenty-eight participants (of 35), also agreed RN communication in shift reports have dramatically shifted from quantity to quality, with focus on readiness and feeding quality, versus only the quantity ingested on each shift. This has not started to transition to the medical team however, most participants reported the team still asks about quantity taken before asking for quality, and focuses on number of full bottles taken, without regard for the quality of the feeding experience. Overall this demonstrates improvement from pre-implementation where RNs reported either no discussions regarding quality of feeding or, if discussion occurred, the medical team disregarded the information. Half of the participants indicated they feel some pressure from parents when they are not able to feed babies due to the infant not cueing. There is also some pressure from certain members of the medical team, yet this has significantly lessened from the period prior to our cue based feeding protocol implementation, and providers are more willing to discuss quality if the RN initiates the conversation.

All participants indicated the new documentation has been very helpful in establishing consistency across the team in documenting feeding readiness, feeding quality, and stress cues. They also reported more nurses are consistently documenting feeding strategies utilized and more clearly documenting feeding related desaturation events compared to before the cue based protocol. This has helped with being able to provide the medical team a clearer picture of how feeding is going, especially when a nurse may take care of an infant for the first time and may not have first-hand knowledge of the infant's feeding skills. Discussion of potential changes to improve process implementation also occurred.

All the participants expressed frustration over the lack of consistency among providers for orders for cue based feeding. Orders are inconsistent and require multiple follow-ups to have them corrected, leading to inconsistency and confusion. Some members of the medical team are not waiting until the infant is 33 weeks to initiate the protocol or are not waiting for the infant to demonstrate cues for fifty percent of cares in 24 hours, prior to initiating PO feeds. According to the protocol, infants should be a minimum of 33-weeks prior to initiating scoring because infants younger than this are not likely to demonstrate consistent cues, and are not developmentally appropriate to coordinate sucking, swallowing, and breathing. The Infant Driven Feeding (IDF) (Ludwig & Waitzman, 2014) protocol also insists infants should demonstrate consistent readiness cues for a minimum of half of their care times every 3 hours, during a 24-hour period, to ensure the infant is demonstrating consistent cues prior to initiating feeds.

Participants also expressed they would like a standardized cue based feeding order versus modifying a general feeding order in the system, so the information is clear.

The other area of challenge has been consistency in scoring babies for readiness when they are not offered a feed. For example, an infant may be alert, but demonstrating significant tachypnea, and the baby is scored as a one by some staff and a five by others. This has led to some confusion when the documentation shows the infant should have received a feed but was not clinically appropriate despite demonstrating alertness. All these suggestions were discussed at length and will be considered to improve program implementation.

### **Conclusion**

Overall feedback from the post groups indicates great improvement in our focus on cue based feeding practices and implementation of developmentally supportive care. Staff feel more confident in the feeding, recognition of stress cues, and response to stress cues, based on cue based feeding tenets. Medical providers are seeking information regarding quality of feeding and nurses feel more respected in their judgement regarding feeding. Nurses are actively discussing feeding in terms of overall quality versus only quantity and are sharing this information daily during shift report. Documentation of feeding readiness and quality has improved communication among staff and has allowed for a better understanding of infant feeding progression. Staff also provided anecdotal support of infants demonstrating faster achievement of full feedings, more positive feeding experiences for staff and babies, and shorter length of

stay for babies who may otherwise have not tolerated volume drive strategies resulting in increased time in the hospital.

Post-intervention focus groups allowed for identification of areas for improvement for the cue based feeding program. Staff reported some members of staff are not recognizing the spectrum of stress cues which is resulting in continuation of feeds and increased volume intake, however decreased quality of feeding and increased negative events (desaturations) during feedings. Staff also felt the medical team needs ongoing education regarding actual discussion at rounds, seeking out information from the nurses regarding readiness to initiate feeds, and quality of feeding, as opposed to a focus on volume. The medical team needs to be periodically reminded only infants greater than 33-weeks gestational age should participate, and infants need to show consistent readiness cues during their care times every three hours over a 24-hour period, prior to offering the first feeding. Staff also reported they felt pressure from parents to feed infants at all care times due to lack of understanding of the new cue based protocol. Focus groups will be held quarterly to continue to gather feedback from the team to ensure team members feel heard and continual improvement occurs within the program.

### **Pre-Implementation Focus Group Questions**

1. What principles do you use to guide decision about feeding babies in your care?
  - a. How do you determine what nipple to use?
2. What are the biggest issues in your opinion regarding feeding on our unit?
3. How do you decide if an infant is ready to initiate bottle or breast feedings?
4. What constitutes a successful feeding?
5. Have you ever received training in cue based feeding? If so, what types of information have you learned and where from?
6. Describe infant cues or issues that would cause you to stop a PO feeding.
7. How confident do you feel making decisions about initiating PO feeding with cues? Continuing feeds based on cues? Stopping feeds based on cues?
8. Do you ever feel pressured to feed babies who aren't demonstrating cues? Continue feeding despite stress cues? If yes, how so?
9. Do you feel it reflects poorly on you if your baby does not take his/her full volume?
10. What are challenges you feel our unit might face in implementing a cue based feeding program?
11. Other comments/questions/concerns regarding feeding on our unit.

### **Post Implementation Focus Group Questions**

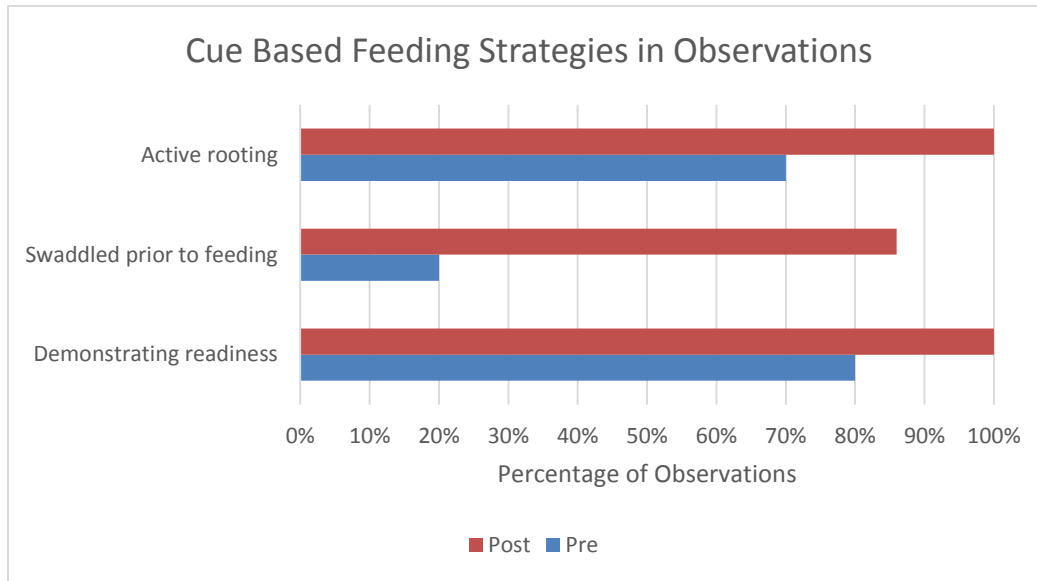
1. What is your confidence level now in assessing cues to:
  - a. Start PO Feeds initially
  - b. Offer a PO feed at a given care
  - c. Stop a PO feed based on stress cues
2. Do you feel your input regarding feeding is valued at rounds regarding infant cues?
3. Do you feel we are more respectful of infant's cues and only offering feeds when infants are cueing? If no, why?
4. Do you feel we are focusing more on quality versus quantity?
5. Do you feel pressure to feed babies who are not cueing? Feed past stress signs?
6. Have we become more consistent in documenting feeding outcomes and events with the new cue based feeding documentation?
7. Do you feel we are more consistent in when/how we are initiating feeds across providers?
8. Challenges/Problems you have faced in implementation
9. Feedback/Changes
  - a. Things to improve

## **Appendix I**

### **FEEDING OBSERVATIONS**

Feeding observations were conducted by trained Occupational Therapists, Speech Language Pathologists, and experienced nurses from the unit staff. A standardized form outlining ten different tenets of cue based feeding guided these observations. Observation points included demonstration of feeding readiness, swaddling, active rooting, supportive interventions provided by the RN, infant engagement during feeding, stress and RN response to stress during the feeding, abortion of the feeding when stress was demonstrated, and techniques utilized during the feeding. A yes/no format was utilized with these items allowing for listing of interventions, signs of stress, and response of RN, as appropriate. Ten observations were completed during pre- and post-implementation. Figure 1 represents the extent to which cue based, supportive methods both pre- and post-program implementation. Ideally, we would see 100% utilization of each of these supportive methods.





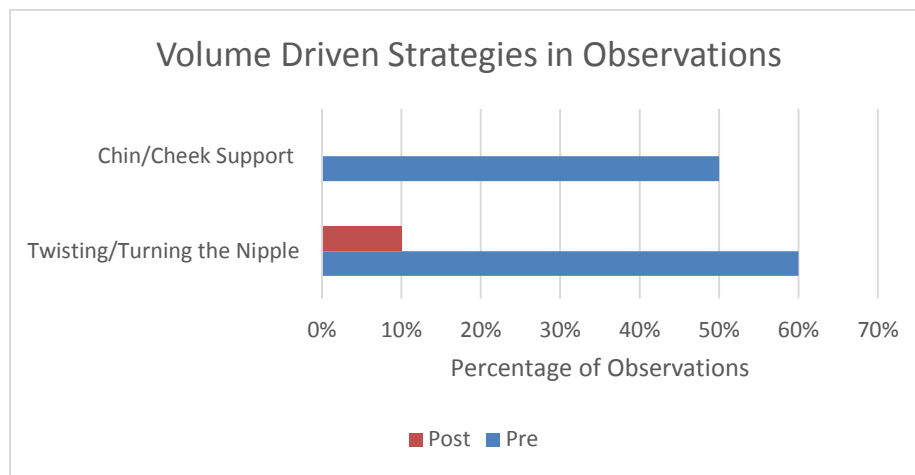
*Figure II.* Cue Based strategies utilized by staff.

Prior to program implementation, eight of the ten infants were demonstrating feeding readiness cues at the initiation of feeding. Despite two infants not demonstrating readiness, feedings were offered regardless. Seven of the infants demonstrated a score of one, one infant scored a two, and two infants scored a three for readiness. Only 20% of infants observed were swaddled prior to the feeding, and both infants who were swaddled were eventually unswaddled when they became sleeping during the feeding. Seventy percent of the infants actively rooted for the nipple to start the feeding, and for three infants, the RN passively placed the nipple in the infants' mouth.

After education and implementation of our cue based program, ten observations were conducted again. During these observations, seven infants were demonstrating

cues and participated in feeds. The other three feeds were appropriately held, and gaviged, given the infants were not demonstrating readiness for feeding. For the seven infants who participated in feeds, six of the infants were swaddled, and none were unswaddled if they fell asleep. This is an improvement compared to pre-implementation, as only 20% of infants were swaddled, and both infants were unswaddled when they became drowsy. All seven infants actively rooted for the nipple, also an improvement from pre-implementation where only 70% actively rooted.

Figure 2 represents the extent to which volume driven strategies were observed. Ideally, we were looking for absence of these behaviors during these observations.



*Figure I2.* Volume driven strategies utilized by staff.

Prior to our program implementation, chin and cheek support was utilized in five observations, despite not being specifically recommended by a feeding therapist for any of the infants. Six of the ten infants became disengaged during the feeding;

however, only in two observations did the nurse stop the feeding when disengagement occurred. Three infants demonstrated overt stress during the feedings. Stress cues included facial expression change, decreased alertness, coughing, and finger splaying. Nurses in all three observations where stress was demonstrated allowed a rest break, but only one completely ended the feeding. During five of the observations, feeding was not aborted if the infant demonstrated two or more stress cues or demonstrated a change in feeding readiness. Twisting and turning the bottle to re-engage the infant was demonstrated in 60% of the observations.

After education and hands on training during the cue based feeding implementation, only one instance of twisting/turning of the nipple occurred, a 50% reduction from the pre-observations. Chin and cheek support were not utilized in any of the post-observations, a 100% reduction from the pre-observations. In the ten observations, all but one was aborted if the infant demonstrated signs of stress not resolved with use of supportive techniques, which was a 50% increase compared to pre-protocol implementation.

### **Conclusions from Pre-Implementation Survey**

These observations provided information to guide our staff education as we implemented our cue based feeding protocol. Feeding readiness scoring was reviewed and staff were educated to only provide feedings for infants scoring a one or a two during care times when feedings would be offered. Swaddling was introduced as a supportive intervention technique for all infants, and it was reviewed that swaddles should not be removed if the infant becomes sleepy, as this is a form of stress cue. Staff

were reminded to always allow the infant to actively root and to not place the nipple in the infants' mouth without rooting demonstrated. Supportive techniques were reviewed and demonstrated for staff. Videos displaying signs and symptoms of infant stress were shared with staff, and discussion of appropriate responses occurred. Staff were encouraged to stop feedings when infants demonstrated two or more stress cues not resolved by supportive techniques, or if the infant demonstrates a change in feeding readiness. Staff were also reminded to avoid twisting/manipulating the nipple or utilizing chin/cheek to support to re-engage the infant.

### **Conclusions from Post Observations**

These observations allowed us to assess improvement in utilization of cue based feeding and supportive development feeding practices. Improvement was noted as evidenced by a decrease in the utilization of volume driven strategies including twisting/turning the bottle, chin/cheek support, and unswaddling if the infant became drowsy. Improved active rooting, utilization of swaddling prior to feeding, and appropriate recognition of readiness for feeding with use of gavage when infants were not demonstrating appropriate cues occurred in examination of post-observations.

These observations also allowed us to garner information to help guide re-education efforts and determine areas of improvement for our cue based feeding program. These results demonstrated improvement in focus on quality of feeding versus quantity, and focusing on the infants' feeding experience, to ensure the infant is an active participant. The results also demonstrated staff are respecting infants' readiness cues when determining whether to offer a feeding and are utilizing stress and

stability cues to guide continuation of feedings. Education will occur regarding aborting feedings if overt signs of stress continue, despite efforts to resolve them with supportive techniques. In the majority of the time, feedings were continued, with only breaks offered, versus recognizing when an infant is demonstrating ongoing stress in which it would be more appropriate developmentally to terminate the feeding.

Although present in less feedings during formal observations, twisting and manipulation of the nipple was still present in one of the observations and has also continued to be noted intermittently by this writer during unit visits. Rationale for not continuing to pump and twist the nipple will be reviewed to help staff understand the infant may be utilizing the break in sucking as a time to catch up on breathing or may be signaling they are too fatigued to continue. Because sucking is reflexive, some infants will continue to suck when stimulated by the twisted or turned nipple even if they are not physiologically ready to continue to participate in feeding.

Overall, these observations demonstrated a drastic improvement in the utilization of cue based feeding strategies and a reduction in the volume driven approaches. Observations will continue to occur on a quarterly basis to ensure adequate protocol implementation and identify any areas of re-education needed.

### Feeding Observation

Date: \_\_\_\_\_

Observer: \_\_\_\_\_

Infant was demonstrating feeding readiness cues at initiation of feed	YES	NO
Feeding Readiness Score: _____		

Infant was swaddled prior to feeding	YES	NO
--------------------------------------	-----	----

Infant was un-swaddled during feed if they fell asleep	YES	NO
--	-----	----

The infant actively rooted for the nipple when feeding was initiated	YES	NO
--	-----	----

RN provided supportive interventions throughout the feeding	YES	NO
List interventions provided: -		
_____		

Infant remained engaged throughout duration of feeding	YES	NO
--	-----	----

The infant demonstrated s/s of stress during the feeding	YES	NO
List s/s of stress noted:		
_____		

The RN responded to s/s of stress during the feeding	YES	NO
List response of RN:		
_____		

The feeding was aborted if the infant demonstrated 2 or more s/s of stress or change in feeding readiness/cues

	YES	NO
--	-----	----

The following techniques were observed during the feeding:

Twisting/Turning the bottle to re-engage sucking	YES	NO
Initiated chin/cheek support if the infant fatigued	YES	NO
Waited for infant to root to bottle to engage in feeding	YES	NO
Feeding continued if infant became disengaged	YES	NO

Feed length: \_\_\_\_\_

Amount ingested: \_\_\_\_\_

Quality Score \_\_\_\_\_

PCA of Infant: \_\_\_\_\_

NG Tube present	YES	NO
-----------------	-----	----

Nipple utilized: SLOW FLOW      STANDARD      SPECIALITY BOTTLE \_\_\_\_\_

## **Appendix J**

### **CUE BASED FEEDING BEDSIDE SCORING AUDITS**

Cue based feeding audits were also conducted to ensure consistency among staff in scoring infant feeding readiness and quality. Twenty-one audits were completed over a two-week period. The scores between the bedside RN and the auditing RN matched for readiness in 81% of trials. Discrepancies were always between scores of one and two where a feeding would be offered in either case, versus discrepancies where one RN scored the infant as ready and appropriate to offer a feed and another scored as inappropriate for a PO feed.

Quality scores matched in 86% of audits. Differences in quality were often between scores of two versus three, and often was a misunderstanding that if an infant received more than two specialized supports, they could automatically not score above a three for quality. No significant differences in quality scores were noted. Re-education provided during the audits included importance of swaddling infants prior to feeding for physiological stability, appropriate external pacing techniques, and appropriate quality scores given amount of supports provided. Audits will continue to be completed once per quarter to continually assess consistency of scoring among staff.

### **Cue Based Feeding Bedside Audit**

Nursing Readiness Score

\_\_\_\_\_.

Nursing Quality Score

\_\_\_\_\_.

Rationale:

---

---

---

Interventions utilized:

---

---

Observer Readiness Score

\_\_\_\_\_.

Observer Quality Score

\_\_\_\_\_.

Rationale:

---

---

---

Interventions utilized:

---

---

Additional education required? If so, comment:

---

---



## **Appendix K**

### **UMMC CUE BASED FEEDING PROTOCOL AND GUIDELINES**

By combining information collected from the literature review, protocol comparison, pre-implementation focus group and survey, as well as review of the IDF protocol by Ludwig and Waitzman (2014), a *Cue Based Feeding Guideline* and a specific protocol were able to be constructed. The *Cue Based Feeding Guideline* includes the purpose and goals of cue based feeding as well as literature support. Terminology related to cue based feeding is defined and discussed in terms of implementation on our specific unit. Supportive caregiver techniques are also discussed in detail, with examples of application in clinical practice. Staff responsibilities are also outlined in these documents to help establish each team members role in the cue based feeding program on our unit.

The decision-making protocol includes the *Feeding Readiness* and *Feeding Quality* score charts from the IDF model, reprinted with permission (Ludwig and Waitzman, 2014). The protocol outlines how to initiate feeding, which infants qualify for the protocol, and how to implement the protocol for infants who do meet the criteria. The algorithm is intended to assist bedside staff in implementing feeding practices and guides decision making before, during, and after feeds. Both of these documents are included here for reference.

**Cue Based Feeding Guidelines**  
**University of Maryland Medical Center**  
**Neonatal Intensive Care Unit**

**I. Purpose:**

The purpose of this document is to outline standardized feeding practices for pre-term infants admitted to the NICU. This will promote the utilization of developmentally supportive care and support infants in the development of age appropriate feeding skills across caregivers. Standardized care will promote uniform feeding practices across caregivers with the intention of maximizing positive oral experiences via cue based feeding and provide a supportive, consistent approach for optimal infant learning. This will hopefully increase positive oral experiences and allow the infant to drive feedings. The infant should be an active participant in each feeding. The infants' cues and physiologic stability dictate how often and how long they nipple at each feeding (Ludwig & Waitzman, 2007; Newland, L'Huillier, & Petrey, 2013; Shaker, 2013).

**II. Goals:**

Feeding initiation will be based on a combination of the infant's chronological age, behavioral cues, physiological stability, and overall medical status. Successful feedings will be measured by quality of the feeding and infant engagement during the feeding including physiological stability, and not just quantity taken at each feeding.

Implementation of a consistent method across caregivers to assess nipple feedings and to communicate in a common language regarding feeding readiness, quality of feeding attempts, and progression of feeding skills.

Consistency of documentation regarding infant feeding attempts to clearly communicate quality of feeding and progression of feeding skills.

**III. Literature Support:**

Oral feeding is one of the most complex behaviors required for infants. Feeding is especially difficult for babies who are born prematurely or who have medically complex conditions. Feeding requires integration of multiple body processes, including the coordination of sucking, swallowing, and breathing, while maintaining physiological stability, to prevent adverse events (Bertoncelli et al., 2012). Premature babies demonstrate difficulty with oral feeding due to differences in muscle tone, state regulation, endurance, and coordination of suck, swallow and breathe behaviors when compared to full-term babies. Often, preemies lack the ability to coordinate these systems, and may communicate stress during feeding. Babies utilize a variety of behaviors and cues to communicate their stability or stress during these types of high

level tasks. Cues indicating stability can include rooting, eye contact, rhythmical sucking bursts, and stable respiratory rate. Stress cues can include finger splaying, head turning, arching, or overt desaturation events (Shaker, 2013). Some of these cues are overt while others may be subtle; however, recognition of these cues is vital to consider while making decisions to proceed or halt an oral feeding. To promote positive feeding experiences, caregivers should want infants to demonstrate stability cues, while limiting stressful experiences.

Cue based feeding utilizes each infant's developmental level and maturity to guide decisions before, during, and after feedings. Ludwig and Waitzman (2007) stressed the importance of utilizing behavioral cues to help guide feedings, allowing the infant to communicate self-regulation and physiological stability, leading to more efficient feedings. In this model, the role of feeding in building relationships and communication is considered. The infant is observed in the moment, and the caregiver continuously modifies the approach through individual interventions to support the infant's stability (Shaker, 2013). Strategies utilized in this method to support developmental feeding practices include selection of a controllable flow rate, utilizing an elevated sidelying position, swaddling to optimize postural control, and avoiding prodding. The goal of the feeding is for the infant to be engaged without signs of distress, even if the session only lasts for a few sucks. Intake will then improve with development, if infants' needs are respected.

A hallmark of this method is recognition that the acquisition of feeding skills is a developmental processes, and infants should not be pushed beyond their developmental capabilities (Browne & Ross, 2011). Protocols allowing the infant to drive the feeding through communication signals supports their development toward becoming competent and efficient oral feeders, the ultimate goal for all infants. Allowing this communication to occur, and be respected, allows for increased self-regulation and coping skills. Through this communication, the caregiver anticipates and accommodates the infants' needs. This allows for avoidance of adverse events, because the caregiver acts proactively versus reactively. If an infant communicates he or she is finished with a feeding, the feeding stops, regardless of whether the bottle is empty. Intake is only viewed within the context of the infant's development, and is a by-product of a quality feeding, versus the sole goal of a feeding (Shaker, 2013). Research has demonstrated utilizing cue based feeding decreases the amount of time between first oral feed and full oral feeds, provides consistency in feeding practices, increases confidence among caregivers, and lowers healthcare cost by decreasing length of stay and resource utilization (Kirk, Alder, & King, 2007; Ludwig & Waitzman, 2007; Newland, L'Huillier, & Petrey, 2013; Wellington & Perlman, 2015; Thoyre, Hubbard, Park, Pridham, & McKechnie, 2016).

#### **IV. Definition of Terminology:**

Infant Driven Feeding© - A specific cue based protocol designed by Ludwig & Waitzman (2007) to guide infant feeding based on feeding readiness, infant cues, and

infant stress/disengagement. Infants are scored on a readiness scale of 1-5 and are provided feeding based on cues demonstrated during cares. When offered, feedings are rated for quality based on a 5 point scale and caregiver techniques are also indicated in documentation. Feeding is initiated and terminated based on the infants' initiation and communication throughout the duration of the feeding. Guidelines from this tool are utilized within the framework of our program at UMMC and are referenced as such throughout this document.

Suck-Swallow-Breathe Coordination - Feeding requires integration of multiple body processes, including the coordination of sucking, swallowing, and breathing, while maintaining physiological stability, to prevent adverse events. Full coordination occurs between 36-37 PMA and is usually in a 1:1:1 ratio of suck, swallow, breathe. (Bertoncelli et al., 2012).

Feeding Readiness – Feeding readiness is indicated through infant behavioral cues which usually appear between 32-34 weeks of corrected gestational age as the infant's neurological system matures. Feeding readiness cues can include active rooting, mouthing of hands, sucking on fingers or pacifier, being in a quiet/alert state, having appropriate body tone, and waking up around care times (Ludwig & Waitzman, 2007; Shaker, 2013; Browne & Ross, 2013).

Disengagement Cues – Disengagement cues indicate infant is communicating they are finished with feeding. These cues can include no active rooting, no active sucking, pulling off or away from nipple, turning head away, tongue thrusting the nipple, losing tone in the upper extremities, or demonstrating compression only sucking (Shaker, 2013).

Physiological Stress Cues – Infants may indicate physiological distress during feeding. By responding appropriately, the caregiver can support the infant to lessen stress cues by providing supportive techniques, or if stress continues, terminate the feeding. Stress cues can include change in alertness, change in tone, color changes, respiratory distress, tachypnea, tachycardia, audible swallows, apnea or bradycardia, spitting or drooling, overt coughing/choking, gagging, change in facial expression, retractions, eyebrow raising, or finger splaying (Ludwig & Waitzman, 2007; Shaker, 2013; Browne & Ross, 2013).

Non-Nutritive Sucking (NNS) – NNS includes sucking on fingers, hands, gloved finger, or pacifier which does not provide nutritional input. Providing NNS prior to a feeding can help improve alertness, improve sucking strength, and when provided in conjunction with gavage feeding, can help the infant associate sucking and their stomach getting full (Browne & Ross, 2013).

Stable Respiratory Status - The infant should demonstrate respiratory stability and should not require high flow O<sub>2</sub>, be on 3L or less of low flow NC, and demonstrate a RR rate of below 70 consistently prior to initiating this standardized cue based feeding protocol. Other infants may be determined appropriate to feed outside of these parameters by the direction of the medical team, and caregivers should follow specific recommendations for those infants. Feeding should stop if RR is above 70 and does not resolve with utilization of supportive techniques. Feeding should not be initiated for infants requiring CPAP, SiPAP, or high flow nasal cannula.

Caregiver Supportive Techniques - Supportive techniques may be provided by the caregiver in response to infants' cues and behaviors during the feeding in an attempt to help the infant cope with stress and promote physiological stability to continue feeding in a safe manner. These can include:

*Sidelying Position* – This position involves placing the infant with one ear down, slightly elevated in arms, facing sideways in the caregivers' lap. The infant's ear and hip should be in a straight line. The bottle is held at a slight angle which helps slow the pull of gravity on the liquid, providing increased transit time for the infant to fully form a bolus for each swallow prior to receiving additional milk. In addition, this position supports the infants' work of breathing by requiring less antigravity movement and promoting airway patency. A study completed by Park et al. (2014) demonstrated significantly less variation in heart rate, less severe and fewer decreases in heart rate, respiratory rate that was closer to the pre-feeding state, shorter and more regular intervals between breaths, and briefer feeding-related apneic events when infants were positioned in upright sidelying for feeding.



*External Pacing* - If the infant demonstrates excessive, continuous sucking bursts that then cause physiological instability, the caregiver can provide external pacing by tilting the bottle down while keeping the nipple in the mouth to prevent disorganization. If the infant continues sucking, the caregiver may need to break the infant's seal and move bottle to the side of the infant's mouth. If after breaking the seal the infant continues attempting to manipulate the nipple and does not appear to be taking a break to breathe, you may consider removing the nipple completely from the mouth and placing at the corner of the lips.

*Adding or Increasing O<sub>2</sub>* - Only with an MD order, a caregiver may add or increase O<sub>2</sub> to help provide the infant with respiratory reserve to help support coordinated suck, swallow, breathe sequence. Caution should be taken to ensure adding or increasing O<sub>2</sub> does not mask desaturations or deficits (Shaker, 2013). Caregivers should defer to the

MD order to determine if a change of FIO<sub>2</sub> or flow should be titrated for a particular infant.

*Imposed Breaks* - Some infants may benefit from breaks during the feed to allow for active recovery, catching of breath, and allowing re-grouping of physiological stability. Infants needing a break may show decreased engagement or stress cues that are then resolved after providing a 3-4 minute break in the middle of the feeding and then show additional interest in feeding after the break. Monitor length of breaks because total feeding time including breaks should not span more than 20-25 minutes.

*Stimulation for Recovery* - When an infant demonstrates a physiological response to feeding including apnea and bradycardia, the caregiver may need to provide stimulation for the infant to appropriately recover if they do not demonstrate recovery independently.

*Frequent Burping* - Infants who demonstrate increased gassiness may benefit from frequent burping to dispel air intake/gas to help keep them comfortable and interested in feeding. Needing to burp may be indicated by cessation of sucking, tongue thrusting, arching, bearing down, head turning, or a change in sucking rhythm.

*Alternative Nipple* - All infants starting in the Cue Based Feeding Protocol should start with the slow flow nipple. This nipple may be too fast for some infants, indicated by excessive spitting/spillage, desaturations, gulping, or overt coughing/choking. If this is the case, providers should contact OT/SLP to assess appropriateness for a slower flow nipple. In other cases, the slow flow may be too slow for the infant as evidenced by collapsing of the nipple, excessive sucks per swallow, and remaining engaged with feeding but volume not being removed efficiently from the bottle. If this is the case, a standard nipple can be trialed but caregivers should closely monitor quality of nipping with the faster flow and contact OT/SLP if the slow flow is too slow but the standard appears too fast. If a specific nipple has been recommended by OT/SLP, this nipple should be utilized by all caregivers. If caregivers feel the infant may be ready to progress to another nipple, they should discuss with the treating therapist prior to making the change. Therapy is available on the unit 7 days a week, usually from 7 AM to 5 PM.

## V. Staff Responsibilities:

Team Member	Responsibilities
RN	<p>Initiates feeding readiness scoring at 33 weeks PMA for all infants demonstrating stable respiratory status, tolerating full volume enteral feeds, and appropriate NNS.</p> <p>Scores infants at each care for feeding readiness cues as indicated by the "Feeding Readiness Scale."</p> <p>Requests a Cue Based Feeding order from the provider once an infant has demonstrated scores of 1/2 for 50% of cares in a 24 hour period.</p> <p>Communicates infant readiness cues and feeding progression to the team during rounds utilizing the "Feeding Readiness Scale" and the "Quality of Feeding Scale."</p> <p>Utilizes developmentally supportive caregiver techniques during feeding including sidelying position, external pacing, imposed breaks, frequent burping, or alternative nipples as appropriate.</p> <p>If an infant shows repeated disengagement or stress cues <u>stops</u> the feeding regardless of volume ingested.</p> <p>Documents infant readiness cues and quality of feeding utilizing the "Feeding Readiness Scale" and the "Quality of Feeding Scale" in the Epic Flowsheet.</p> <p>Requests an OT/SLP feeding consult from the team during medical rounds if an infant shows repeated scores of 3 or more.</p> <p>Consults therapy for utilization of any nipple other than a slow flow. If breastfeeding, consults Lactation for repeated poor-quality scores.</p> <p>Educates families regarding the importance of cue based feeding and how they can determine if their infant is ready to feed and how to know when to terminate feedings.</p>
Medical Providers (MDs and NPs)	<p>Discusses infant's feeding progression with RNs on rounds including "Feeding Readiness" Scores and "Feeding Quality" scores.</p> <p>Initiates OT/SLP consults for infants whose RNs report a score of 3 or above on more than 2 feedings.</p>
Occupational Therapist and Speech Language Pathologist	<p>Provides assessment for all infants who are born less than or equal to 32 weeks gestation or less than 1500 grams per standing order criteria.</p> <p>Consults on infants who RNs report score a 3 or above on more than 2 feedings once Cue Based Feeding is initiated.</p> <p>Collaborates with staff to determine appropriate nipple flow rates as infants' progress in feeding.</p>
Lactation Consultants	<p>Promotes oral feeding readiness cues during breastfeeding attempts and utilizes developmentally supportive feeding methods to promote successful breastfeeding.</p> <p>Supports infants who demonstrate repeated poor quality scores during breastfeeding attempts.</p>

## VI. Guidelines:

### *Pre-Oral Feeding Infants*

- Promote frequent kangaroo care and skin to skin contact, especially during gavage feedings to allow the infant to be exposed to smell of mother/father and breastmilk.
- Provide oral care with colostrum or breastmilk per MD order.
- Offer NNS during gavage feeding to promote association of sucking with the stomach getting full. If appropriate small dips of milk/formula on the pacifier can be offered with an MD order.

### *Pre-Feeding Readiness*

- Initiate pre-feeding readiness scoring for infants at 33 weeks PMA if respiratory status is stable (see definition above) and the infant is tolerating full enteral feeds. Readiness scores should be given at each care once initiated.
- Request a Cue Based feeding order from the provider once an infant scores a 1 or 2 at a minimum of 50% of cares during a 24 hour period.

### *Feeding Attempts*

- Attempt nipple feeding based on the infants score on the “Feeding Readiness Scale”.

Infant-Driven Feeding Scales© (IDFS) - Readiness			
Score		Description	
Breastfeed	Bottle	1	Alert or fussy prior to care. Rooting and/or hands to mouth behavior. Good tone.
		2	Alert once handled. Some rooting or takes pacifier. Adequate tone.
Gavage with skin to skin	Gavage with NNS	3	Briefly alert with care. No hunger cues. No change in tone.
		4	Sleeping throughout care. No hunger cues. No change in tone.
Gavage Only		5	Significant change in HR, RR, O2, or work of breathing outside safe parameters.

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- Administer medications including multivitamins after the feeding via feeding tube until the tube is removed as able (Philbin & Ross, 2011). Infants have an extreme sense of taste and providing medication outside of feedings helps to promote positive feeding experiences.
- Avoid force feeding. Do not place the nipple into the baby’s mouth by forcing the mouth open. Slowly stroke the baby’s cheek or lips with the nipple and only place in



the oral cavity once the infant has rooted for the nipple (Shaker, 2013; Philbin & Ross, 2011).

- Avoid prodding the infant to feed by turning, twisting, and pumping the nipple to engage the infant in sucking. Avoid chin and cheek support unless specifically recommended by an OT or SLP who has evaluated the baby utilizing those strategies. If cheek support is determined appropriate, unilateral support with light touch is the best supportive method (Shaker, 2013; Philbin & Ross, 2013; Ludwig & Waitzman, 2007).
- Monitor the infant for the duration of the entire feeding for cues – if a change in readiness score from a 1/2 is seen, stop the feeding.
- Limit feedings to a maximum of 25 minutes or less if an infant shows a change in cues (no longer demonstrating a 1 or 2 readiness score, shows disengagement cues, or shows repetitive signs and symptoms of stress not alleviated with use of supportive techniques).
- Stop the feeding if the infant demonstrates consistent stress and disengagement cues not resolved with use of supportive techniques.
- Make sure to document any change in vitals outside of the patients prescribed vital sign parameters in EPIC.

Infant Stress Cues	
Disengagement	No active rooting No active sucking Pulling off the nipple Turning head away Tongue thrusting Compression only sucking
Stress	Change in alertness level Change in tone/postural control Color change Respiratory distress Tachypnea Nasal flaring Chin tugging Audible swallows Desaturation events Apnea/brady Spitting/drooling Gulping Multiple swallows Overt coughing/choking Gagging Hiccups Finger splaying Facial expression change Watery eyes

- Score the feeding based on the “Quality of Feeding Scale.”

Infant-Driven Feeding Scales© (IDFS) - Quality	
Score	Description
1	Nipples with strong, coordinated suck throughout entire feed.
2	Nipples with a strong coordinated suck initially, but fatigues with progression.
3	Difficulty coordinating SSB despite consistent suck.
4	Nipples with weak/inconsistent SSB. Little to no rhythm.
5	Unable to coordinate SSB pattern. Significant change in HR, RR, O2, work of breathing outside safe parameters or clinically unsafe swallow during feeding.

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#### *Document the feeding*

- Utilize the Epic Flowsheet to document the “Feeding Readiness Score,” the “Quality of Feeding Score” and any “Caregiver Techniques” provided during the feeding.
- Document any bradycardia or apnea events that occur during the feeding.

#### *Communicate with the medical team.*

- Communicate daily in rounds with medical team about the “Feeding Readiness Scores” and the overall “Quality of Feeding Scores.” (See Rounds Script)
- Request orders for OT/SLP consults if an infant demonstrates a score of 3 or above for 2 or more feeding attempts once Cue Based Feeding has been initiated.
- Speak with OT/SLP covering therapist prior to changing a recommended nipple for an infant.

## **VII. Feeding Techniques to Support Oral Feeding**

### Positioning

- Stable body position - keep the body elevated with the head at midline.
- Utilize sidelying position as discussed above
- Swaddle the baby to promote stability and allow for hands to face.
- Avoid unswaddling the baby if they show a change in alertness. Change in alertness is a stress or disengagement cue.

### Non-Nutritive Sucking

- Provide prior to initiation of nipple feedings to support the association of sucking and the belly getting full during gavage feedings if the infant is awake, roots to pacifier, and demonstrates respiratory stability.
- Do not force the pacifier into the infant's mouth.
- Use NNS prior to initiation of feeding to promote a more alert state.

### Environment

- Provide a quiet environment without extraneous noise such as the TV or music.
- Dim the lights to avoid overstimulation.
- Minimize talking and extra people in the room during feeding whenever possible.

### Nipple and Pacing

- Utilize a slow flow nipple for all infants initiating the Cue Based Feeding protocol. If a slower or faster nipple may be appropriate, please contact OT/SLP. Avoid changing a nipple prior to speaking with OT/SLP therapist.
- A slow flow nipple allows standardized practice and helps the infant coordinate SSB while the volume is minimized.
- Changes in nipple should be established collaboratively between RN and OT/SLP to help ensure developmental appropriateness prior to making the change, to optimize safety and consistency.
- Utilize pacing as described above if the infant is demonstrating gulping, spitting, or excessive sucking without sufficient breaks to breathe.
- Pacing allows maintenance of stability by giving the infant a chance to catch their breath if they are demonstrating poor SSB coordination and integration of breathing.
- Pacing can be provided by tipping the nipple up, moving to the corner of the mouth, or completely removing the nipple depending on the individual infant and their response.

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## Cue Based Feeding Protocol

### Cue Based Feeding Clinical Decision Making Protocol

Infant must:

- Be > 33 weeks PMA
- Stable respiratory status (NC <3L, RR <70)
- Tolerating full volume enteral feeds
- Able to suck on pacifier for 1 minute with appropriate suck/breathe pattern
- **If followed by OT/SLP please follow specific recommendations**

### Start Protocol with Slow Flow Nipple

Infant-Driven Feeding Scales® (IDFS) - Readiness		
Score		Description
Breadfeed	Bottle	1 Alert or fussy prior to care. Rooting and/or hands to mouth behavior. Good tone.
	Bottle	2 Alert once handled. Some rooting or takes pacifier. Adequate tone.
Gavage with skin to skin	Gavage with NNS	3 Briefly alert with care. No hunger cues. No change in tone.
	Gavage with NNS	4 Sleeping throughout care. No hunger cues. No change in tone.
Gavage Only		5 Significant change in HR, RR, O2, or work of breathing outside safe parameters.

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Infant Stress Cues***	
Disengagement	No active rooting No active sucking Pulling off the nipple Turning head away Tongue thrusting Compression only sucking
Stress	Change in alertness level Change in tone/postural control Color change Respiratory distress Tachypnea Nasal flaring Chin tugging Audible swallows Desaturation events Apnea/brady Spitting/drooling Gulping Multiple swallows Overt coughing/choking Gagging Hiccups Finger splaying Facial expression change Watery Eyes

Infant-Driven Feeding Scales® (IDFS) – Caregiver Techniques	
Score	Description
A	Side-lying Position
B	External Pacing
C	Adding or Increasing O2
D	Imposed Breaks
E	Stim for Recovery from A/B's during feed
F	Frequent Burping
G	Alternative Nipple
H	Other:

Figure K1. Cue based clinical decision-making protocol.

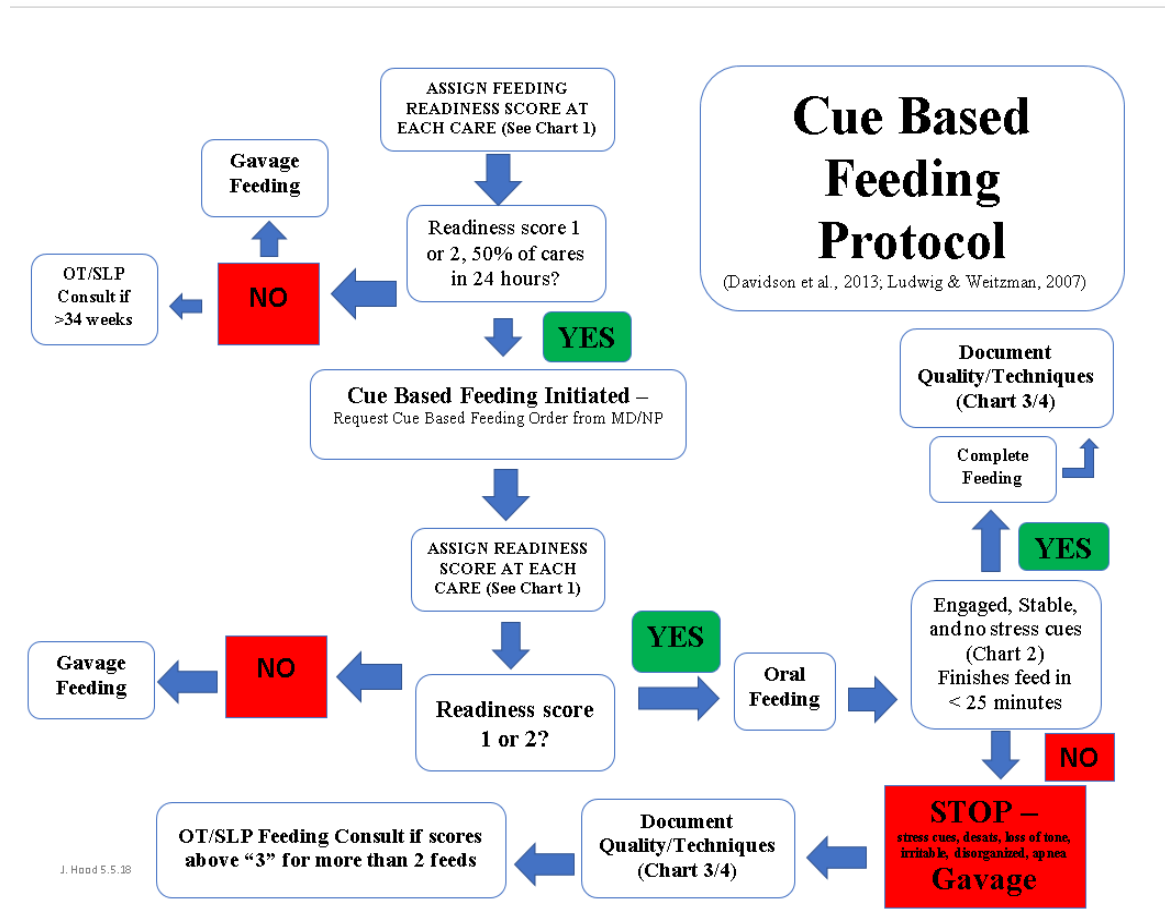


Figure K2. Cue based algorithm.

Infant-Driven Feeding Scales® (IDFS) - Quality	
Score	Description
1	Nipples with strong, coordinated suck throughout entire feed.
2	Nipples with a strong coordinated suck initially, but fatigues with progression.
3	Difficulty coordinating SSB despite consistent suck.
4	Nipples with weak/inconsistent SSB. Little to no rhythm.
5	Unable to coordinate SSB pattern. Significant change in HR, RR, O2, work of breathing outside safe parameters or clinically unsafe swallow during feeding.

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If provided 2 or more caregiver techniques, cannot score below a "3"

- ➡ Infants less than 33 weeks – offer NNS opportunities 2x/shift for 5-10 minutes during gavage feeding if alert or place to empty breast 1x/day after Mom has fully pumped (with medical team clearance)
- ➡ Infants greater than 34 weeks who demonstrate lack of progress with protocol or no readiness cues – OT/SLP Feeding referral, if not already consulted (Repeated scores of 3-6 after 2 attempts)

\*\*\*(Shaker, 2013; Surenus, 2013)

*Figure K3. Cue based feeding algorithm.*



## **Appendix L**

### **STAFF CUE BASED FEEDING TRAINING MODULE**

An education module was created to instruct staff on cue based feeding tenets, review the cue based feeding protocol and guidelines for implementation, and complete scoring practice. The module included information from the formalized Infant Driven Feeding Program (Ludwig & Waitzman, 2014). The module was also personalized for our unit to include information garnered from the pre-knowledge survey and the focus group feedback, to ensure we targeted specific information our staff identified as areas of weakness. All staff including RNs, care technicians, neonatologists, nurse practitioners, and residents participated in the education sessions.

Over 25 sessions were held across shifts. Each session was forty-five minutes to one hour long depending on discussion and questions. Sessions were led by OTs, SLPs, and trained RNs. Rationale for movement to a cue based feeding program was reviewed. Expected outcomes of the new protocol were also discussed including feeding initiation consistency, focus on feeding quality, and consistent methods across caregivers. A description of cue based feeding was reviewed including the highlighting of vital IDF components including supporting development, unifying a team, changing the culture, and creating experiences (Ludwig & Waitzman, 2014). The UMMC protocol and guidelines were then reviewed, including how to initiate cue based feeding and a review of scoring feeding readiness and quality.

Video scoring practice of feeding readiness and feeding quality provided staff opportunity to practice and ensure scoring consistency and accuracy. The sessions also

included time to review caregiver supportive techniques via video examples and specific scenarios regarding utilization of particular techniques. Videos of infant stress cues included in the training demonstrated what caregivers should look for especially concerning more subtle stress cues. Handouts were provided to staff to reference and a copy of the education modules are accessible on the staff intranet page.



UNIVERSITY of MARYLAND  
MEDICAL CENTER

*Cue Based and Infant Driven®  
Feeding*  
IMPLEMENTING A STANDARD APPROACH TO  
FEEDING AT UMMC NICU

*Objectives*

- Review Cue Based and Infant Driven® Feeding program tenets
- Provide practice for scoring the Infant Driven® Feeding Scales
- Provide practice for feeding modifications and techniques through infant dolls and demonstration
- Provide universal language for each team member to use for education with the family and staff members
- Answer any questions you may have regarding Cue Based feeding

UMM\_Opt1-PPTa-01

*Why are we here?*


- Standardize feeding practices on our unit
- Promote utilization of developmentally supportive care
- Support infants in development of age appropriate feeding skills across caregivers
- Standardized care will promote consistent feeding practices across caregivers to help infants learn in a supportive environment

*Expected Outcomes*

- Feeding initiation consistency
- Success = quality
- Consistent methods across caregivers
- Consistent documentation

*What is Cue Based Feeding?*

- Utilizes each infant's developmental level to guide decisions
- Importance of behavioral cues to guide feedings
- Constant observation and modification throughout feeding



*What is Cue Based Feeding?*

- Support developmental feeding practices
- Goal = engagement in feeding without stress
- Intake will improve with development and skill level




Figure L1. Powerpoint education module

### Infant Driven® Feeding Components

- Support Development
- Unify Team
- Change Culture
- Create Experiences
- Establish Systems
- Strategize Interventions
- Sustain Progress

Ludwig and Whistman (2007)

### Infant Driven® Feeding Components

#### Supporting Development

- Acquisition of feeding skills is a process
- Allowing infant to communicate through signals supports their development
- Feeding starts long before first breast/bottle introduction
- Early experiences = long term success
- Support of all sensory systems

### Infant Driven® Feeding Components

#### Unify Team – It takes a Village

- Everyone has a role
- Discuss and communicate openly
- Discuss quality versus quantity

### Infant Driven® Feeding Components

#### Changing the Culture

- Remember reason!
- Active participation by infant
- Let go of old ways
- Change mindset



### Infant Driven® Feeding Components

#### Create Experiences

- Set up infants for success
- Assess at EACH care
- Make each feeding safe, functional, and nurturing

Nutrition is Primary.  
The means by which an infant eats is secondary.



Cue Based Feeding at UMMC

### Cue Based Feeding Implementation

**Who?**  
All infants >33 weeks PMA

**How?**

Score the infant during EACH care time and document using the EPIC Flowchart

Pre-feeding orders: If infant scores a 1 or 2 for readiness over 50% of care times in 24 hours, ask for an order for infant-driven/structure based feeding.

Post-feeding orders: If infant scores a 1 or 2 for readiness at care times, infant may be offered breast or bottle during feeding.

If NOT scoring 1 or 2, infant to be given feed and continue to support pre-feeding activities, i.e. skin-to-skin, offering drops of breastmilk or formula on pacifier as appropriate during side feeds.

**When?**

- Begin to assess feeding cues when:
  - stable respiratory status (<3L NC, RR <70)
  - tolerating full volume enteral feeds
  - able to suck on pacifier for 1 minute with appropriate suck-swallow pattern
- Assess at EACH care once scoring initiated

Infant-Driven Feeding System (IDFS) - Readiness	Score	Description
1	1	Observation: Active but quiet awake. Breathing and/or hands towards breast/bottle. Good tone.
2	2	Observation: Active and/or hands towards breast/bottle. Good tone.
3	3	Observation: Active and/or hands towards breast/bottle. Good tone.
4	4	Observation: Active and/or hands towards breast/bottle. Good tone.
5	5	Observation: Active and/or hands towards breast/bottle. Good tone.
6	6	Observation: Active and/or hands towards breast/bottle. Good tone.
7	7	Observation: Active and/or hands towards breast/bottle. Good tone.
8	8	Observation: Active and/or hands towards breast/bottle. Good tone.
9	9	Observation: Active and/or hands towards breast/bottle. Good tone.
10	10	Observation: Active and/or hands towards breast/bottle. Good tone.

### Completing a Feeding

**Score QUALITY of the feeding**

- When to stop a feeding:
  - Quality of Nipple Suck = 4/5
  - Infant demonstrates any backspasms or GI discomfort that is not a "gasp" and quickly self-resolving.
  - If feeding breakdown score no longer = 3 or 2 (after decreasing drive cues)
  - Significant change in vital signs
  - If demonstrating other physiologic or behavioral cues, including but not limited to: eye rolling, frowning, grimacing, arching, noisy agitated, crying, gagging, poor suck, multiple spit-ups, playing with milk, multiple spit-ups, playing with milk.

Document CAREGIVER TECHNIQUES used during the feeding

Contact OTISLP team for feeding assessment if infants are demonstrating difficulty with feedings and score above a 3 for repeated feedings.

Infant-Driven Feeding System (IDFS) - Quality	Score	Description
1	1	Infant with strong, coordinated suck throughout entire feed.
2	2	Infant with strong, coordinated suck initially, but begins to play with pacifier.
3	3	Infant with strong, coordinated suck initially, but begins to play with pacifier.
4	4	Infant with weak/intermittent suck. Significant change in HR, RR, O2, work of breathing, or other parameters or clearly weak suck during feeding.
5	5	Infant with weak/intermittent suck. Significant change in HR, RR, O2, work of breathing, or other parameters or clearly weak suck during feeding.

Infant-Driven Feeding System (IDFS) - Caregiver Techniques	Score	Description
1	1	Side-lying Position
2	2	External Pacing
3	3	Adding or increasing O2
4	4	Imposed Breaks
5	5	Stim for Recovery from A/Ts during feed
6	6	Frequent Burping
7	7	Alternative Nipple
8	8	Other

### Caregiver Supportive Techniques

- Side-lying Position
- External Pacing
- Adding or Increasing O2
- Imposed Breaks



### Caregiver Supportive Techniques

- Stimulation for Recovery
- Frequent burping
- Alternative Nipple



### Ready for Oral Feeding

Behaviorally ready for an oral feeding



### Stability During Feeding



## **Appendix M**

### **STAFF IMPLEMENTATION RESOURCES**

Staff resources were also created to assist staff in successful program implementation. A cue based feeding reminder sheet was constructed to review who to score, when to score, and how to score infants in the cue based feeding program. A handout reviewing feeding readiness and stress cues, utilizing a traffic light analogy, was created to assist staff and parents in recognizing when an infant is ready to feed, and when a feeding may need to stop. A cue based feeding information sheet provides a brief review of oral feeding development, current evidence based literature with research outcomes, scoring tools, and a sample list of infant stress cues. Two varieties of this document were created, including one for staff, and one for parents.

A feeding strategy sign was also implemented in each infant's room to communicate to staff supportive strategies helpful for that infant. A rounding script was developed to help support staff in sharing feeding readiness and quality information during medical rounds. Signs including the feeding readiness and quality scores were also posted at each RN documentation station to ensure accuracy in score assignment and documentation. These resources were created to help staff with successful program implementation. All resources were included in the cue based feeding handbook provided at each nurses' documentation station throughout the unit. Pictures or copies are included here for reference.

## Cue Based Feeding Reminder Sheet

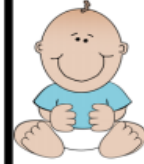
- **WHO to Score**
  - All infants >33 weeks CGA
- **WHEN to SCORE**
  - Begin to assess feeding cues when:
    - Respiratory status is stable (no high flow O2, 3L or less NC, RR <70).
    - Order for full volume enteral feeds over 30 minutes.
    - Able to suck on pacifier for 1 minute without distress.
  - Assess at **each** care once scoring initiated.
- **HOW to Score**
  - Score the infant during **each** care time and document using the *EPIC Flowsheet*.
  - Pre-feeding orders: If infant scores a 1 or 2 for readiness **over 50% of care times** in 24 hours, ask for an order for “**Cue Based Feeding**”.
  - Post feeding orders:
    - If the infant scores a **1 or 2** for readiness at the care time, infant may be offered a breast or bottle feeding per the prescribed volume.
    - If the infant scores a **3-5** for readiness at the care time, the infant should be gavage fed and RN may continue to support pre-feeding activities, i.e. skin-to-skin, non-nutritive sucking, etc.
- Score **QUALITY** of the feeding and document in the *EPIC Flowsheet*.
  - **WHEN TO STOP a feeding:**
    - Quality of Nippling Score = 4/5.
    - If infant demonstrates any bradycardia or O2 desaturation that is not quickly self-resolving.
    - If **Feeding Readiness Score** no longer = 1 or 2 (infant begins demonstrating stress cues).
    - Change in vital signs not resolved with caregiver techniques.
    - If infant demonstrates other physiologic or behavioral stress cues, including (but not limited to): eye rolling, eyebrow furrowing, head bobbing, nasal flaring, finger splay, salute, fatigue, poor suck, multiple swallows, or gulping.
- Document **CAREGIVER TECHNIQUES** utilized during the feeding.
- Contact OT/SLP team for feeding assessment if infants are demonstrating difficulty with feedings and score above a 2 for greater than 2 feedings.

*Figure M1.* Cue Based Feeding Reminder Sheet

## Cue Based Feeding in the NICU

### Oral Feeding Development

- Learning to eat is a complex process involving the coordination of multiple subsystems
- Most complex process the infant will learn, due to the need to integrate these subsystems, and develop the motor coordination required for sucking, swallowing, and breathing coordination (Bertoncelli, et al., 2012)
- Reliant on neurodevelopment, maturation, and ability to maintain physiological stability
- Co-dependent on behavioral state, all while sucking, swallowing, and breathing, in a carefully timed manner, to prevent adverse events (McGrath & Braesch, 2004)
- Additionally influenced by environmental factors and caregiver actions (Jones, 2012)



### Cue-Based Feeding

- Utilizes each infant's developmental level and maturity to guide decisions before, during, and after feedings
- Infant observed in the moment
- Continuously modify the approach through individual interventions to support the infant's stability

#### Research outcomes:

- Decreases the amount of time between first oral feed and full oral feeds
- Provides consistency in feeding practices
- Increases confidence among caregivers
- Lowers healthcare cost
  - Decreases length of stay
  - Improved resource utilization

Infant-Driven Feeding Scales© (IDFS) - Quality	
Score	Description
1	Nipples with strong, coordinated suck throughout entire feed.
2	Nipples with a strong coordinated suck initially, but fatigues with progression.
3	Difficulty coordinating SSB despite consistent suck.
4	Nipples with weak/inconsistent SSB. Little to no rhythm.
5	Unable to coordinate SSB pattern. Significant change in HR, RR, O2, work of breathing outside safe parameters or clinically unsafe swallow during feeding.

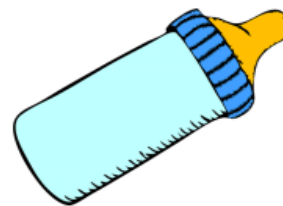
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### Infant-Driven Feeding Scales© (IDFS) - Readiness

Score		Description
Breast	B o t t l e	1 Alert or fussy prior to care. Rooting and/or hands to mouth behavior. Good tone.
		2 Alert once handled. Some rooting or takes pacifier. Adequate tone.
Gavage with skin to skin Or NNS		3 Briefly alert with care. No hunger cues. No change in tone.
		4 Sleeping throughout care. No hunger cues. No change in tone.
Gavage Only		5 Significant change in HR, RR, O2, or work of breathing outside safe parameters.

### Infant Stress Cues

Disengagement	No active rooting or sucking Pulling off the nipple or turning head away Tongue thrusting Compression only sucking
Stress	Change in alertness level Change in tone/postural control Color change Respiratory distress or Tachypnea Nasal flaring Chin tugging Audible swallows Desaturation events, Apnea/Brady Spitting/Drooling, Gulping Multiple swallows Overt coughing/choking Gagging Hiccups Finger Splaying



J. Hood 2/28/18

Figure M2. Cue based feeding staff handout.



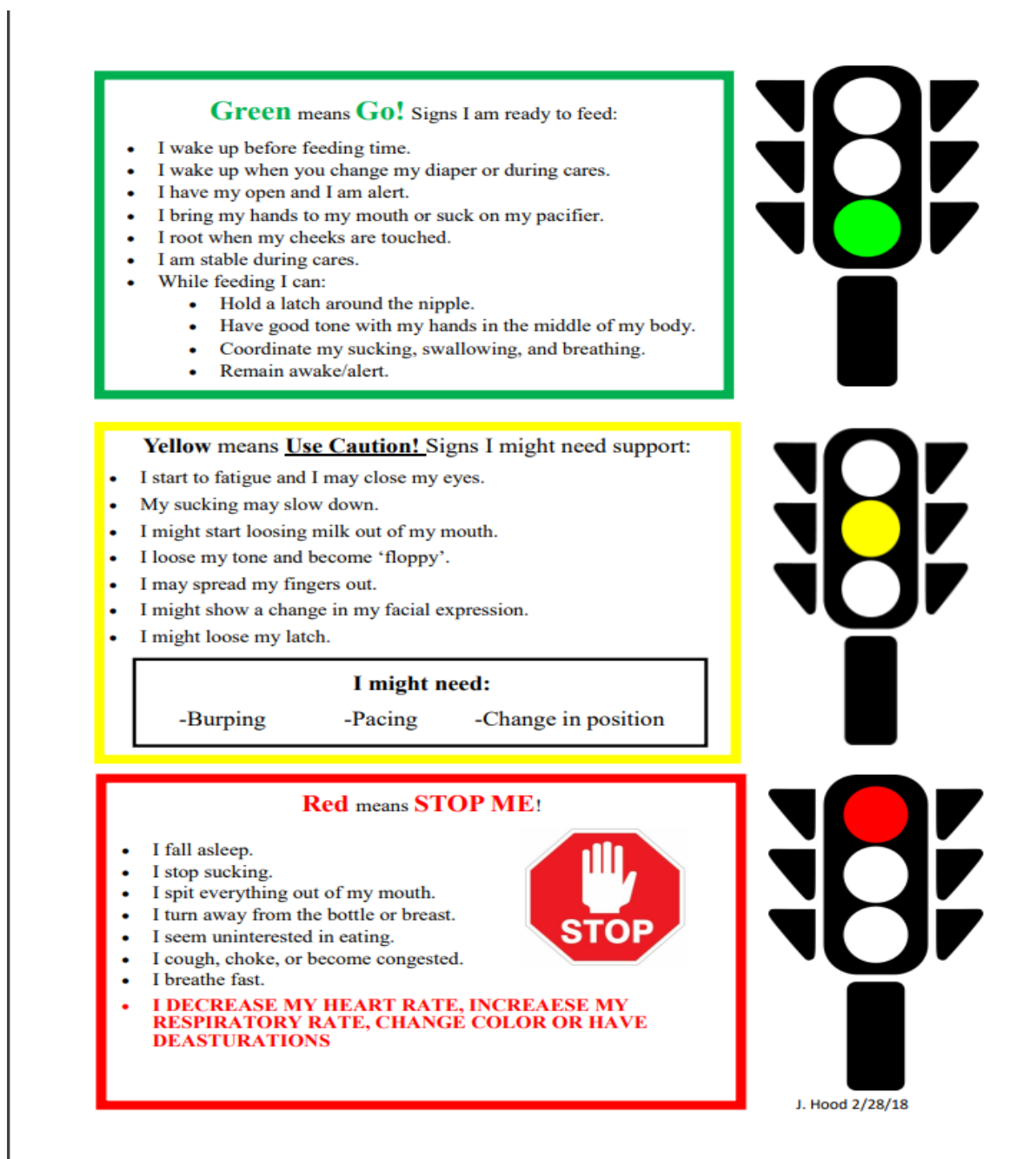


Figure M3. Traffic light feeding cue handout.

## Cue Based Feeding Go Live!

### WHO to Score

All infants > 33 weeks CGA

### WHEN to Score

1. Resp. status is stable (no high flow, 3L or less NC, RR <70)
2. Order for full volume enteral feeds over 30 minutes

**Assess at each care once scoring initiated**

### Infant-Driven Feeding Scales© (IDFS) - Quality

Score	Description
1	Nipples with strong, coordinated suck throughout entire feed.
2	Nipples with a strong coordinated suck initially, but fatigues with progression.
3	Difficulty coordinating SSB despite consistent suck.
4	Nipples with weak/inconsistent SSB. Little to no rhythm.
5	Unable to coordinate SSB pattern. Significant change in HR, RR, O2, work of breathing outside safe parameters or clinically unsafe swallow during feeding.

### Infant Stress Cues

Disengagement	No active rooting or sucking Pulling off the nipple or turning head away Tongue thrusting Compression only sucking
Stress	Change in alertness level Change in tone/postural control Color change Respiratory distress or Tachypnea Nasal flaring Chin tugging Audible swallows Desaturation events, Apnea/Brady Spitting/Drooling, Gulping Multiple swallows Overt coughing/choking Gagging Hiccups Finger Splaying

### Infant-Driven Feeding Scales© (IDFS) - Readiness

Score	Description
Breast	1 Alert or fussy prior to care. Rooting and/or hands to mouth behavior. Good tone.
Bottle	2 Alert once handled. Some rooting or takes pacifier. Adequate tone.
Gavage with skin to skin Or NNS	3 Briefly alert with care. No hunger cues. No change in tone.
	4 Sleeping throughout care. No hunger cues. No change in tone.
Gavage Only	5 Significant change in HR, RR, O2, or work of breathing outside safe parameters.

### HOW to Score

1. Score appropriate infants during each care time and document in the EPIC Flowsheet
2. Pre-Feeding Order—if scores a 1 or 2 over 50% of cares in 24 hours, request **Cue Based Feeding Order**
3. Post Feeding Order—if scores a 1 or 2, offer feeding
  - \* If scores a 3-5 for readiness, gavage feed and offer other pre-feeding activities as appropriate.
4. If feeding offered, score Quality of feeding and document in the EPIC Flowsheet

When to stop a feeding:

- \* Quality score 4 or 5
- \* Significant brady or o2 desats
- \* Readiness score change
- \* Significant stress cues



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Figure M4. Cue based feeding go live reminder sheet.

**Rounding Script Pre-Feeding**

This infant is greater than 33 weeks PCA however is not demonstrating cues more than 50% of feeds. It is not appropriate yet to begin cue based feeding and gavage feeding should continue.

This infant is now greater than 33 weeks PCA and is demonstrating cues more than 50% of cares. It would be appropriate to initiate cue based feeding for this infant given their PCA and stability.

**Rounding Script Once Feeding**

This infant demonstrated an average readiness score of \_\_\_\_\_ over the last 24 hours. The infant demonstrated an average feeding quality score of \_\_\_\_\_ over the last 24 hours. The infant demonstrated cues and attempted PO feeding in \_\_\_\_ out of 8 opportunities. The infant required total gavage in \_\_\_\_ out of 8 feeds. The infant required partial gavage in \_\_\_\_ out of 8 feeds. Total PO intake was \_\_\_\_\_ ml.

\*\*\* If an infant has scored above a 2 for more than two feedings, recommend an OT/SLP consult for oral feeding support

*Figure M5. Rounding script.*

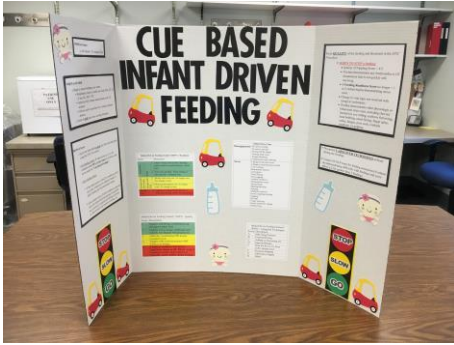


Figure M6. Staff lounge display.

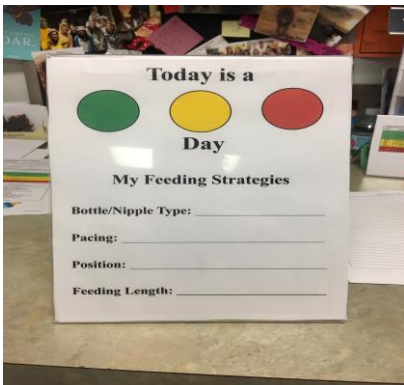


Figure M7. Feeding strategy room sign.

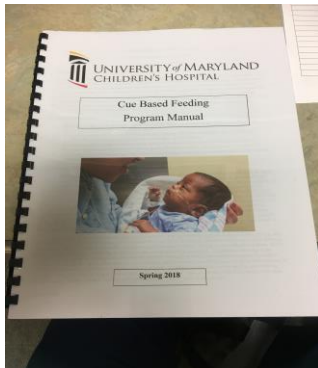


Figure M8. Cue based feeding handbook

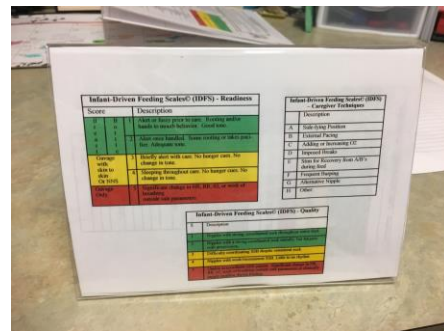


Figure M9. RN station sign.

## Appendix N

### UNIT POSTER DISPLAY

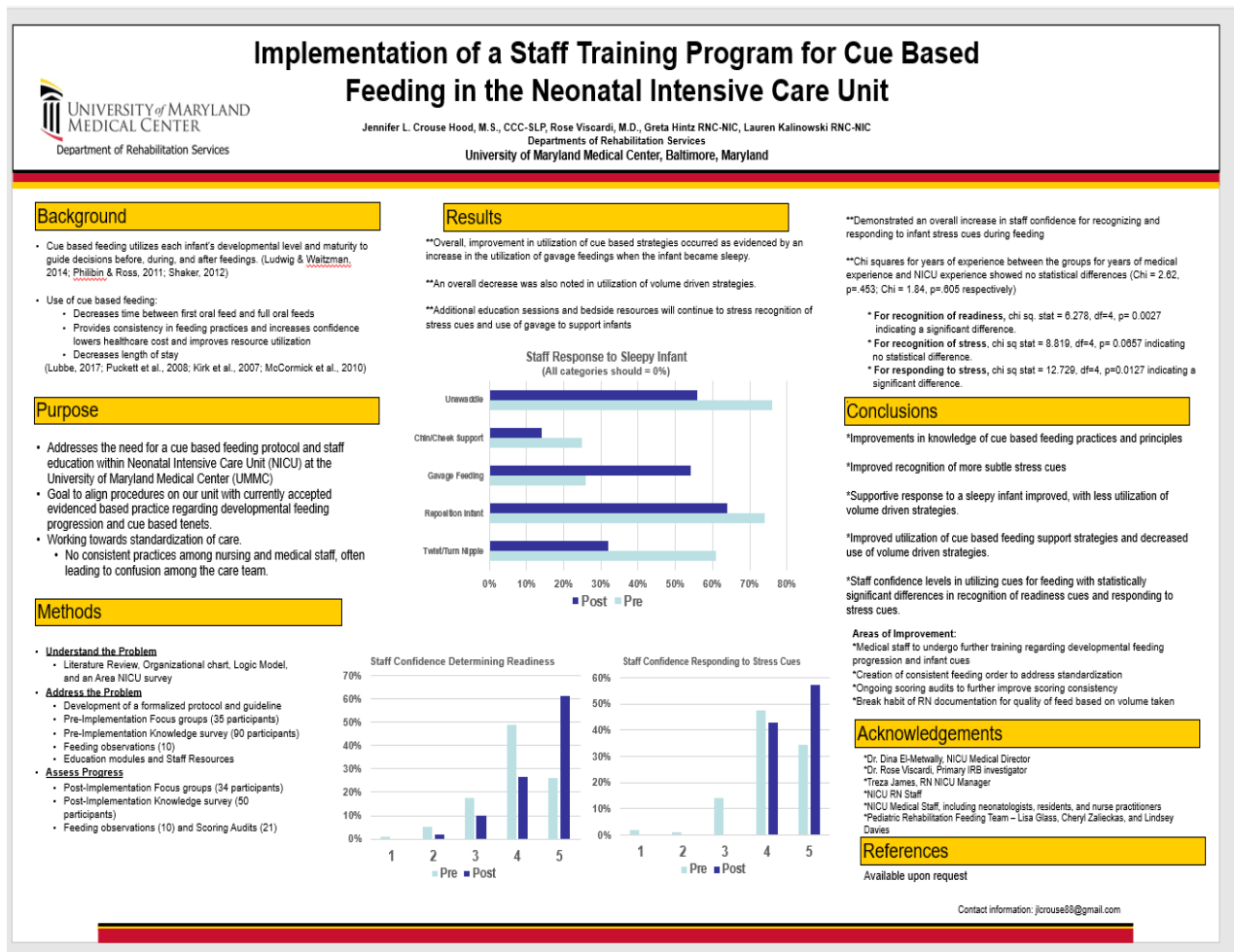


Figure N1. Unit poster regarding cue based feeding project results.

## Appendix O

### IRB APPROVAL LETTER

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RESEARCH OFFICE

210 Halliher Hall  
University of Delaware  
Newark, Delaware 19716-1551  
Ph: 302/831-2136  
Fax: 302/831-2828

DATE: February 21, 2018

TO: Jennifer Crouse Hood, M.S.  
FROM: University of Delaware IRB

STUDY TITLE: [1186007-1] Assessing Cue Based Feeding Staff Training Program Development

SUBMISSION TYPE: New Project

ACTION: Administrative Review  
APPROVAL DATE: February 20, 2018  
EXPIRATION DATE: February 12, 2019  
REVIEW TYPE: Administrative Review - University of Maryland, Baltimore ~~will~~ be the IRB of record for this project.

Thank you for your submission of New Project materials for this research study.

The University of Delaware IRB will rely on the The University of Maryland Baltimore's IRB for review and regulatory oversight for this project.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

Please note that all research records must be retained for a minimum of three years.

Based on the risks, this project requires Continuing Review by this office on an annual basis. Please use the appropriate renewal forms for this procedure.

If you have any questions, please contact Nicole Farnese-McFarlane at (302) 831-1119 or [nicolefm@udel.edu](mailto:nicolefm@udel.edu). Please include your study title and reference number in all correspondence with this office.