

St. Catherine University

SOPHIA

Doctor of Occupational Therapy Doctoral
Projects

Occupational Therapy

8-2022

Promoting Pre-Feeding Skills: Development and Implementation of an Oral Motor Protocol and Clinical Guidelines in a Level IV NICU

Joy Berthelsen
St. Catherine University

Follow this and additional works at: https://sophia.stkate.edu/otd_projects

Recommended Citation

Berthelsen, Joy. (2022). Promoting Pre-Feeding Skills: Development and Implementation of an Oral Motor Protocol and Clinical Guidelines in a Level IV NICU. Retrieved from Sophia, the St. Catherine University repository website: https://sophia.stkate.edu/otd_projects/51

This Doctoral Project is brought to you for free and open access by the Occupational Therapy at SOPHIA. It has been accepted for inclusion in Doctor of Occupational Therapy Doctoral Projects by an authorized administrator of SOPHIA. For more information, please contact sagray@stkate.edu.

Promoting Pre-Feeding Skills: Development and Implementation of an Oral Motor Protocol and
Clinical Guidelines in a Level IV NICU

Joy Berthelsen

St. Catherine University

Capstone Project completed in partial fulfillment of the Doctor of Occupational Therapy Degree

Faculty Advisor: Dr. Stephanie de Sam Lazaro

Capstone Mentor: Holly Schifsky

Table of Contents

Abstract.....	1
Background Literature	0
Oral Motor Interventions	1
Gaps in Knowledge.....	1
Purpose.....	2
Approach.....	3
Participants.....	4
Procedures.....	4
Evaluation Process	7
Outcomes	8
Follow-Up Survey.....	8
Quantitative Survey Results on Protocol and Guidelines.....	8
Qualitative Survey Results on Protocol and Guidelines.....	11
Tracking Sheet Outcomes	13
Case Study Development.....	14
Implications.....	14
References.....	19
Appendix A: Scoping Review	23
Appendix B: Doctoral Capstone Project Proposal Needs Assessment.....	47
Appendix C: Training Presentations.....	78

Appendix D: Protocol Handouts.....	81
Appendix E: Clinical Guidelines	88
Appendix F: Nursing Guidelines	102
Appendix G: Education Presentation.....	105
Appendix H: Pre-Survey Questions.....	110
Appendix I: Focus Group Questions.....	115
Appendix J: Post-Survey Questions.....	116
Appendix K: Final Poster Presentation.....	119

Abstract

Intro: Oral feeding is often the last discharge criterion for preterm infants in the NICU and a leading cause of extended hospital stay. Preterm infants lack motor practice they would receive in utero when swallowing amniotic fluid and have underdeveloped physiological systems and oral structures, delaying feeding skills. Standardized pre-feeding oral motor protocols that include stimulation of oral structures and sucking on pacifiers have been shown to improve feeding efficiency, decrease transition time to full oral feeding, and decrease length of stay.

Purpose: The purpose of this doctoral capstone project was to update the clinical guidelines on oral motor interventions in the University of Minnesota Masonic Children's Hospital (UMMCH) NICU to improve the neurodevelopmental outcomes of premature infants by targeting oral motor skills through a new protocol to enhance breastfeeding and bottle feeding.

Approach: Following an extensive literature review on best oral motor practices, the occupational therapists participated in a survey and focus group, were trained to implement the new protocol, and completed a follow-up survey to assess the utility of the protocol and updated clinical guidelines. Infant oral motor outcomes were also analyzed.

Outcomes: All therapists reported feeling satisfied with the guidelines and confident in implementing the protocol and modifying it with intubated infants. Therapists also reported improved patient outcomes, including secretion management and swallowing, arousal levels, tolerance to stimulation and oral interest, and bottling skills. Short-term infant outcomes during the protocol include high percentages of good secretion management, activated swallowing, and latching to a pacifier.

Recommendations: UMMCH NICU should continue to implement the protocol with infants of appropriate gestational age, utilize the clinical guidelines to train new therapists, provide

additional training on the protocol as needed, continue quality improve cycle and adjust guidelines appropriately based on new evidence, provide parent education on protocol, and distribute modified nursing guidelines to further promote positive oral input for premature infants in the NICU.

Background Literature

Like all humans, feeding is a vital occupation for infants in the Neonatal Intensive Care Unit (NICU). Difficulty feeding is one of the leading causes for extended hospital stays in the NICU, as successful feeding by breast or by bottle is often a major criterion for discharge home (Fry et al., 2018; Tanta & Youngblood Langton, 2010). Poor feeding is also one of the leading reasons for readmission into the NICU within two weeks of discharge (Fry et al., 2018; Lubbe, 2018). Up to 80% of infants with developmental delays, including those born prematurely, experience oral feeding difficulties (Lau, 2015). Prolonged hospitalizations and high readmission rates from poor oral feeding lead to greater utilization of resources and financial and emotional burdens for families (Fry et al., 2018). Additionally, problems with feeding early on can lead to oral feeding issues over the long term, having harmful effects on health and quality of life (Hardy et al., 2018).

While an infant's ability to feed safely and competently is vital for infant health and their ability to discharge home, it is the most challenging and complex skill for premature infants in the NICU to master, as they often have underdeveloped cardiorespiratory systems, central nervous systems, and oral musculature (Fucile et al., 2002). Oral feeding requires the complex coordination of sucking, swallowing, and breathing. Sucking and swallowing typically mature at 32 weeks, but breathing may not fully integrate with sucking and swallowing until 34-42 weeks (Bache et al., 2013; Chen et al., 2021). Because preterm infants lack the oral motor practice that they would receive while in utero when swallowing amniotic fluid, they are often delayed in their oral feeding development and skills (Chen et al., 2021). Preterm infants often have poor oral motor control due to weaker muscle tone around the mouth, immature reflexes, and less sensitivity and strength in their tongue (Calk, 2019; Rodriguez Gonzalez et al., 2021).

Oral Motor Interventions

Interventions that promote oral motor development and feeding readiness are therefore crucial for premature infants in the NICU. Oral motor interventions, such as nonnutritive sucking and stimulation of oral muscles and structures on the face and in the mouth, have been shown to positively promote oral feeding. Facial muscles in the cheeks, under the chin, around the lips, and in the tongue play a coordinative role in the successful expelling of liquid out of the nipple, to the back of the mouth, and down the esophagus (Capilouto et al., 2021). Evidence reveals that oral motor stimulation can improve feeding efficiency, decrease transition time to full oral feeding, and decrease length of hospital stay (Tian et al., 2015; Younesian et al., 2015).

Gaps in Knowledge

While literature reveals the benefits of oral motor stimulation for premature infants, there is a lack of research on and implementation of standardized and structured oral motor therapy in NICUs, which can increase the variability of practice and be detrimental to providing the highest quality of care (Kish, 2014; Lessen, 2011). Many oral feeding interventions in the NICU are based on individual observations and clinical judgment instead of evidence, resulting in inconsistent processes and decisions (Kish, 2014). There is a need for greater education on evidence-based oral motor interventions, along with uniform training and protocols, in order to improve feeding outcomes, reduce length of stay, and promote greater infant health and quality of life. It is vital that neonatal professionals promote positive oral experiences on a consistent basis, as each new sensation promotes the development of new neuronal pathways in the brain (Lessen Knoll, 2019). A scoping review focused on identifying the current practices for educating NICU healthcare providers on feeding and oral motor interventions (Appendix A) illustrates the benefits of implementing quality improvement projects, including use of a Plan-

Do-Study-Act (PDSA) cycle to bring about consistent change in the NICU (Digal et al., 2020; Osborn & Jadcherla, 2022).

Additionally, there is a lack of research on oral motor interventions for premature infants on respiratory devices. While studies on standardized oral motor protocols have been done with premature infants as young as 26-28 weeks, many of them exclude infants who need respiratory support, including intubation, noninvasive positive pressure ventilation (NPPV), such as Continuous Positive Airway Pressure (CPAP), or High Flow Nasal Cannula (HFNC). Premature infants at this early stage of development often require support for their lungs by way of tubes and tapes on the lower face (Bache et al., 2013; Estep et al., 2008). One cannot disregard respiratory status during oral motor stimulation of facial structures, as respiratory support interfaces impact the type of stimulation and precautions to be aware of during intervention (Stumm et al., 2008). Providing oral motor interventions may be even more critical for this population, as respiratory devices can limit important sensory and motor experiences during a critical period of brain development and lead to more disorganized sucking and dysfunctional oral feeding (Stumm et al., 2008).

Purpose

The purpose of this doctoral capstone project was to update the occupational therapy clinical guidelines on oral motor interventions in the University of Minnesota Masonic Children's Hospital (UMMCH) NICU. The clinical guidelines were updated by completing a quality improvement project pilot study to test out a new oral motor protocol for premature infants, including infants on pulmonary support. This protocol is based on a thorough review of evidence on oral motor interventions in premature infants and the anatomy and physiology of oral feeding, as well as the unique patient care needs of the UMMCH NICU identified through a

needs assessment (Appendix B). This project aimed to address the question: How can an updated oral motor clinical guidelines and the integration of an evidence-based, standardized oral motor protocol in the UMMCH NICU impact therapists' patient care and premature infant outcomes?

Approach

The UMMCH NICU is a Level IV NICU that specializes in extremely premature and complex infants. It is an occupational therapist-only rehabilitation model, which means that the occupational therapists are the experts on feeding and oral motor interventions. With the increase in medical advances over the past several years, more premature infants as young as 22 weeks are surviving and requiring complex medical interventions and care in Level IV NICUs. One year prior to this quality improvement project, the UMMCH NICU had begun the shift toward a new respiratory interface called the NeoBar. This bar acts as a replacement for taping the face to secure the endotracheal tube in intubated infants and allows for easier access to facial structures and the mouth. This update in medical devices in the UMMCH NICU resulted in the opportunity to provide oral motor interventions for intubated infants. Therefore, an evidence-based oral motor stimulation protocol for premature infants, including intubated infants, was indicated to provide safe, developmentally appropriate care. Additionally, the UMMCH NICU required a general update to their written oral motor clinical guidelines for premature infants, including assessment and intervention, an updated stimulation protocol, pacifier use guidelines, and milk drop and oral immune therapy guidelines.

Institutional Review Board (IRB) approval was requested and received from St. Catherine University. The IRB approved this project as a quality improvement project.

Participants

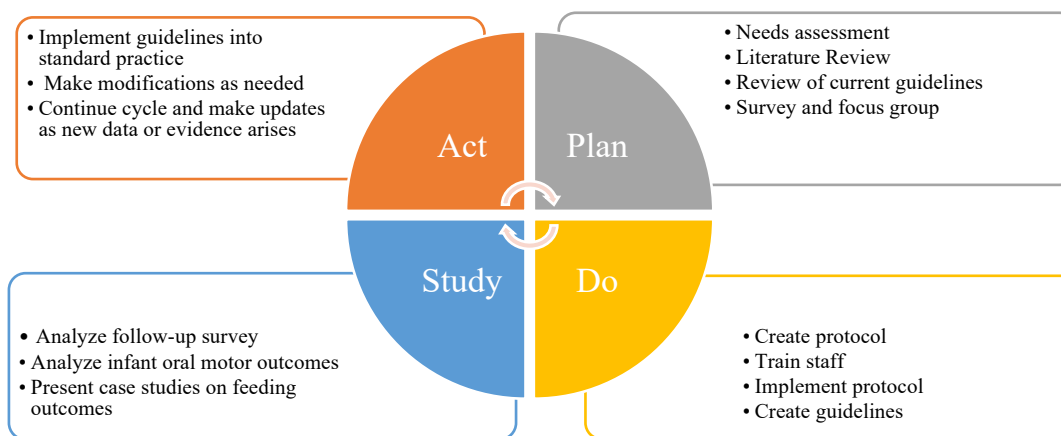
The occupational therapists in the UMMCH NICU participated in a survey and focus group to better understand the needs of the team, were trained to implement the new oral motor protocol in their clinical care, and completed a follow-up survey to assess the utility of the protocol and updated guidelines.

Procedures

Several deliverables were created to support the implementation of the quality improvement project in the UMMCH NICU using the Plan-Do-Study-Act Cycle (See Figure 1). The materials developed during the various steps of the cycle included training presentations (See Appendix C), handouts on the protocol overview and steps in the protocol (See Appendix D), updated oral motor clinical guidelines (See Appendix E), nursing oral motor and milk drop guidelines (Appendix F), and a final educational presentation (See Appendix G).

Figure 1

Plan-Do-Study-Act Cycle of Quality Improvement



Note. Information on quality improvement project activities that occurred in each of the four steps in the Plan-Do-Study-Act quality improvement process cycle for this project.

The deliverables were developed through a rigorous literature review of evidence-based practice and in collaboration with the capstone student's site mentor, and other occupational therapists in the UMMCH NICU. The literature review included information on feeding and oral motor interventions, current oral motor stimulation protocols, oral immune therapy, pacifier use, quality improvement development, clinical guideline development, and training teams in the NICU. Additionally, a review of the current UMMCH NICU feeding and oral motor guidelines was done to have a thorough understanding of the current practices and areas of need.

Prior to the creation of the deliverables, a survey (Appendix H) was disseminated and a focus group (Appendix I) were completed with UMMCH NICU occupational therapists to better gauge the current state and understanding of oral motor interventions in the UMMCH NICU. Twelve therapists completed the survey and six therapists participated in the focus group. Both the survey and focus group addressed the types of assessments and oral motor interventions therapists were currently providing, frequency of interventions, opinions on the importance of the interventions, barriers to providing the interventions, comfort level in performing interventions, and training on interventions. Descriptive categorical analysis and thematic analysis of the survey and focus group data were utilized to identify areas of need and next steps for training.

Following the literature review, focus group, and survey, an updated oral motor stimulation protocol was developed in collaboration with the capstone student's mentor. The stimulation techniques were based on previous evidence-based oral motor protocols and assessments for infants, including the Beckman Oral Motor Protocol, Premature Infant Oral Motor Intervention (PIOMI), Fucile protocol, and Neonatal Oral Motor Assessment Screen (NOMAS) (Fucile et al., 2022; Chen et al., 2021; Lesson, 2011; Lessen Knoll et al., 2019;

Rodriguez Gonzalez et al., 2021; Younesian et al., 2015). The protocol was developed after a thorough review of these evidence-based protocols and identification of the unique needs of the UMMCH NICU, including the current level of oral motor intervention provided and complexity of the infants in a Level IV NICU. The protocol consisted of manual stimulation techniques of five major areas of the face and mouth, including the temporomandibular joint, cheeks, lips, gumline, and hard palate, followed by non-nutritive sucking on a pacifier. The inclusion criteria for the protocol consisted of premature infants ages 26-32 weeks gestational age with any respiratory interface, as the protocol could be modified to include only perioral stimulation for intubated infants. See Appendices C and D for handouts and presentation materials on the protocol.

Following the development of all of the materials, the following procedures occurred. First, two training presentations were delivered to the occupational therapists before implementing the updated protocol. The first training presentation included overview of the protocol, including evidence supporting it, the muscles and areas of the face being stimulated, the rationale behind each technique, how to perform each technique, and next steps in the quality improvement project. The second in-service presentation was specific to pacifier use for premature infants receiving the protocol. The presentation included information on the benefits of pacifier use in the NICU, pacifier properties, and the use of different kinds of pacifiers for premature infants based on age, respiratory support, and mouth structure. Handouts on the updated protocol and each oral stimulation technique were provided to the occupational therapists as well. During the piloting of the protocol, occupational therapists completed the typical documentation on oral motor interventions with additional documentation noting the protocol was completed. Therapists also completed an additional simple checklist each time an

infant received the protocol to examine variables that may impact the protocol, such as respiratory interface, or oral motor skill outcomes variables, such as swallowing activation and latching to a pacifier.

The final deliverables were developed and disseminated following the implementation of the updated protocol in clinical care for six weeks. The final activities included sharing the updated clinical guidelines (Appendix E) and nursing guidelines (Appendix F), and then delivering an educational presentation (Appendix G) to the occupational therapists on the full quality improvement process. The guidelines included an overview and rationale behind oral motor interventions, steps of assessment, and treatment interventions, including the updated protocol with precautions for infants with various types of respiratory interfaces, pacifier use, milk drops, and oral immune therapy. The educational presentation provided recommendations for UMMCH NICU to continue to increase the quality of care for premature infants and improve oral feeding outcomes based on outcomes of the quality improvement process.

Each deliverable was reviewed multiple times by the capstone student's mentor for accuracy of information and delivery. The final guideline and presentation were also reviewed and edited by the capstone student's faculty advisor.

Evaluation Process

A survey (Appendix J) was developed to evaluate the utility of the updated oral motor protocol and clinical guidelines. Questions addressed satisfaction with, understanding of, and comfort level in performing the protocol and using the clinical guidelines in practice. This survey was implemented following training and implementation of the protocol and dissemination of the final clinical guidelines.

Additionally, feeding outcomes of all premature infants participating in the protocol were compared to retrospective data of premature infants from 2018-2019 at UMMCH NICU who had not received the protocol. Due to the limited timeline of the project and the small sample of infants participating in the current oral motor protocol, full statistical analysis was not appropriate. Instead, a general comparison was done, including case study analyses, to identify themes and trends related to feeding outcomes in infants with the same birth gestational age and similar medical backgrounds, including time to first breast or bottle feed, transition time to infant driven feeding, and time to 100% oral feeding. Tracking sheet checklist data was also analyzed for short-term oral motor outcomes. Recommendations for ongoing analysis processes based on data available were provided to the UMMCH NICU team.

Outcomes

The outcomes of the project came from survey responses from UMMCCH NICU team members. Eight responses were received on the survey. In addition, outcomes of the tracking sheets used by clinicians and case study information shared with the team are included.

Follow-Up Survey

Eight occupational therapists from the University of Minnesota Level IV NICU participated in the follow-up survey. The survey questions addressed both the piloting of the protocol in the NICU and the updated clinical guidelines created for occupational therapy and nursing.

Quantitative Survey Results on Protocol and Guidelines

Therapists self-reported their attitudes after the training and implementation of the protocol in the NICU. When asked about whether they felt confident in implementing the oral motor protocol with infants, 62.5% of therapists responded strongly agree and 37.5% of

therapists responded agree. 75% of therapists strongly agreed and 25% of therapists agreed that the protocol improved their patient care. Out of the eight therapists that responded to the survey, three responded that they did not implement the protocol with intubated infants (not all therapists in the UMMCH NICU work with intubated infants). Out of the five therapists that implemented the protocol with intubated infants, four responded strongly agree and one responded agree that they feel comfortable modifying and providing the protocol with intubated infants. See Figure 2 for all responses to scale rating items on the survey.

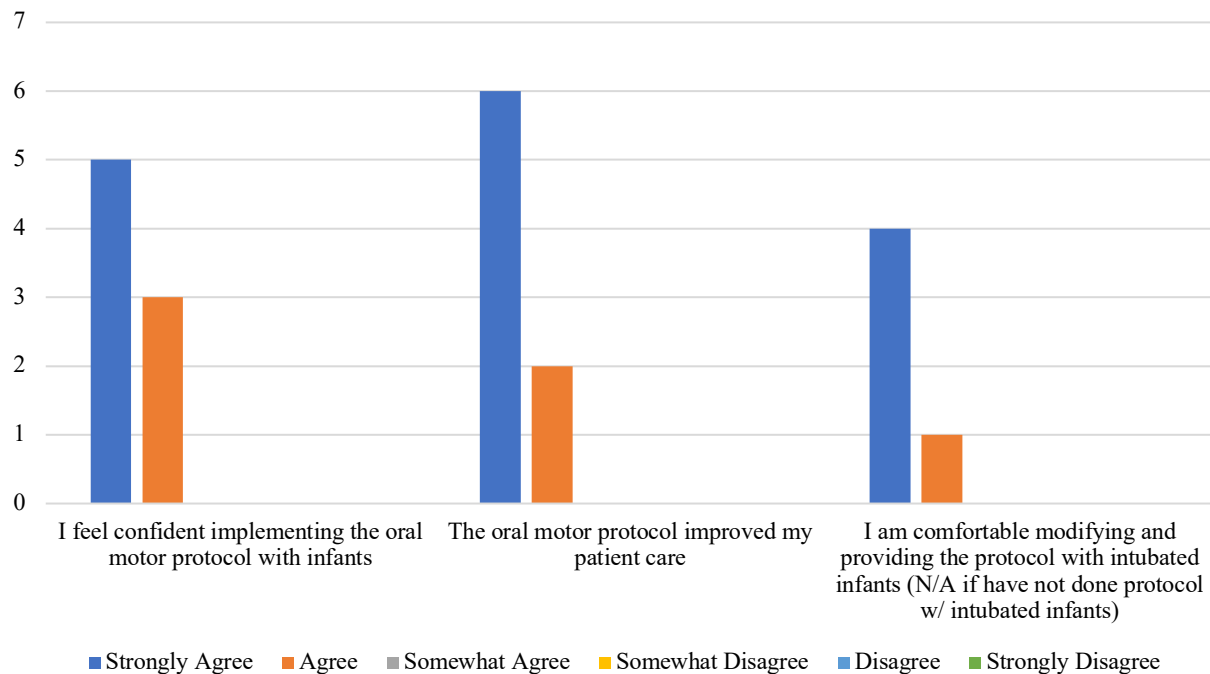


Figure 2

Occupational Therapy Attitudes Post-Protocol Implementation

Note. For the first two items the total $n=8$. For item 3 (protocol use with intubated babies) $n=5$ as three participants do not work with intubated babies.

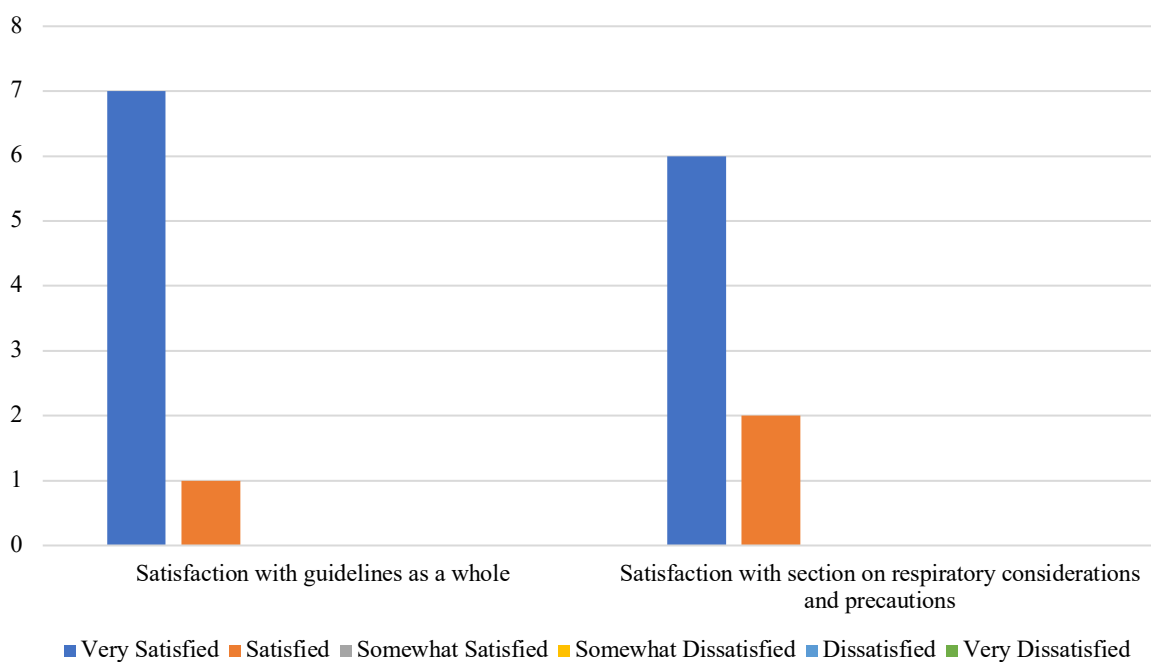
Therapists also reported their attitudes on the helpfulness of the training materials provided and the likelihood of them continuing to use the protocol with patients going forward. 75% of therapists found the training very helpful and 25% of therapists found the training

somewhat helpful. 88% of therapists reported that they would continue to implement the protocol in future patient care.

Therapists self-reported their attitudes about the updated occupational therapy oral motor clinical guidelines and the clinical oral motor nursing clinical guidelines. All therapists reported that they were very satisfied or satisfied with the guidelines as a whole and with the section of the guidelines that explain incorporating the protocol with infants with various respiratory interfaces (See Figure 3). All therapists also reported that they believed that the guidelines were strongly supported by evidence.

Figure 3

Satisfaction with Guidelines



Note. Satisfaction ratings from all 8 participants on two scaled items on the post-project survey related to the updated oral motor guidelines and protocol.

Qualitative Survey Results on Protocol and Guidelines

Therapists answered short answer questions pertaining to the impact of the protocol on patient outcomes and their own patient care and skills set. Short answer responses were analyzed for themes. Therapists reported that they noticed an improvement in secretion management and swallow activation, reduced need for oral suctioning, increased tolerance for oral motor stimulation, improved non-nutritive sucks skills, increased oral interest and hunger cues, improved initial bottling skills, and improved infant arousal. Additionally, therapists reported that the protocol resulted in more structured and focused therapy sessions, improved standardization of practice across clinicians, increased intervention time for younger and intubated infants, improved observation skills of infant behaviors, and increased family involvement (See Table 1 for examples of responses in each of the theme areas).

Table 1

Thematic Examples of Impact on Patient Outcomes and Patient Care and Skill Set

Themes	Quotes
Improved secretion management and swallowing	<p><i>“Improved swallow activation, reduced need for oral suctioning”</i></p> <p><i>“Improved oral secretion management”</i></p> <p><i>“...improved oral secretion management and swallow activations”</i></p>
Improved arousal	<p><i>“Earlier ability to provide therapeutic drops/tastes”</i></p> <p><i>“Increased arousal of infant after protocol for more social/bonding time with parents”</i></p> <p><i>“Improved arousal states overall with oral motor interventions”</i></p> <p><i>“My patients were more engaged in oral motor activities”</i></p>
Improved oral tolerance and interest	<p><i>“Increased tolerance for oral motor stim in infants <30wks with increased cueing as days progressed”</i></p> <p><i>“Improved oral interest less oral disinterest observed”</i></p>
Improved bottling skills	<p><i>“Improved SSB physiology upon initiation of bottling”</i></p> <p><i>“Improved initial bottling skills”</i></p>
More structured session/intervention	<p><i>“It gave me a more structured session with oral motor facilitation”</i></p> <p><i>“Allowed for more focused oral motor intervention”</i></p>

	<i>“It also provided a more intentional methodical approach for oral motor intervention”</i>
	<i>“Implementing this protocol positively affected my own skill set, by providing me with a structured checklist that assisted me in consistent progression”</i>
Standardization of practice	<i>“Encouraged me to focus on more systematic application of oral motor intervention with infants and advanced my observation skills of infant responses”</i>
	<i>“Better standardized implementation across various populations, improved standardized techniques facilitating oral motor work with improved progression for PMAs”</i>
	<i>“Provided me with evidence based information to guide my practice”</i>
Increased intervention time for younger and intubated infants	<i>“Allowed me to start working on oral motor skills with intubated infants in a safe and developmentally appropriate manner”</i>
	<i>“It provided a specific treatment strategy to implement with younger babies and brought to mind the use of EBM to promote swallow and engagement at a younger gestational age”</i>
Observation skills of infant behaviors	<i>“Advanced my observation skills of infant responses”</i>
Family involvement	<i>“Helped my ability to explain oral motor structures and exercises to the family unit”</i>
	<i>“Increased parent engagement in developmental sessions”</i>

Note: Seven therapists responded to the short-answer question on patient outcomes and eight therapists responded to the short answer question on patient care and skill set

Therapists provided short answer responses on modifications or improvements they would make to the occupational therapy clinical guidelines and nursing guidelines. Therapist responses included incorporating guidelines for reintegrating the protocol when infants begin oral feeding but go NPO (nothing by mouth) or backslide in their progress, additional clarification on drops of milk for intubated infants, and additional information in the nursing guidelines on pacifier selection.

Therapists also offered their thoughts on additional training they would like in the future, including additional training for working with intubated infants, offering drops of milk, parent

education, and incorporating the protocol with infants who have orofacial anomalies, and advancing to support implementation of manual edema mobilization (See Table 2).

Table 2

Additional Training Recommendations

Theme	Quote
Intubated infants	<i>“Integration for infants with H-taping”</i>
Milk drops	<i>“More training with protocol for infants who are intubated”</i> <i>“Would like to hear more about specifics of offering drops/tastes to intubated infants”</i>
Parent teaching	<i>“I think teaching parents could potentially be helpful”</i>
Orofacial anomalies	<i>“I would like to learn more about how to incorporate with orofacial anomalies if possible!”</i>
Advancing protocol	<i>“More regarding advancement (at what point would you recommend moving from sidelying to upright, therapeutic tastes OOB, etc)”</i> <i>“Facial MEM advanced skill to support implementation of advancing oral motor interventions, both intubated and non-intubated patients”</i>

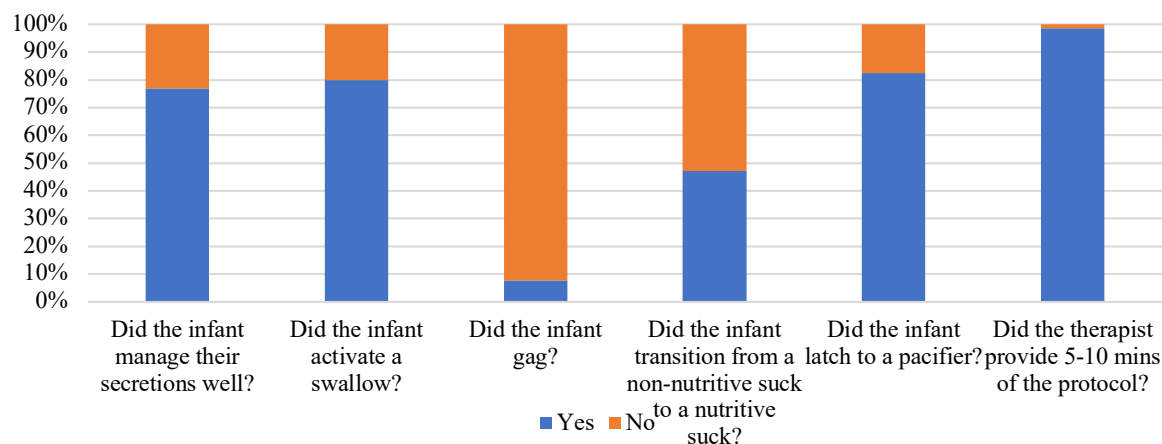
Note. Six therapists responded to this short-answer question.

Tracking Sheet Outcomes

Each time the protocol was implemented, therapists used a tracking sheet to record variables that may impact the implementation of the protocol and oral motor skills outcomes. The protocol was implemented 272 times with 15 different infants. Key outcomes include: 1) 76.8% of the time infants managed their secretions well during the protocol; 2) 79.8% of the time infants activated a swallow during the protocol; and 3) 82.4% of the time infants latched to a pacifier during the protocol for non-nutritive sucking. See Figure 4 for short-term outcomes as a result of the protocol based on tracking sheet items.

Figure 4

Short-term Infant Outcomes During Protocol



Note. For all items, $n=272$.

Case Study Development

One final outcome of the data tracking process was the creation and presentation of two case study examples comparing infants who participated in the protocol to those who did not and were of similar gestational ages at birth and similar presentations (intubated versus non-intubated). General outcomes indicated that those on the protocol transitioned to oral feedings sooner, transitioned to 100% oral feedings sooner, and discharged from the NICU earlier than those who did not receive the protocol. Data sets are too small and short at this time to examine for long term or generalizable impacts, however, recommendations based on this preliminary information have been shared with UMMCH NICU team and later in this manuscript. See Appendix G for case study information presented in the final education presentation to the UMMCH NICU team.

Implications

Prior to implementation of the oral motor protocol, there was not a structured or standardized method for therapists to complete oral motor interventions with premature infants in the UMMCH NICU. Additionally, there was not a standard of care on oral motor interventions for infants who were intubated, so intubated infants did not receive any oral motor interventions

until extubation, which may not be for several weeks or months after birth. The implementation of this protocol and the creation of clinical guidelines provided the therapists with more evidence-based, focused approaches to oral motor therapy for premature infants and created more consistent interventions across therapists to support best practices in neuroprotective care. The modification of the protocol for infants on various invasive and non-invasive respiratory supports and inclusion of considerations and precautions for these infants in the clinical guidelines provided therapists with greater opportunities to complete safe and developmentally appropriate oral motor stimulation for all premature infants.

The most valuable aspect of this project was the ability to see the oral motor outcomes associated with this author's provision of the protocol with infants. Other therapists completing the protocol also noted these changes in their patient care. While the protocol's positive impact on standardization of care and therapist skill was evident and important, it was vital that this change in patient care was reflected in the infant's daily skills and occupations. Infants demonstrated greater secretion management, swallow activation, arousal to bond with parents, suck-swallow-breathe coordination, and initial bottling skills. The largest challenge of the project was ensuring accurate uptake of the protocol by all therapists, as not all therapists worked the same days that training occurred. However, this author was able to provide additional training as needed on a group and individual basis, which further supported their learning and improved standardization across therapists.

Recent literature on oral motor interventions in the NICU, particularly concerning interventions with intubated infants, is limited. Additional research in the area of oral motor interventions is needed to continue improvement of standardized oral motor protocols and ensure best practices to support oral feeding skills. With the challenges of access and availability of

recent literature, it is recommended that sites spend the time reviewing additional areas of literature that may support uptake of changes. For example, literature on facial muscle activation and the muscles required for oral feeding as well as precautions to consider on various pulmonary supports supplemented the limited high-quality and recent literature on oral motor interventions. For future PSDA quality improvement cycles in the UMMCH NICU or other sites, a thorough review of relevant literature to support changes, involvement of all stakeholders through continuous training to ensure consistency and buy-in of all staff, and use of data to drive improvement is recommended. Quality improvement projects rely on real-time designing, testing, and implementation of a new approach with measurement of outcomes to ensure improvement. It is imperative that quality improvement initiatives are consistently monitored and adapted as needed based on new evidence or project outcome data. Additionally, as the initiatives show success, scaling the changes up and to other disciplines, such as the inclusion of nursing in oral motor interventions during care times, can allow for greater widespread adoption of changes and improved outcomes.

The following recommendations were provided to the UMMCH NICU therapists and leadership:

- Continue to implement the oral motor protocol in routine clinical care with premature infants of appropriate gestational age
- Utilize the updated occupational therapy oral motor clinical guidelines to train new therapists during onboarding
- Distribute nursing milk drop and perioral stimulation guidelines to nursing to promote more positive, purposeful, and developmentally appropriate oral cares for nursing to implement with infants during care times

- Provide additional training for therapists on the following:
 - Providing the protocol for intubated infants with H-Taping and modifications of the protocol for infants with orofacial anomalies
 - Offering milk drops for intubated infants
 - Providing parent teaching
 - Advancement of the protocol as an infant matures (e.g. positioning of the infant, therapeutic tastes out of bed)
 - Manual edema mobilization to support advancement of oral motor interventions
- Continue to follow the Plan-Do-Study-Act cycle for quality improvement, adjusting the occupational therapy clinical guidelines as appropriate based on new evidence or data gathered from the pilot study
 - Utilize provided data sheet and add infants of appropriate gestational age (26 weeks or above) that have not started orally feeding, as the protocol has been integrated as standard care for this population by all therapists at the UMMCH NICU
 - Continue to compare current feeding outcomes to retrospective group of infants of similar gestational ages, comparing averages in feeding outcomes, including weight gain, time to first nutritive breast or bottle feed, 100% oral feeding, and length of stay to further examine the effectiveness of the updated protocol and guidelines on patient outcomes.
- Create a simplified protocol handout for parent involvement at crib side with the potential for additional parent handouts from UC San Diego's Supporting Premature Infant Nutrition (SPIN) program to encourage parent involvement in oral motor interventions

and support their infant's pre-feeding and bottle-feeding skills (University of San Diego Health, 2020).

These recommendations will allow for increased opportunities for infants to receive positive sensory and motor oral input, even while intubated or on other forms of respiratory support. They will also provide more opportunities for interdisciplinary and parent involvement in supporting oral motor skills.

Occupational therapists' facilitation of successful oral feeding is vital in supporting infants in the NICU and their journey to discharging home. Oral feeding is challenging for premature infants and is one of the top reasons infants have increased length of stay in NICU. The provision of oral motor therapy during a critical period of neuroplasticity and development can better prepare premature infants to succeed at this complex occupation. Occupational therapists can provide oral motor interventions earlier and in a more structured, standardized, and developmentally appropriate manner to support better oral feeding skills and get infants home to their families sooner. See Appendix K for summary of the full capstone experience and project activities, outcomes, and implications that were disseminated to stakeholder audiences through a poster presentation.

References

- Bache, M., Pizon, E., Jacobs, J., Vaillant, M., & Lecomte, A. (2014). Effects of pre-feeding oral stimulation on oral feeding in preterm infants: A randomized clinical trial. *Early Human Development, 90*(3), 125-129. <http://dx.doi.org/10.1016/j.earlhumdev.2013.12.011>
- Calk, P. (2019). Best practices for oral motor stimulation to improve oral feeding in preterm infants: a systematic review. *Ann Physiother Occup Ther, 2*(5).
<https://doi.org/10.23880/aphot-16000143>
- Capilouto, G. J., Cunningham, T. J., Rembecki, R. R., & Wells, E. L. (2021). Real-time analyses of sucking waveforms to drive oral feeding practice and improve patient care outcomes. *International Journal of Nursing Health Care and Research, 4*, 1-7.
<https://doi.10.29011/2688-9501.101209>
- Chen, D., Yang, Z., Chen, C., & Wang, P. (2021). Effect of oral motor intervention on oral feeding in preterm infants: A systematic review and meta-analysis. *American Journal of Speech-Language Pathology, 30*(5), 2318-2328. https://doi.org/10.1044/2021_AJSLP-20-00322
- Digal, K. C., Upadhyay, J., Singh, P., Shubham, S., Grover, R., & Basu, S. (2021). Oral care with mother's own milk in sick and preterm neonates: a quality improvement initiative. *The Indian Journal of Pediatrics, 88*(1), 50-57. <https://doi.10.1007/s12098-020-03434-5>
- Estep, M., Barlow, S. M., Vantipalli, R., Finan, D., & Lee, J. (2008). Non-nutritive suck parameters in preterm infants with RDS. *Journal of Neonatal Nursing, 14*(1), 28-34.
<https://doi.org/10.1016/j.jnn.2007.12.005>

- Fry, T. J., Marfurt, S., & Wengier, S. (2018). Systematic review of quality improvement initiatives related to cue-based feeding in preterm infants. *Nursing for women's health*, 22(5), 401-410. <https://doi.org/10.1016/j.nwh.2018.07.006>
- Fucile, S., Gisel, E., & Lau, C. (2002). Oral stimulation accelerates the transition from tube to oral feeding in preterm infants. *The Journal of Pediatrics*, 141(2), 230-236. <https://doi.org/doi:10.1067/mpd.2002.125731>
- Hardy, C., Senese, J., & Fucile, S. (2018). Rehabilitation of infant oral feeding difficulties: a survey of occupational therapists practice approaches. *Occupational Therapy in Health Care*, 32(1), 14-27. <https://doi.org/10.1080/07380577.2017.1419398>
- Kish, M. Z. (2014). Improving preterm infant outcomes: implementing an evidence-based oral feeding advancement protocol in the neonatal intensive care unit. *Advances in Neonatal Care*, 14(5), 346-353. <https://doi.org/10.1097/ANC.0000000000000099>
- Lau, C. (2015). Development of suck and swallow mechanisms in infants. *Annals of Nutrition and Metabolism*, 66(Suppl. 5), 7-14. <https://doi.org/10.1159/000381361>
- Lessen, B. S. (2011). Effect of the premature infant oral motor intervention on feeding progression and length of stay in preterm infants. *Advances in Neonatal care*, 11(2), 129-139. <https://doi.org/0.1097/ANC.0b013e3182115a2a>
- Lessen Knoll, B. S., Daramas, T., & Drake, V. (2019). Randomized controlled trial of a prefeeding oral motor therapy and its effect on feeding improvement in a Thai NICU. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, 48(2), 176–188. <https://doi-org.pearl.stkate.edu/10.1016/j.jogn.2019.01.003>

Lubbe, W. (2018). Clinicians guide for cue-based transition to oral feeding in preterm infants: An easy-to-use clinical guide. *Journal of Evaluation in Clinical Practice*, 24(1), 80-88.

<https://doi.org/10.1111/jep.12721>

Osborn, E. K., & Jadcherla, S. R. (2022). Developing a quality improvement feeding program for NICU patients. *NeoReviews*, 23(1), e23-e35. <https://doi.org/10.1542/neo.23-1-e23>

Rodriguez Gonzalez, P., Perez-Cabezas, V., Chamorro-Moriana, G., Ruiz Molinero, C., Vazquez-Casares, A. M., & Gonzalez-Medina, G. (2021). Effectiveness of oral sensory-motor stimulation in premature infants in the neonatal intensive care unit (NICU) systematic review. *Children*, 8(9), 758. <https://doi.org/10.3390/children8090758>

Stumm, S. L., Barlow, S. M., Estep, M., Lee, J., Cannon, S., Carlson, J., & Finan, D. (2008). Respiratory distress syndrome degrades the fine structure of the non-nutritive suck in preterm infants. *Journal of Neonatal Nursing*, 14(1), 9-16.

<https://doi.org/10.1016/j.jnn.2007.11.001>

Tanta, K. J., & Youngblood Langton, S. (2010). NICU primer for occupational therapists: Exploring the needs of fragile infants, the context in which they are cared for, and the role of OT in this specialized practice area—part I of II. *Journal of Occupational Therapy, Schools, & Early Intervention*, 3(2), 179-186.

<https://doi.org/10.1080/19411243.2010.491020>

Tian, X., Yi, L. J., Zhang, L., Zhou, J. G., Ma, L., Ou, Y. X., ... & Song, G. M. (2015). Oral motor intervention improved the oral feeding in preterm infants: evidence based on a meta-analysis with trial sequential analysis. *Medicine*, 94(31).

<https://doi.org/10.1097/MD.0000000000001310>

University of San Diego Health. (2020). Supporting infant nutrition program (SPIN).

<https://health.ucsd.edu/for-health-care-professionals/pages/spin.aspx>

Younesian, S., Yadegari, F., & Soleimani, F. (2015). Impact of oral sensory motor stimulation on feeding performance, length of hospital stay, and weight gain of preterm infants in NICU.

Iranian Red Crescent Medical Journal, 17(7).

[https://doi.org/10.5812/ircmj.17\(5\)2015.13515](https://doi.org/10.5812/ircmj.17(5)2015.13515)

Appendix A: Scoping Review

Special Acknowledgement to Scoping Review Advisor: Hannah Oldenburg

Introduction

The neonatal intensive care unit (NICU) is a unique and specialized practice area for rehabilitation professionals and other healthcare providers due to the high-risk nature of the patients (Vergara et al., 2006). Infants in the NICU setting are physiologically fragile, and their health can be easily compromised by the environment and interactions with others (Vergara et al., 2006). NICU families must deal with uncertain outcomes, complex medical conditions, a highly technical and stimulating environment, separation, and maternal complications after birth (Vergara et al., 2006). Because of the complex and vulnerable nature of the NICU setting, occupational therapists and other rehabilitation professionals must have advanced training and expertise to safely and effectively care for their patients and families (National Association of Neonatal Therapists, 2014).

Like all humans, feeding is a vital occupation for infants in the NICU. Difficulty feeding is one of the leading causes for extended hospital stays in the NICU, as successful feeding, whether by breast or by bottle, is often a major criterion for discharge home (Fry et al., 2018; Tanta & Langton, 2010). Poor feeding is also one of the leading reasons for readmission into the NICU within two weeks of discharge (Fry et al., 2018; Lubbe, 2018). Up to 80% of infants with developmental delays, including those born prematurely, experience oral feeding difficulties (Lau, 2015). Prolonged hospitalizations and high readmission rates lead to greater utilization of resources, and therefore greater costs and financial burden on NICU families (Fry et al., 2018). Additionally, problems with feeding early on can lead to feeding issues over the long term, having harmful effects on health and quality of life (Hardy et al., 2018). With these considerations, it is essential for occupational therapists and other rehabilitation professionals to receive the training needed to improve feeding outcomes for their patients in the NICU. If rehabilitation professionals receive

proper education and training on feeding and oral motor interventions, they can provide infants and their families with safe, effective, and reliable care.

This scoping review aligns with one of the World Federation of Occupational Therapists' (WFOT) international research priorities, specific to evidence-based practice and knowledge translation. This refers to how therapists currently practice based on available evidence, how they can best learn and adjust their practice, and the creation of evidence reviews surrounding specific practice areas (World Federation of Occupational Therapy, 2018). This research priority has implications for how neonatal therapists apply evidence in their clinical practice and engage with their patients and families in regard to feeding for infants in the NICU.

This purpose of this scoping review was to identify the current practices for educating NICU staff on feeding and oral motor interventions in the NICU. As noted earlier, understanding the most effective ways to approach feeding in the NICU is critical for outcomes for NICU patients. These outcomes include discharge timing, readmission rates, and the overall health and quality of life of infants who have been patients in the NICU (Fry et al., 2018; Lubbe, 2018). Additionally, proper education on best evidence-based practices the NICU can help guide rehabilitation professionals whose aim is to promote successful delivery of care. Promoting high-quality care in the NICU, particularly surrounding an occupation as critical as feeding, can help neonatal healthcare professionals in their development of effective education and training, interventions, and protocols for working with their patients.

There have been previous interdisciplinary studies on feeding and oral motor interventions in the NICU, along with studies on approaches to care and education for neonatal healthcare providers. However, there has not yet been a review on the practices for educating NICU healthcare providers on feeding and oral motor interventions. Healthcare professionals must be properly equipped to address feeding and oral motor interventions so that they can provide their patients and families with high-quality care.

Methods

There was no standardized protocol used for this scoping review. An informal checklist was used by one independent reviewer based on scoping review guidelines by Arksey and O'Malley (2005). Steps in the process include 1) identifying the research question, 2) identifying relevant studies, 3) study selection, 4) charting the data, and 5) collating, summarizing, and reporting the results. A review of the literature was conducted using Google Scholar, CINAHL, Google, American Journal of Occupational Therapy (AJOT), The National Association of Neonatal Therapists (NANT), The World Federation of Occupational Therapists (WFOT), and March of Dimes between June 14-18, 2021. The search included both primary evidence and alternatives searches of grey literature. Keyword search included NICU, neonatal intensive care unit, feeding, infant-driven feeding, cue-based feeding intervention, oral motor, factors, facilitators, barriers, challenges, teamwork, and feeding staff. Search yield varied greatly on the database, and each search pulled an average of two articles.

An initial review of abstracts revealed a total of 43 resources relevant to best practices for educating on feeding and oral motor interventions in the neonatal intensive care unit (NICU). Thirty of the resources were then selected for full-text review, with 16 chosen for initial appraisal based on inclusion criteria. All 16 articles were initially appraised using a standard appraisal template. Selection of articles was based on relevance to feeding and oral motor interventions and education on current practices on training and education of healthcare staff, level of evidence, and whether the articles were derived from credible, peer-reviewed journals. Data quality was assessed through standard initial and critical appraisal processes. Articles that met criteria were collated and themes were developed.

The following methods were utilized to identify the most relevant articles for the scoping review question:

- Included information on training, education, protocols, quality improvement initiatives, or staff collaboration in the NICU.
- Tested specific oral motor interventions (i.e., PIOMI or nonnutritive sucking) or feeding interventions or feeding models (i.e., cue-based feeding).
- More recently published (2010 or later) and were, for the most part, primary research studies or reviews of primary research studies. Older articles were included due to paucity of research on the topic.

Results

The purpose of this scoping review was to identify the current practices for educating neonatal intensive care unit (NICU) healthcare providers on feeding and oral motor interventions. This included evaluating training and educational methods as well as the kinds of interventions and practices that should be included in training. The search revealed a moderate level of relevant studies, with few studies directly answering the scoping review question in its entirety. Some factors that contributed to limitations in literature selection include neonatal care being a relatively novice area of research, lack of established scholars that research neonatal feeding and oral motor practices, and that neonatal training and evidence-based practice education is something that has only recently been recognized as an important area of neonatal research.

The search resulted in 16 articles. Fourteen articles met the inclusion criteria for the scoping review, including 10 primary research articles, three reviews, and one grey literature resource. Figure 1 shows the study selection process. Inclusion criteria consisted of one or more of the following:

- Implementing oral motor interventions or feeding practices in the NICU
- Training, education, or quality improvement in the NICU
- Published after 2010

Two primary research articles and one systematic review were chosen for critical appraisal based on relevance to the scoping review question. The three articles separately address training and education on feeding practices, the impact of a cue-based feeding quality improvement project, and the outcomes associated with oral motor therapy for preterm infants. Articles were also chosen for critical appraisal based on having a more recent publication date and strong methodology.

Of the 14 studies in this scoping review, four focused on cue-based or infant-driven feeding (Fry et al., 2018; Chrupcala et al., 2015; Hood, 2019; Thomas et al., 2021), five focused on oral motor interventions (Ghomi et al., 2019; Kish, 2014, Lessen Knoll, 2019; Tian et al., 2015; Younesian et al., 2015), one focused on a combination of feeding and oral motor interventions and practices (Girgin et al., 2021), two focused on broader developmental care practices in the NICU (Altimier et al., 2015; Semenic et al., 2012), and two focused on NICU staff attitudes and teamwork (Masten et al., 2019; Shattnawi, 2017).

Thirteen of the articles chosen for this scoping review were retrieved from scholarly peer-reviewed journals, and one was retrieved from a credible dissertation database. Five took place in the United States, two in Iran, one in Turkey, one in Thailand, one in Jordan, and one study took place in the Netherlands, Belgium, and United States. The integrative review included articles from 16 different countries, with the majority completed in the United States, United Kingdom, and Australia. Two of the reviews included studies in China, the United States, and Canada. Eight of the articles were published between 2017-2021, and six of the articles were published between 2012-2015. Three of the 14 articles were quantitative quality improvement programs or initiatives (Altimier et al., 2015; Chrupcala et al., 2015; Thomas et al., 2021), one was a systematic review of quality improvement programs (Fry et al., 2018), three were randomized controlled trials (Ghomi et al., 2019; Lessen Knoll, 2019, Younesian et al., 2015), two were quasi-experimental designs (Girgin et al., 2021; Kish, 2014), one was a descriptive qualitative quality improvement study (Masten et al., 2019); one was an ethnography (Shattnawi, 2017), one was an integrative review (Semenic et

al., 2012), one was a meta-analysis (Tian et al., 2015), and one was an educational portfolio/dissertation (Hood, 2019).

Of the quantitative quality improvement program samples, one consisted of level I and Level II NICU sites (n= 81), two consisted of premature infants (n=20, and n=249), and the systematic review on quality improvement programs examined seven articles with samples ranging from 89 to 196, including both preterm neonates and other infants with complex conditions. All three randomized controlled trial samples each consisted of premature infants (n=30, n=30, n=20). The quasi-experimental design samples consisted of neonatal nurses (n=73) and premature infants (n=91), the descriptive qualitative study sample consisted of parents and healthcare staff (n=113), and the ethnography sample consisted of interviews with 10 nurses and five physicians. The integrative review examined 45 articles with samples consisting of healthcare providers, mothers, or health facilities. The meta-analysis examined 11 articles with a total of 855 preterm infants. The educational portfolio included a feeding procedure survey, knowledge survey, and focus group of healthcare staff (n=33, n=90, and n=35). See Table 6 for a full summary of studies by design, publication, and participant samples.

While many of the articles were published in nursing discipline or practice-based journals, most of the studies that engaged in the implementation of interventions or improvement programs were multidisciplinary in nature, including physicians, neonatal therapists, nurses, lactation consultants, and other healthcare providers. One randomized controlled trial used their own researchers for oral motor intervention implementation.

Synthesis of Results

The search and appraisal process revealed that there is relatively little research on training and education for neonatal occupational therapists, let alone neonatal staff in general, particularly surrounding oral motor and feeding practice. However, there was substantial literature on quality improvement initiatives and programs for NICU staff and a multitude of studies on particular

feeding practices, care models, and oral motor interventions. One key model of practice discussed in multiple studies was infant-driven feeding, or cue-based feeding, which is a facet of a broader neuroprotective developmental care model. Multiple studies described the methods for implementing a cue-based feeding protocol in the NICU and associated positive outcomes, such as earlier transitions to full oral feedings, shorter length of hospital stay, and greater weight gain. Several articles also discussed the importance of oral motor therapy in achieving successful oral feeding for infants in the NICU. The Premature Infant Oral Motor Intervention (PIOMI), for example, provided NICU staff with a structured program for the development of pre-feeding skills and resulted in preterm infants having earlier readiness for full oral feedings (Ghomi et al., 2019; Lessen Knoll et al., 2019).

Several studies examined the impact of quality improvement projects concerning cue-based feeding and other developmental care practices. Altimier et al. (2015) emphasized the value of quality professional practices in the NICU, which are key in providing developmental care, including infant-driven feeding. This means designing and offering desirable and effective training programs for standardized care approaches in the NICU for all staff, ultimately improving infant and family outcomes. The quality improvement initiatives in the literature focused on creating structured approaches in the NICU, incorporating evidence-based literature, and standardizing clinical practice to enhance quality of care. It also emphasized collaboration and cooperation between NICU staff members and creating goals, action plans, and measurable outcomes. Girgin (2021) and Chrupcala et al. (2015) found that consistent repetition of educational material, with updates that reflect the most recent evidence-based recommendations, is critical in retaining knowledge and maintaining high-quality feeding practices.

While research on training and education on NICU feeding and oral motor interventions was limited, most of the literature underscored the importance of providing structured, standardized interventions and models of practice for staff to follow. Kish (2014) reported that many

interventions for oral feeding in the NICU are currently based on individual staff observations and clinical judgment. Staff must have the opportunity to learn the evidence in order to maintain consistent in their approaches and provide patients and families with the best care possible. The methods found in this literature search have the potential to inform the development of quality education and programs to address this need.

Themes

The purpose of this scoping review was to search the literature for current practices on educating healthcare staff on infant feeding and oral motor interventions in the NICU, including education on best practices and methods for training. This review identified four themes:

- Infant-driven/cue-based feeding should be a standard of practice in the NICU
- There is a need for training and implementation of structured oral motor therapy in the NICU
- NICUs should utilize continuous quality improvement protocols to standardize practice and ensure reliable care
- Training for interdisciplinary teams in the NICU should focus on collaboration and a shared mission

Theme 1: Infant-driven/cue-based feeding

One theme that emerged from the literature was the effectiveness of implementing an infant-driven feeding protocol in the NICU. Infant-driven feeding is a model of feeding that supports cue-based feeding methods, which consider the signals and needs, or cues, of the infants, such as bringing hands to the mouth, rooting, or sucking on fingers or pacifiers (Fry et al. 2018). This feeding method compares to the traditional method of volume-driven feeding, which focuses on the infant's gestational age and feeding at 2-3 hour intervals (Girgin et al., 2021). Success is based on the completion of a specific volume of milk (Girgin et al., 2021). Cue-based feeding relies on the infant's signs of hunger to start feeding as well as signs of stress to stop feeding (Girgin et al.,

2021). Quality of the feed is prioritized over quantity of milk in order to develop oral and feeding skills at the infant's own pace (Chrupcala et al., 2015; Fry et al., 2018).

Six studies mentioned utilizing infant-driven feeding practices in the NICU (Altimier et al., 2015; Chrupcala et al., 2015; Fry et al., 2018; Girgin et al., 2021; Thomas et al., 2021, Hood, 2019). Girgin et al. (2021) included cue-based feeding in their training of neonatal nurses due to the high level of evidence indicating its effectiveness at transitioning preterm infants to full oral feeding. Hood (2019) reviewed cue-based feeding literature and found it to be a superior feeding methodology for infants in the NICU when comparing it to other feeding methods, thus supporting a shift to implement it as a new protocol in a Maryland NICU. In a survey, the NICU staff reported they felt positive about its implementation and felt comfortable recognizing infant cues and responding to stress. They also provided anecdotal evidence of faster achievement to full oral feedings, faster time to discharge, and more positive feeding experiences for mothers and infants.

Two quantitative studies and the systematic review examined similar outcomes associated with the implementation of cue-based feeding (Chrupcala et al., 2015; Fry et al., 2018; Thomas et al., 2021). These studies utilized quantitative metrics to identify the effectiveness of cue-based feeding, including length of stay (LOS) in the hospital and transition time to full oral feeding. Fry et al. (2018) reviewed seven articles on quality improvement initiatives on cue-based feeding in the NICU, which included establishing multidisciplinary task forces, involving parents in the implementation, and staff education. The review found that the cue-based quality improvement initiatives resulted in significant decreases in LOS, greater weight gain, and decreased time to full oral feeding. Chrupcala et al. (2015) and Thomas et al. (2012) both found that implementing a cue-based quality improvement project resulted in a significant decrease in LOS, with average decreases of 2.7-4.4 days and 10.1 days, respectively. Chrupcala et al. (2015) calculated a savings of \$38,255 per patient due to the shortened hospital stays during the quality improvement study. Thomas et al. (2012) reported that their organization saved \$103,950 per year by decreasing LOS.

Altimier et al. (2015) studied the effects of a quality improvement project on the implementation of the Wee Developmental Care Program, a neuroprotective family-centered care training program based on best evidence. One facet of the program includes optimizing nutrition. This portion of the training included education on developmentally supportive and individualized feeding interventions, incorporation of infant readiness cues, and quality of nipping over quantity of milk. This was included with six other developmentally supportive care core categories, such as creating a healing environment, partnering with families, protecting skin, and positioning and handling. The training program resulted in a significant increase in the use of these developmentally supportive care practices, including a 153% increase in the optimizing nutrition core measure. The Wee program has been shown to improve infant outcomes, decrease length of stay, and lower hospital costs.

Theme 2: Structured oral motor therapy

Six articles mentioned the need for structured oral motor therapy in the NICU, with five of the studies examining the effects of an oral motor therapy protocol in the NICU (Ghomi et al., 2019; Kish, 2014; Lessen Knoll, 2019; Tian et al., 2015; Younesian et al., 2015). All articles reported overall positive effects when implementing oral motor therapy in the NICU. In a randomized controlled trial, Younesian et al. (2015) found that preterm infants who had received 15 minutes of general oral motor stimulation per day achieved independent oral feeding earlier and were discharged earlier compared to those infants who did not receive the stimulation. The oral motor stimulation was based on traditional oral motor stimulation, including stroking of cheeks, lips, gums, and tongues and sucking of fingers. Tian et al. (2015) performed a meta-analysis of 11 randomized controlled trials studying the effects of oral motor therapy and found that it improved transition time to full feedings, length of hospital stays, feeding efficiency, and intake of milk in preterm infants.

While there is ample literature indicating the positive effects of oral motor stimulation on feeding outcomes in neonates, there is a lack of systematic and structured interventions to implement oral motor therapy, which can increase the variability of practice and be detrimental to providing the highest quality of care in the NICU (Kish, 2014). While the meta-analysis by Tian et al. (2015) revealed oral motor therapy to be an effective intervention for the development of feeding skills, authors cautioned that there are still questions on its clinical promotion, stating that “oral motor interventions for infants should be more standardized and systematic” (p. 9). There is a lack of clear and uniform regulations on the implementation of oral motor stimulation. Many oral feeding interventions in the NICU are based on individual nursing observations and clinical judgment, resulting in inconsistent processes and decisions made based on custom instead of evidence (Kish, 2014). Additionally, the literature revealed a need for uniform training and protocols on oral motor therapy in order to provide structured interventions. The oral motor and feeding training program studied by Girgin et al. (2021) found that one month after the training was completed, the nurses did not remember specific yet vital information about oral motor therapy. While general training on feeding practice in the clinic can be a beneficial start to providing consistent and quality care for infants in the NICU, Girgin et al. (2021) reported a further need for certification on oral motor interventions with practical training components and repetition through the education in order to promote consistent and structured care.

Several of the studies examined the impact of more structured and standardized oral motor therapy programs. Kish (2014) evaluated the impact of an oral feeding advancement protocol in the NICU, which consisted of 10 minutes of nonnutritive sucking protocol, or sucking on the breast without feeding or a pacifier, with advancement through the protocol based on successful progression of oral feeding skills of each infant. Staff were trained on the evidence and the protocol, their responsibilities, and goals for care delivery. The protocol was placed at each bedside for quick reference. The structured protocol resulted in clinically observed decreases in the number of days to

full oral feeding, but the results of this protocol were not statistically significant. However, this study only used nonnutritive sucking and did not include any other kind of oral stimulation or stroking, which has been shown to promote successful development of feeding skills (Tian et al., 2015).

Lessen Knoll (2019) and Ghomi et al. (2019) studied the impact of a more recent, systematic, and structured intervention for oral motor stimulation that is created explicitly for preterm infants called the Premature Infant Oral Motor Intervention (PIOMI). The PIOMI is based on Beckman's Oral Motor Intervention (BOMI) and is the only preterm oral intervention with published intervention fidelity and a formal training program to produce reliable and consistent performance (Ghomi et al., 2019). While other oral motor protocols in the NICU have been examined to facilitate feeding skills, these interventions take a lot of time, and infants with a low gestational age have difficulty tolerating them (Ghomi et al., 2019). The PIOMI was developed based on this reason and is a focused 5-minute, 8-step therapy designed to improve preterm infants' responses to pressure movements of the lips, jaw, and tongue (Lessen Knoll, 2019). Staff provide stimulation through stroking with the index finger through specific movements (Lessen Knoll, 2019). In these studies, the PIOMI resulted in significantly increased feeding efficiency, decreased time to full oral feedings, significantly shorter length of hospital stay, and greater velocity of weight gain. These results indicate the value of implementing a structured oral motor intervention in the NICU.

Theme 3: Quality improvement for standardized and reliable care

Ten of the articles in the review mentioned the importance of consistent and reliable care in the NICU, with five articles utilizing continuous quality improvement as a way to standardize feeding practice (Altimier et al., 2015; Chrupcala et al., 2015, Fry et al., 2018; Kish, 2014; Thomas et al., 2012). Continuing education and quality improvement can support the implementation of consistent care and standardized, evidence-based practice (Altimier et al., 2015). While there is

ample evidence for the use of specific feeding and oral motor practices in the NICU, including infant-driven feeding, the transfer of this evidence to consistent clinical practice has been slower (Hood, 2019). Use of subjective indicators and abstract decisions to initiate oral feedings can result in inconsistencies in practice (Thomas et al., 2015). Feeding strategies and goals will vary among disciplines and individual staff members unless there is universal training, standardization, and continuous education (Thomas et al., 2015).

The feeding practices training program that Girgin et al. (2021) implemented helped increase the knowledge of neonatal nurses, but only within one month. After one month, the staff answered many knowledge-based questions on feeding practices incorrectly, indicating they required more frequent repetition of information. While one-time team training can be effective in increasing knowledge, training should be repeated at regular intervals and updated consistently as new evidence arises to keep the information fresh for NICU staff. Chrupcala et al. (2015), Fry et al. (2018), and Thomas et al. (2015) also emphasized the importance of ongoing staff education and reeducation the duration of the project in order to have continued success and sustainment of new practices. Semenic et al. (2012) found that one of the most commonly reported barriers to implementing a breastfeeding protocol was the lack of opportunities for formal and informal education and skills training, along with outdated practices and inadequate staff knowledge.

The 18-month continuous quality improvement project developed in Altimier et al. (2015) resulted in the effective implementation of a developmental care program, showing increases in core measures of developmental care practices. The project included one year of didactic hands-on workshops to ensure full integration of developmental care practices and clinical and leadership follow-ups throughout implementation. Based on the positive outcomes, Altimier et al. (2015) stated that ongoing evaluation of all NICU training programs is recommended to ensure that the information remains evidence-based and major practice changes are hardwired over time.

Multiple studies mentioned the creation of a core team to advocate for the implementation of new protocols and programs in the NICU. Chrupcala et al. (2015) created a multidisciplinary team and created designated infant-driven feeding champions (IDFs) to facilitate the project. Thomas et al. (2015) also selected five multidisciplinary team members to serve as champions for training and education, implementation, and evaluation of the project. The primary research studies in the review by Fry et al. (2018) included various QI protocols, with three studies using feeding champions to facilitate the project, five studies using multidisciplinary stakeholders and task forces, and one study using a Plan-Do-Study-Act approach with emphasis on the process itself over the outcome. Continuous quality improvement that emphasizes regular and updated education, ongoing audits, and core team champions can ensure reliable care delivery and result in positive outcomes for staff and patients (Chrupcala et al., 2015; Fry et al., 2018; Thomas et al., 2015).

Theme 4: Interdisciplinary training

Five of the articles mentioned that the training for interdisciplinary teams in the NICU should focus on collaboration and a shared mission between team members (Altimier et al., 2015; Chrupcala et al., 2015; Fry et al., 2018; Masten et al., 2019; Semenic et al., 2012; Shattnawi, 2017). Several studies specifically emphasized the importance of collaboration and cohesion between all disciplines and parties involved in the care of infants in the NICU, not just select staff. Altimier et al. (2015) stressed that the inclusion of as many healthcare providers as possible in trainings, instead of only a few “experts”, brings the level of care higher and results in greater consistency in care, supporting buy-in and sustainability. Chrupcala et al. (2015) reported that collaboration of care providers is essential for oral feeding success, and that the success of the quality improvement project was founded on the strong collaboration between providers of all disciplines. As neonatal care continues to advance and change, the delivery of high-quality care to complex infants requires a collaborative, cohesive team that can communicate well (Chrupcala et al., 2015; Masten et al., 2019). Optimal care in the NICU requires this interdisciplinary cohesiveness and is dependent on

optimizing teamwork and building trust between staff (Chrupcala et al., 2015; Masten et al., 2019). NICU team members must be trained in mutual respect, communication, and teamwork in order to enhance care of the patients and their families (Altimier et al., 2015).

A shared mission and buy-in on intervention implementation are critical to the quality of care in the NICU. The oral feeding project implemented by Kish (2014) had poor staff compliance, which is an important component of any quality improvement project. Staff compliance during the quality improvement project averaged 50%, despite education and staff support. Staff showed resistance to change, which resulted in inconsistent care. Training must address the importance of compliance and the evidence behind implementation in order to give staff a buy-in to follow protocol. Semenic et al. (2012) highlighted priorities for implementing breastfeeding programs in the NICU, which included the training of healthcare workers to shift their attitudes toward breastfeeding to create a unified commitment to the program.

Unified commitment and compliance to specific models of care result from a shared mission, with all staff working toward the same goals for delivery of safe care and optimal outcomes (Masten et al., 2019). The prioritization of a shared mission or common goals were highlighted in the literature. Masten et al. (2019) described a teamwork model based on the Interprofessional Education Collaborative, which features teamwork as a central competency for interdisciplinary practice with an emphasis on a shared mission, or “common purpose and strong mutual commitment” (Masten et al., 2019). Rather than a collection of individuals, NICU staff must be a team with a shared mission and model for execution (Masten et al., 2019). In a survey of providers in the NICU, the idea of a common mission was ranked as the most important team attribute among physicians and nurses (Masten et al., 2019). Therefore, training for NICU staff must involve guidelines on establishing effective communication and cooperation between team members. The quality improvement project on infant-driven feeding implemented by Chrupcala et al. (2015) used a different model to facilitate leadership skills and collaboration. This model

required the development of a cohesive team and cooperative goals that established a common purpose and mutual respect among the team. With the staff's dedication to the project and their team, the quality improvement project resulted in successful uptake of infant-driven feeding and better outcomes for the patients.

Shattnawi (2017) performed an ethnographic study focusing on the NICU staff attitudes and practices in supporting breastfeeding and found that staff attitudes and behaviors can have a significant impact on mothers' confidence in breastfeeding. Shared attitudes and goals are vital for success in the NICU, and any barriers that may impact the uptake of shared goals should be addressed through continuing education committees and collaboration by all parties, including hospital management (Shattnawi, 2017). In a complex environment like the NICU, "consistent, uniform care is not possible without uniformity in attitudes, behaviors and practices" (Altimier et al., 2015, p. 9).

Discussion

This scoping review aimed to identify the current practices for educating NICU staff on feeding and oral motor interventions in the NICU. A scoping review was conducted to determine educational methods for staff along with the types of feeding interventions and models of care that are successful in the NICU. In order to adequately train and educate NICU care providers, it is first essential to understand current and best practices. This review found evidence that a developmental, infant-driven, cue-based feeding approach along with structured oral motor therapy protocols are important for the success of NICU staff and patients. This review also found that continuous quality improvement programs, interdisciplinary training with a focus on collaboration and shared goals, and standardization of protocols in the NICU are vital for effective teamwork and achievement of high quality feeding care.

This review has implications that align with the research priorities of the WFOT, including evidence-based practice and knowledge translation in the NICU (World Federation of Occupational

Therapy, 2018). The results indicate that knowledge translation of NICU practice is not simple and cannot be successful without intentional and continuous action. The education of NICU staff must be consistent and completed at regular intervals, with updates as new evidence arises. The NICU is a complex environment for all healthcare professions and has been a challenging area of practice to instigate evidence-based practice. Thus, education of NICU staff requires thoughtful, ongoing, goal-oriented, and collaborative training of all professions. This is particularly important for feeding and oral motor service delivery, which is highly interprofessional and where practices vary greatly between NICUs, professions, and individuals. The use of continuous quality improvement programs is one way that NICU staff can provide reliable and evidence-based feeding care and ensure positive outcomes for all patients and their caregivers and families.

Service delivery in the NICU should focus on providing the highest quality of care, which means that the care must be quality, reliable, and evidence-based. The literature emphasized that NICUs should strive for consistent care practices across all staff members through the implementation of structured and standardized feeding and oral motor models of care and interventions. Staff must advocate for continuing education on best practices and models of care, as well as workshops focused on collaboration, cohesion, and the development of shared attitudes and goals between team members. NICU management should clearly articulate the shared mission for feeding protocols and ensure that staff are adequately equipped to put those goals into action in their daily practice with patients and families.

This review has the opportunity to inform practices for better quality of care for patients and families in the NICU. As medical care advances, more infants are born preterm and more are surviving, requiring better feeding practices to support the health and development of these infants (Ghomi et al., 2019). It is critical that NICU staff can provide quality care to support the influx of vulnerable and medically complex infants. Based on the evidence in this review, an infant-driven, cue-based feeding protocol should be a standard of care in the NICU. The literature revealed ample

evidence that an infant-driven model of feeding can reduce transition time to oral feeding, improve feeding efficiency, lead to greater weight gain, and shorten length of stay for infants. NICUs should consider moving away from volume-driven feeding models and focus on developmentally supportive care that considers quality of feeding and reading feeding readiness signs and stressor signals. Implementing an infant-driven and cue-based feeding model in the NICU improves feeding outcomes for infants and decreases healthcare costs and utilization of resources.

Structured and standardized interventions for oral motor therapy, such as the PIOMI, should also be implemented in the NICU. The development of oral motor skills in infants is critical for feeding, and independent oral feeding is a major criterion for discharge from the NICU, so successful feeding should be an important target for NICU staff (Tian et al., 2015). Staff should be educated on standardized oral motor therapies, as “best practice in a NICU involves the provision of oral motor therapy in a neuroprotective care environment during the critically sensitive periods of brain development” (Lessen Knoll, 2019, p. 186). The literature revealed the need for uniform regulations surrounding oral motor therapies and the need for standardized, evidence-based oral motor programs in the NICU. Preterm infants have better feeding outcomes when they have structured, consistent, and reliable oral motor therapy. These findings have implications for the type of education and certification that NICU staff should have in order to provide quality feeding care.

Limitations

This scoping review was limited to articles published in English, which led to a dominance of articles from industrialized countries. While non-English countries were represented, such as Jordan, Iran, Turkey, China, and Thailand, the majority came from countries like The United States, Canada, and the United Kingdom. It may be difficult to generalize these findings to other countries that may have different beliefs or attitudes on feeding, or low-income and developing countries with different resources and infrastructure. Many of the studies were also conducted within one single NICU. While some studies examined NICUs across the country or several countries, the majority of

the studies were conducted using only one NICU, which may not be a good representation of most NICUs.

Despite a rigorous search, few studies focused on education and training on NICU feeding practices specifically. While some articles mentioned education and training for general NICU practice, there was limited research on feeding and oral motor education or quantitative experimental studies on education and training outcomes. This made it difficult to draw conclusions on best methods for training and educating NICU staff, and more research should address this gap in the literature. Moreover, the majority of studies did not examine long-term outcomes associated with trainings and interventions, only immediate and short-term outcomes.

An additional limitation of this scoping review is that not all feeding and oral motor models and interventions may have been considered for review, as only two databases were explored and only one independent reviewer was used. Due to the broad nature of scoping reviews, it is challenging to identify all literature on a topic, and thus certain models of feeding and oral motor therapy were not considered. However, the literature search unquestionably pointed toward the use of infant-driven, developmental feeding practices, and thus the review focused on this model of care.

Conclusions

This scoping review outlined the current practices for educating healthcare professionals on feeding and oral motor interventions in the NICU. The literature points to the use of an infant-driven model of care, structured oral motor programs, continuous interdisciplinary training and education in order to support practice change and sustain those changes, and the prioritization of collaboration and shared goals for NICU staff. The findings inform how training and education should be addressed for NICU staff and illustrate the need for standardized and consistent feeding and oral motor practices in order to provide reliable care for patients and families. The NICU is a complex and vulnerable environment, and feeding is the most challenging occupation infants

engage in each day. Occupational therapists have the opportunity to learn and translate best evidence into practice in order to support infants in their daily occupations. NICU staff must be equipped to provide best practices and effectively implement the quality care that these infants need.

References

- Altimier, L., Kenner, C., & Damus, K. (2015). The wee care neuroprotective NICU program (Wee Care): The effect of a comprehensive developmental care training program on seven neuroprotective core measures for family-centered developmental care of premature neonates. *Newborn and Infant Nursing Reviews*, *15*(1), 6-16.
<http://dx.doi.org/10.1053/j.nainr.2015.01.006>
- Chrupcala, K. A., Edwards, T. M., & Spatz, D. L. (2015). A continuous quality improvement project to implement infant-driven feeding as a standard of practice in the newborn/infant intensive care unit. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, *44*(5), 654-664.
<https://doi.org/10.1111/1552-6909.12727>
- Er, I., & Günlemez, A. (2021). Transition time to full oral feeding skill and its determinants in very preterm infants: a single center experience. *The Journal of Pediatric Research*. *8*(2):216-224. <https://doi.org/10.4274/jpr.galenos.2021.6937>
- Fry, T. J., Marfurt, S., & Wengier, S. (2018). Systematic review of quality improvement initiatives related to cue-based feeding in preterm infants. *Nursing for women's health*, *22*(5), 401-410.
<https://doi.org/10.1016/j.nwh.2018.07.006>
- Ghomi, H., Yadegari, F., Soleimani, F., Knoll, B. L., Noroozi, M., & Mazouri, A. (2019). The effects of premature infant oral motor intervention (PIOMI) on oral feeding of preterm infants: A randomized clinical trial. *International journal of pediatric otorhinolaryngology*, *120*, 202-209. <https://doi.org/10.1016/j.ijporl.2019.02.005>

- Girgin, B. A., Gözen, D., & Temizsoy, E. (2021). The effect of training on neonatal nurses' knowledge about transitioning preterm infants to oral feeding. *Journal of Pediatric Nursing, 61*, 185-190. <https://doi.org/10.1016/j.pedn.2021.05.019>
- Gibbins, S., Hoath, S. B., Coughlin, M., Gibbins, A., & Franck, L. (2008). The universe of developmental care: a new conceptual model for application in the neonatal intensive care unit. *Advances in Neonatal Care, 8*(3), 141-147. <https://doi.org/10.1097/01.ANC.0000324337.01970.76>
- Hardy, C., Senese, J., & Fucile, S. (2018). Rehabilitation of infant oral feeding difficulties: a survey of occupational therapists practice approaches. *Occupational therapy in health care, 32*(1), 14-27. <https://doi.org/10.1080/07380577.2017.1419398>
- Halder, P., Bera, D., & Banerjee, A. (2015). Developmentally supportive care in neonatal intensive care unit (NICU): a review. *Indian Journal of Medical Research and Pharmaceutical Sciences, 2*(2), 17-23. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.681.1703&rep=rep1&type=pdf>
- Hood, J. L. C. (2019). *Implementing a cue based feeding protocol and staff education program in the neonatal intensive care unit*. University of Delaware. <https://www.proquest.com/openview/1151cfcc6f31102679fea4ffc5965304/1?pq-origsite=gscholar&cbl=18750&diss=y>
- John, H. B., Suraj, C., Padankatti, S. M., Sebastian, T., & Rajapandian, E. (2019). Nonnutritive sucking at the mother's breast facilitates oral feeding skills in premature infants: A pilot study. *Advances in Neonatal Care, 19*(2), 110–117. <https://doi-org.pearl.stkate.edu/10.1097/ANC.0000000000000545>
- Kish, M. Z. (2014). Improving preterm infant outcomes: implementing an evidence-based oral feeding advancement protocol in the neonatal intensive care unit. *Advances in Neonatal Care, 14*(5), 346-353. <https://doi.org/10.1097/ANC.0000000000000099>

- Lau, C. (2015). Development of suck and swallow mechanisms in infants. *Annals of Nutrition and Metabolism*, 66(Suppl. 5), 7-14. <https://doi.org/10.1159/000381361>
- Lessen Knoll, B. S., Daramas, T., & Drake, V. (2019). Randomized controlled trial of a prefeeding oral motor therapy and its effect on feeding improvement in a Thai NICU. *JOGNN: Journal of Obstetric, Gynecologic & Neonatal Nursing*, 48(2), 176–188. <https://doi-org.pearl.stkate.edu/10.1016/j.jogn.2019.01.003>
- Lubbe, W. (2018). Clinicians guide for cue-based transition to oral feeding in preterm infants: An easy-to-use clinical guide. *Journal of evaluation in clinical practice*, 24(1), 80-88. <https://doi.org/10.1111/jep.12721>
- Ludwig, S. M., & Waitzman, K. A. (2007). Changing feeding documentation to reflect infant-driven feeding practice. *Newborn and Infant Nursing Reviews*, 7(3), 155-160. <https://doi.org/10.1053/j.nainr.2007.06.007>.
- Masten, M., Sommerfeldt, S., Gordan, S., Greubel, E., Canning, C., Liroy, J., & Chuo, J. (2019). Evaluating teamwork in the neonatal intensive care unit: A survey of providers and parents. *Advances in Neonatal Care*, 19(4), 285-293. <http://doi.org/10.1097/anc.0000000000000604>
- National Association of Neonatal Therapists (NANT). (2014). Neonatal therapy scope of practice. *NANT Professional Collaborative*. https://s3.amazonaws.com/nant-resources/Free+Resources/Neonatal+Therapy+Core+Scope+of+Practice_rfd.pdf
- Semenic, S., Childerhose, J. E., Lauzière, J., & Groleau, D. (2012). Barriers, facilitators, and recommendations related to implementing the baby-friendly initiative (BFI) An integrative review. *Journal of Human Lactation*, 28(3), 317-334. <https://doi.org/10.1177/0890334412445195>
- Settle, M. & Francis, K. (2019). Does the infant-driven feeding method positively impact preterm infant feeding outcomes? *Advances in Neonatal Care*, 19(1), 51-55. <https://doi.org/10.1097/ANC.0000000000000577>.

- Shaker, C. S. (2013). Cue-based co-regulated feeding in the neonatal intensive care unit: supporting parents in learning to feed their preterm infant. *Newborn and Infant Nursing Reviews*, 13(1), 51-55. <https://doi.org/10.1053/j.nainr.2012.12.009>
- Shattnawi, K. K. (2017). Healthcare Professionals' Attitudes and Practices in Supporting and Promoting the Breastfeeding of Preterm Infants in NICUs. *Advances in Neonatal Care (Lippincott Williams & Wilkins)*, 17(5), 390–399. <https://doi-org.pearl.stkate.edu/10.1097/ANC.0000000000000421>
- Tanta, K. J., & Youngblood Langton, S. (2010). NICU primer for occupational therapists: Exploring the needs of fragile infants, the context in which they are cared for, and the role of OT in this specialized practice area—part I of II. *Journal of Occupational Therapy, Schools, & Early Intervention*, 3(2), 179-186. <https://doi.org/10.1080/19411243.2010.491020>
- Thomas, T., Goodman, R., Jacob, A., & Grabher, D. (2021). Implementation of cue-based feeding to improve preterm infant feeding outcomes and promote parents' involvement. *JOGNN: Journal of Obstetric, Gynecologic & Neonatal Nursing*, 50(3), 328–339. <https://doi-org.pearl.stkate.edu/10.1016/j.jogn.2021.02.002>
- Tian, X., Yi, L. J., Zhang, L., Zhou, J. G., Ma, L., Ou, Y. X., ... & Song, G. M. (2015). Oral motor intervention improved the oral feeding in preterm infants: evidence based on a meta-analysis with trial sequential analysis. *Medicine*, 94(31). <https://doi.org/10.1097/MD.0000000000001310>
- Vergara, E., Anzalone, M., Bigsby, R., & Gorga, D. (2006). Specialized knowledge and skills for occupational therapy practice in the neonatal intensive care unit. *The American Journal of Occupational Therapy*, 60(6), 659. <https://doi.org/10.5014/ajot.60.6.659>
- World Federation of Occupational Therapy. (2018, May 23). *The development of international research priorities for occupational therapy*. [PowerPoint Slides]. https://congress2018.wfot.org/downloads/presentations/SE18/liliana_alvarez.pdf

Younesian, S., Yadegari, F., & Soleimani, F. (2015). Impact of oral sensory motor stimulation on feeding performance, length of hospital stay, and weight gain of preterm infants in NICU.

Iranian Red Crescent Medical Journal, 17(7).

[https://doi.org/10.5812/ircmj.17\(5\)2015.13515](https://doi.org/10.5812/ircmj.17(5)2015.13515)

Appendix B: Doctoral Capstone Project Proposal Needs Assessment

Student Name	Joy Berthelsen
Primary Area of In-Depth Exposure	Education
Secondary Area of In-Depth Exposure	Clinical Practice Skills
Working Title of Doctoral Capstone Project	Developing Updated Oral Motor Guidelines to Support Feeding Outcomes in the Neonatal Intensive Care Unit
Capstone Mentor name and credential	Holly Schifsky, OTR/L, CNT, NTMTC, CBIS
Capstone Mentor role and expertise	NICU occupational therapist in level IV NICU; expertise in neonatal touch and massage, infant NDT, advancing developmental and clinical care for multidisciplinary NICU team members
Capstone Site	University of Minnesota Masonic Children's Hospital NICU
Capstone Faculty Advisor	Dr. de Sam Lazaro
Date	04/24/2022

Part 1: Description of the Organization or Community

Description of Organization/Community

The University of Minnesota Masonic Children's Hospital (UMMCH) is part of the University of Minnesota Fairview hospital system, M Health Fairview. The mission at M Health Fairview is "Driven to Heal, Discover, and Educate for Longer, Healthier Lives". The vision of M Health Fairview is "Driving a Healthier Future". Values that drive the company include dignity, integrity, service, compassion, and innovation. UMMCH is located in Minneapolis, MN and provides comprehensive pediatric care, including neonatal intensive care. It is designated as a Level III trauma hospital, with the Neonatal Intensive Care Unit (NICU) designated as a Level IV NICU, providing care for the most complex and critically ill newborns. UMMCH is known for their innovation, as it is a teaching hospital that works closely with the University of Minnesota to incorporate effective research findings into their care for patients. Primary stakeholders for this capstone project are the NICU staff at UMMCH, including nurses and neonatal therapists, and the patients and families that they serve. The UMMCH NICU is family-centered and values evidence-based practice and strong working relationships between disciplines.

Infants in the NICU require specialized care, and often have complex conditions or complications, including prematurity, that impact their ability to engage in occupations, including feeding, positioning, diapering, sleeping, or bonding time with their caregivers. While NICUs feature advanced technology that is specific for the small patients the staff serve, staff also work to ensure that it is a healing environment, considering all factors of an infant's sensory system to promote optimal development. In 2020, preterm birth impacted 1 in 10 infants born in the United States (Centers for Disease Control and Prevention [CDC], (2021). The rate of preterm birth among African American women was 14.4%, or 50% higher than preterm births among white (9.1%) and Hispanic Women (9.8%) (CDC, 2021). Additionally, 17% of infant deaths in 2020 were from preterm births and low birth weight (CDC, 2021). Babies who are born premature and are in the NICU can experience a wide variety of issues related to health and development, including problems with the heart, brain, or other organs, infections, anemia, jaundice, vision/hearing problems, and feeding difficulties, among other issues (March of Dimes, 2019). Neonatal therapists, including occupational therapists, "use an integrated, neuroprotective, family-centered model to provide highly specialized and individualistic interventions" that support development, including feeding and oral motor interventions (National Association of Neonatal Therapists, 2014). According to Osborn and Jadcherla (2022), feeding problems impact 42% of premature infants that do not have comorbidities. This percentage is likely higher for premature infants with comorbidities. Additionally, 40% of infants referred to clinical for chronic feeding issues are premature. Oral feeding is often delayed in preterm infants due to their lack of ability to coordinate sucking, swallowing, and breathing, which does not fully mature until 34-36 weeks (Garber, 2013). Oral motor interventions, including oral stimulation, have been shown to facilitate the coordination of nutritive sucking patterns and functional feeding and therefore increased weight gain, earlier discharge from the hospital, and earlier nipple feeding competence (Garber, 2013).

Priority/Need/Issue #1

Primary Goal: Implement oral motor interventions in the NICU through a pilot study, including training NICU staff on those interventions, and following the infants until discharge to assess oral feeding outcomes.

Strategy:

- Learn the various oral motor interventions and how to implement them appropriately and safely with patients.
- Cross train other staff on the interventions for the study.
- Learn the oral feeding assessments to assess outcomes associated with the oral motor interventions.

Priority/Need/Issue #2

Primary Goal: Develop an updated oral motor guide/program based on the data collected and feeding outcomes.

Strategy:

- Use the data collected to assess oral feeding outcomes and feeding readiness at discharge following oral motor interventions.
- The guide will explain the different oral motor interventions and how to implement them as well as evidence and outcomes associated with the interventions.

Priority/Need/Issue #3

Primary Goal: Create a standard of care for oral motor interventions for babies in the NICU that are intubated.

Strategy:

- Learn about intubation in the NICU and its impact on feeding and oral motor development
- Have discussion with mentor on current equipment used in the NICU for feeding, including special pacifiers for babies who are intubated and complete observation in clinic
- Build from information in general oral motor guide

References

Centers for Disease Control and Prevention [CDC] (2021). *Preterm Birth*.

<https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm>

Garber, J. (2013). Oral-motor function and feeding intervention. *Physical & Occupational Therapy In Pediatrics*. 33(1), 111-138, 10.3109/01942638.2012.750864

March of Dimes. (2019, October). *Premature Babies*.

<https://www.marchofdimes.org/complications/premature-babies.aspx>

National Association of Neonatal Therapists [NANT] (2014). *Neonatal Therapy Core Scope of Practice*. https://s3.amazonaws.com/nant-resources/Free+Resources/Neonatal+Therapy+Core+Scope+of+Practice_rfd.pdf

Osborn, E. and Jadcherla, S. (2022), Developing a quality improvement feeding program for NICU patients. *NeoReviews*. <https://doi.org/10.1542/neo.23-1-e23>

Part 2: Preliminary Information and Resources for Learning about a Priority/Need/Issue

Internal Information and Resources

Name of Information or Resource	Description of Information or Resource	Brief Summary of Key Learning
University of Minnesota Fairview Neonatology and NICU page	This website describes the UMMCH NICU, including the approach and conditions treated.	<ul style="list-style-type: none"> - There is a Neuro NICU with specialized care for babies with neurologic conditions - Other staff include nurses, respiratory therapists, licensed social workers, speech and physical therapists, lactation consultants, pharmacists, and nutritionists. - Involvement in national clinical trials and research programs - NICU follow up care
University of Minnesota Masonic Children's Hospital NICU staff	Pre-survey along with informal meetings to gain a better understanding of feeding processes and needs in the NICU	I plan to assess current knowledge and get a better understanding of training/education needs by sending a survey out to staff that are involved in feeding. I also hope to connect with other staff during clinical work to gain a better understanding of current needs
Interview with site mentor	I will be interviewing my mentor to have a better understanding of current oral motor and feeding practices in the NICU.	<ul style="list-style-type: none"> - Infant-driven feeding - OTs are the feeding experts, see each baby once a day. Nurses implement the care plan the OTs provide - Family-focused NICU - Current 55 page guideline that needs updating on oral motor interventions

External Information

Name of Information or Resource	Description of Information or Resource	Brief Summary of Key Learning
Occupational Therapy in Neonatal Services and Early Intervention:	This document is a clinical practice guide for	- It included summaries of the development process of the

<p>Practice Guideline, Royal College of Occupational Therapists: https://www.rcot.co.uk/practice-resources/rcot-publications/downloads/neonatal-services</p>	<p>occupational therapists in the NICU.</p>	<p>guidelines, PICO question used, literature review, search strategies, databases used, inclusion/exclusion criteria, and outcomes. - Section on feeding</p>
<p>National Association of Neonatal Therapy (NANT) Website: https://neonataltherapists.com/</p>	<p>This website is the hub for resources for neonatal therapists, including articles and webinars on feeding and oral motor stimulation.</p>	<p>- One article found on the website summarized literature on oral motor stimulation, finding that it improves later feeding outcomes on bottles and by breast, including at three and six months post-discharge from the NICU. Oral motor stimulation does happen automatically in the womb, with infants sucking and swallowing amniotic fluid that helps wire neural networks feeding at birth. - Other webinars on the website have good information on feeding for babies on respirators and the difference between feeding breast vs bottle.</p>
<p>PEDIATRIC NEWBORN MEDICINE CLINICAL PRACTICE GUIDELINES: Feeding in the Weeks Leading Up to Discharge; Brigham and Women's Hospital Department of Pediatric Newborn Medicine: https://www.brighamandwomens.org/assets/BWH/pediatric-newborn-medicine/pdfs/feeding-cpg---final-06-06-2016.pdf</p>	<p>This document is a clinical practice guideline on feeding in the NICU, created for multidisciplinary developmental practice.</p>	<p>- Includes tables, photos, bolded words - Evidence-based interventions - Equipment needed - Feeding assessment and readiness</p>
<p>Occupational Therapy's Role in the Neonatal Intensive Care Unit (AOTA): pubmed.ncbi.nlm.nih.gov/30674405/</p>	<p>This article describes the role of the occupational therapist in the NICU and guidance in the areas of evaluation and intervention.</p>	<p>- Part of the ADLs in the NICU is feeding, including facilitating and supporting oral-sensory-motor development, prefeeding skills, and transition to oral feeding.</p>

Gaps in Learning:

- The level of training that will be needed for NICU staff to implement oral motor interventions (will hopefully have better understanding after administering survey to staff)
- The amount of time required to implement oral motor interventions for each patient each day

- Knowledge about current oral feeding guidelines used in the NICU

Part 3: Informational Interviews

Summary of Interview Guide

Holly Schifsky, OTR/L, CNT at UMMCH

Interview date: April 18th, 2022 at 2:30

Interview questions:

1. What is the history of the UMMCH NICU, particularly in terms of oral motor interventions and feeding? (frameworks/guidelines guiding practice)
2. What are the current oral motor practices in the UMMCH NICU? Is there a current guide in use that I will be updating or will I be creating one?
3. What are the oral motor interventions we will be implementing in the pilot study?
4. Who is involved in infant feeding and oral motor in the NICU? (Which staff? Parents?)
5. What are current strengths in the oral motor program in the NICU?
6. What kind of training do NICU staff complete for feeding interventions?
7. Are there any documents or guides that the NICU currently uses for oral motor interventions/feeding that I could have access to? Or someone that would give me access to internal documents that might be helpful?
8. I am hoping to interview another person to gain information for my needs assessment. Are there other stakeholders that would be beneficial to interview for information on the UMMCH NICU/oral motor interventions and feeding?

Summary of interview:

This UMMCH NICU has had OTs present the past 15 years. In the past 10 years, their presence regarding feeding has increased. OTs get referrals on 95% on babies admitted to the NICU. Evolution of care has really changed. Decades ago, there weren't nasogastric tubes so it was difficult to keep babies alive. There have been a lot of advances for alternative feeding methods, saving infants that are born as young as 22 weeks. Oral feeding considers neurological, respiratory, and GI function. The NICU has established oral feeding guidelines based on evidenced based practice with different frames of reference for different approaches. At UMMCH in the last 5 years, the NICU has gotten into infant driven feeding. This was the biggest change. Many institutions do volume driven feeding, but now they have a better understanding of neurological development, and volume-driven feeding is not sustainable neurologically. The goal is for babies to learn *how* to feed. Even with terminology, the word "feeding" has a connotation the baby's role is passive. However, infants need to learn *eating* skills. It is a dyad between parent and baby; a reciprocal, active occupation. The goal is to transition the terminology surrounding feeding skills to make it more family centered.

Currently, the UMMCH NICU has written interdisciplinary oral motor guidelines (55 pages long). Within the occupational therapy department, there are also more specific clinical feeding practices and guidelines. The NICU also has a nutrition steering committee that oversees feeding practices in the NICU. My project is a branch off of that committee to update the oral motor guidelines for the entire NICU team. The various oral motor skills that we will be looking at for the project include extra-oral skills (cheek, lip function), intra-oral skills (tongue activation – compression and suction), swallow, and respiratory (secretion management and taste of milk). Feeding in the NICU involves many different disciplines. First, the OT assesses a patient and then creates a feeding plan for other staff to follow. The nurses and doctors use the feeding plan during routine care. Feeding also involves the lactation team, for breastfeeding mothers, and dieticians, who look at the calories and what the babies are being fed/how much. Parents also play an important role, as they are educated on feeding practices to complete while in the NICU and after discharge. Strengths in the UMMCH NICU include being infant/family focused, the team is very experienced, the staff use a lot of evidence-based practice and stay up to date on new evidence, and the OTs have strong working relationship with other disciplines. In the NICU, OTs are the feeding experts and onboard new team members. Training of new staff involves pairing staff with a mentor and a required competency training (4-6 weeks). There are certain things staff need to know before working on their own. The mentoring track is helpful since every baby has different needs and every therapist has different levels of knowledge. The mentoring can be years long. There is also an interdisciplinary preceptor program, where new staff are assigned a nurse mentor. Nurses also connect with OTs to train new nurses, including an education class on feeding and positioning.

Part 4: Public Records and Organizational/Community Resources

Internal Resource: UMMCH's current oral motor guidelines in the NICU

Description: The University of Minnesota Masonic Children's Hospital NICU currently has oral motor guidelines for therapists and interdisciplinary feeding guidelines.

Summary: The current feeding guideline is 55-pages long and is an interdisciplinary guideline. The current oral motor guideline is a few pages discussing steps for assessment and intervention. The NICU staff would like the current guideline updated to reflect new evidence and best practices, including protocols for intubated infants. I plan to thoroughly read the guidelines during the first week of my project and go over them with my mentor. This will be a good starting point to figuring out what kind of content to have in the new guidelines and how the format will be.

External resource: Occupational Therapy in Neonatal Services and Early Intervention: Practice Guideline, Royal College of Occupational Therapists

Retrieved from <https://www.rcot.co.uk/practice-resources/rcot-publications/downloads/neonatal-services>

Description: This document is a clinical practice guide for occupational therapists to “assist and facilitate the development of coordinated care plans for each and every baby going through the neonatal care pathway” (p. V).

Summary: This guideline begins with an introduction and key recommendations for implementation before diving into the specific evidence for recommendations. It then includes a background on practice requirements for the guideline, national context on NICU statistics, occupational therapy's role in the NICU, and the objective of the guide. The guide then includes summaries of the key clinical question used and guideline scope, search strategies, databases used, inclusion/exclusion criteria, outcomes, recommendations and supporting evidence, and how the guide was implemented. Pertaining to feeding, the guide includes an overview on feeding, recommendations, and summarized evidence to support those recommendations. There is also a section on parent perspectives, as parent engagement was sought during the creation of the guideline. It also includes a development process of creating the guideline, explaining how they created it based on a group of 11 different occupational therapists, educators, and researchers. There is a glossary and abbreviation table at the end of the document. There is a longer practice guide along with a shorter quick reference and implementation guide with key recommendations only for easy access by practitioners during patient care.

Part 5: Organization or Community Assets

Nutrition steering committee

The UMMCH NICU has a nutrition steering committee that supports and oversees feeding practices in the NICU. The committee is comprised of multiple disciplines. My project will be a branch off of the steering committee to update the oral motor guidelines. It will be beneficial to meet with the steering committee and better understand their goals and desires for the guidelines.

Strong evidence-based foundation and interdisciplinary work

The UMMCH NICU is a very experienced team that prioritizes evidence-based interventions and practices with their patients. The team is consistent about staying up to date on the latest research in order to provide the best care. Additionally, the team of occupational therapists have a strong working relationship with the other disciplines, allowing for better coordination and less variability of care.

Part 6: Proposed Methods to Collect Other Information During the Doctoral Capstone

Experiences and Project

Internal Information and Resources

Name of Information or Resource	Description of Information or Resource	Brief Summary of Focus of Learning
Meetings with the NICU Nutrition Committee	The Nutrition Steering Committee is a multidisciplinary team that oversees feeding protocols in the NICU	My project on oral motor interventions is a branch off of the nutrition committee. Having regular meetings with the committee will help me to ensure that my project is moving in a direction that

		fulfills the goals of the committee.
Observation in the NICU	Observing current oral motor interventions, feeding, interdisciplinary care, and education with families	Observation in the NICU will give me a better idea of the current oral motor and feeding interventions used, along with the various problems that premature infants often have.
NICU families and caregivers	Families and caregivers of NICU patients at UMMCH.	Connecting with NICU families and caregivers will give me a better understanding of the role they play in feeding and how they can support the practice of oral motor stimulation with their babies.
Possible observation of new nurse education class by mentor on feeding and positioning	Once a month, my mentor teaches an education class for new nurses.	This class is on feeding and positioning in the NICU. Observing a training course would give me insight into the types of information that new staff receive on feeding and the best methods for a training course.
Data on NICU patients	Data on current or past patients and their development of oral feeding skills and the types of interventions used	Access to this data can provide me with evidence to create my clinical guidelines.
Current written oral motor guidelines or documents used in the UMMCH NICU	Any documents or resources that are currently guiding oral motor interventions in the UMMCH NICU.	I will be accessing these documents the first week of the project.
UMMCH NICU feeding staff	I plan to send out a survey to NICU feeding staff, particularly the occupational therapists and nurses, to get an idea of current knowledge on oral motor interventions and training needs before implementing the new oral motor protocols.	I have not sent the survey yet and gotten feedback, but I plan to send the survey out to nursing and occupational therapy staff the first week or two. Types of questions and information to gather in the survey: <ul style="list-style-type: none"> - Years of NICU experience - Comfort level (scale 1-10) in performing certain feeding interventions - Rating strongly agree → strongly disagree: I know what oral motor interventions are and how to implement them in patient care

		<ul style="list-style-type: none"> - Rating scale 1-10: Providing oral motor interventions in the NICU is important - Rating Rarely→Always: How often do you use oral motor interventions for feeding - Which oral motor interventions do you implement routinely in patient care? (List options to have staff check off) - Strongly agree → strongly disagree: Feeding interventions, including oral motor interventions, are a priority in my unit - Strongly agree → strongly disagree: My unit has the necessary supplies to provide oral motor interventions - Strongly agree → strongly disagree: I feel I have the necessary training to provide oral motor interventions - Barriers to providing oral motor interventions include... (list potential barriers for staff the check off, such as patient condition/acuity, lack of supplies, inadequate knowledge/skills, provider preference, inadequate training, time constraints, etc.)
--	--	--

External Information and Resources

Name of Information or Resource	Description of Information or Resource	Brief Summary of Focus of Learning
Articles that my mentor would like me to read	My mentor mentioned she will continue to send me various articles she would like me to read that pertain to my project.	The first article she sent me is on a quality improvement project to improve feeding outcomes in the NICU.

AOTA Hospital-Based Peds Community of Practice	The AOTA Communities of Practice (CoP) are a way to network and learn more about a specific setting of practice.	The Hospital-based pediatrics CoP is focused on children in acute care, addressing the challenges of working with this setting.
“Interventions to Improve Oral Feeding Performance of Preterm Infants”: Lau, C. (2014). Interventions to improve oral feeding performance of preterm infants. <i>Perspectives on Swallowing and Swallowing Disorders (Dysphagia)</i> , 23(1), 23-45.	This is a 23-page review on interventions to improve oral feeding in the NICU.	This summarizes development of oral feeding skills in infants, feeding issues they may face as preterm infants, and evidence-based interventions that can help facilitate transitions to oral feeding from tube feeding.

Part 7: SWOT Analysis: Strengths, Weaknesses, Opportunities, and Threats

Internal		External	
Strengths	Weaknesses	Opportunities	Threats
Staff willingness to discuss project with me and makes updates to current practices	Potential lack of time to train staff and implement pilot study to make recommendations	Advances in medical technology allow for greater advances in feeding practices	Cultural barriers and beliefs of patients that may impact the implementation of oral motor and feeding interventions
As a Level IV NICU, staff are competent and skilled to provide high levels of care for complex patients	Cannot require staff to fill out surveys or take the time for interviews or meetings	Connected with the University of Minnesota, opportunities for increased funding and assistance with research	With the advances in technology and premature infants born and surviving much earlier, some needs of these most young and vulnerable infants may not be addressed with practices being so new
Highly evidence-based and motivation to stay up to date on current practices for best care	Level of staff comfort/acceptance with changing to a new protocol for feeding	Increased NICU provider awareness of the importance of feeding and its impact on premature infant health and well-being and consequently	Research on oral motor skills and infant feeding, particularly in premature infants, is a relatively underdeveloped field of study

		length of stay in the NICU	
NICU has a current clinical feeding guideline to work off of for the updated guideline	The number of filled beds in the NICU has recently increased and therefore the NICU team has grown significantly in a short amount of time, leading to more potential for variability in skills and practices	Increased support for evidence-based therapy practices in NICUs over the past few years	Potential family or staff hesitancy toward the idea of providing hands-on physical interventions to such premature infants
Extremely interdisciplinary, all disciplines want to be on the same page, leading to less variability in care	Families and caregivers may not agree to their infants receiving pacifiers or oral motor interventions		

**Part 8: Preliminary Evidence Review on Populations, Interventions, and Programs of the
Organization/Community**

#1	Overview of Article
Type of article	Overall Type: Review of Research Specific Type: Quality Improvement Project Review
APA Reference	Osborn, E. K., & Jadcherla, S. R. (2022). Developing a Quality Improvement Feeding Program for NICU Patients. <i>NeoReviews</i> , 23(1), e23-e35. https://doi.org/10.1542/neo.23-1-e23
Abstract	“Practices in NICUs vary widely, particularly when clinical decisions involve complex tasks and multiple disciplines, which occurs with feeding preterm infants. Neonatal feeding difficulties in preterm infants often lead to prolonged tube feeding and therefore lengthened hospital stays. Education and compliance with evidence-based protocols and guidelines are needed on the initiation of feedings and feeding advancement to transform enteral and oral feeding practices and thus reduce practice variation and improve clinical outcomes” (p. e23).
Author	Credentials: MS, APRN, NNP-BC Position and Institution: Innovative Neonatal and Infant Feeding Disorders Research Program, Center for Perinatal Research, The Research Institute at Nationwide Children’s Hospital, Columbus, OH Publication History in Peer-Reviewed Journals: Limited (2 other articles). Second author has extensive publishing history
Publication	Type of publication: Scholarly peer-reviewed journal Publisher: NeoReviews Journal
Date and Citation History	Date of publication: 2022 Cited By: None (Recently published)
Stated Purpose or Research Question	“In this review, we provide an overview of the evidence that we incorporated into our feeding program’s guidelines to allow other units to establish a similar, but unit-specific, program” (p. e24).
Author’s Conclusion	“Consensus of care with evidence-based feeding guidelines can lead to improved clinical outcomes of infants in the NICU” (p. e32)
Overall Relevance to your Doctoral Capstone Project	Overall Relevance of Article: Good Rationale: Like this article, I will be implementing a quality improvement project in the NICU on feeding. The article discusses cue-based feeding, which is the type of feeding approach used in the UMMCH NICU. Additionally, like this article states, the UMMCH NICU has a steering committee, which the article states is an important part of a QI project. It also discusses the importance of establishing guidelines, which is what my project is on.
Overall Quality of Article	Overall Quality of Article: Good Rationale: It was recently published (2022) and from a peer-reviewed journal. The second author has extensive publishing history.
Your Focused Question and Clinical Bottom Line	<i>Question:</i> Do quality improvement feeding programs positively impact clinical outcomes of NICU patients? <i>Clinical Bottom Line:</i> Quality improvement feeding projects can lead to better quality of care in the NICU, such as less variability in care and better clinical outcomes, including decreased time to full enteral feedings, increased weight gain velocity, and decreased length of hospital stay (LOHS).

Your Lay Summary	This article looked at the evidence on the creation of a guide for feeding in the NICU. The article talked about current research on the best feeding interventions and how babies eat their food. When creating a guide for feeding for babies in the NICU, it is important to have a group of people that can oversee the project, a group of people who collect the data and educate the workers, and a group of people that put the guide into practice. It is also important to educate the workers every few months. This article is important as better guides for feeding can lead to better care for babies. The guides should be based on previous research and involve all workers who do feeding in the NICU.
Your Professional Summary	The purpose of this study was to provide an overview of evidence gathered to develop a feeding improvement protocol in the NICU. The study gave an overview of the research by discussing epidemiology and physiology-based feeding guidelines, the types of feeding and interventions at each stage, and the development of coordination of suck-swallow-breathing. The article also discussed the importance of establishing a steering committee, a core group, and feeding champions, along with implementing continued education. The article provides an in-depth evaluation of the creation of feeding guidelines and the importance of quality improvement in the NICU. Implications of the review include evidence-based guidelines in the NICU lead to greater clinical outcomes, feeding guidelines should be based on evidence, the development of a protocol requires the involvement of all stakeholders, dedication to tracking feeding milestones and compliance, and continuous education to caregivers and staff.

#2	Overview of Article
Type of article	Overall Type: Conceptual or Theoretical Article Specific Type: Narrative Review
APA Reference	Garber, J. (2013). Oral–motor function and feeding intervention. <i>Physical & Occupational Therapy in Pediatrics</i> , 33(1), 111-138. https://doi.org/10.3109/01942638.2012.750864
Abstract	“This article presents the elements of the Oral Motor Intervention section of the Infant Care Path for Physical Therapy in the Neonatal Intensive Care Unit (NICU). The types of physical therapy interventions presented in this path are evidence based as well as infant driven and family focused. In the context of anticipated maturation of suck–swallow–breathe coordination, the timing and methods for initiation of oral feedings and transition from gavage to full breast or bottle-feedings are presented with supporting evidence” (p. 111).
Author	Credentials: PT, MACT Position and Institution: Neonatal Special Care Nurseries, Emory University Hospital Midtown and Grady Memorial Hospital, School of Medicine Division of Physical Therapy, Emory University, Atlanta, Georgia, USA Publication History in Peer-Reviewed Journals: Limited
Publication	Type of publication: Scholarly peer-reviewed journal Publisher: Physical & Occupational Therapy in Pediatrics Journal
Date and Citation History	Date of publication: 2013 Cited By: 46
Stated Purpose or Research Question	“This article guides the reader through the elements of the Oral Motor Intervention section of the Infant Care Path for Physical Therapy in the Neonatal Intensive Care Unit” (p. 111)
Author’s Conclusion	“In conclusion, all of the interventions described in this article may be initiated by occupational, physical, or speech and language therapists but are selectively taught to parents who gradually assume all aspects of their infant’s care. Parents benefit from frequent and consistent practice nipple feeding their infant by bottle, breast, or both. Information gathered by interviews following discharge supports both the need for specific feeding-related content in pre-discharge teaching as well as the need for extended parental caregiving opportunities (Reyna et al., 2006). The more consistent the information and guidance the family receives from nursery staff members, the more secure and competent the parents feel at time of discharge” (p. 134).
Overall Relevance to your Doctoral Capstone Project	Overall Relevance of Article: Good Rationale: This article reviews physical therapy oral motor interventions in the NICU. The interventions are evidence-based and informed by infant-driven feeding, the kind of feeding framework I will use for my project.
Overall Quality of Article	Overall Quality of Article: Good Rationale: Published in the last 10 years, author has limited publication history
Your Focused Question and Clinical Bottom Line	<i>Question:</i> How do feeding skills develop in premature infants and what are the interventions to support their development? <i>Clinical Bottom Line:</i> Premature infants typically develop a functional, although immature, sucking pattern before they can coordinate the full sequence of feeding. A mixture of oral motor stimulation, nutritive and nonnutritive sucking, and other feeding practices can improve the development of feeding skills in premature infants.
Your Lay Summary	This article looked at different feeding interventions in the NICU and the way that babies develop feeding skills. It goes through the different stages of feeding and how premature babies can have difficulty feeding, especially if they have problems with their breathing. Premature

	babies often have a sucking pattern when they feed, but it is not fully developed. The article mentions that stimulation of cheeks and lips and practice sucking can help babies to gain more weight, leave the hospital earlier, and fully feed earlier.
Your Professional Summary	This article reviews the oral motor interventions in the Infant Care Path for Physical Therapy in the NICU, which corresponds with the elements of American Physical Therapy Association's <i>Guide to Physical Therapy Practice</i> . This article discusses the maturation of suck-swallow-breathe coordination, including the stages of development of those skills and the problems that can occur due to respiratory needs in premature infants. Premature infants typically develop a functional, although immature, sucking pattern before they can coordinate the full sequence of feeding. The review discusses the benefits of swaddled oral motor stimulation and nonnutritive sucking, including increased nipple feeding intake, increased weight gain, decreased LOS, and earlier competence with nipple feeding. The article ends by discussing the challenges of implementing clinical practice in the NICU, offering strategies to promote it, including bedside reference posters.

#3	Overview of Article
Type of article	Overall Type: Conceptual or Theoretical Article Specific Type: Narrative Review
APA Reference	Lau, C. (2015). Development of suck and swallow mechanisms in infants. <i>Annals of Nutrition and Metabolism</i> , 66(Suppl. 5), 7-14. https://doi.org/10.1159/000381361
Abstract	“Preterm infants’ hospital discharge is often delayed due to their inability to feed by mouth safely and competently. No evidence-based supported guidelines are currently available for health-care professionals caring for these infants. Available interventions advocating benefits are not readily acknowledged for lack of rigorous documentation inasmuch as any improvements may ensue from infants’ normal maturation. Through research, a growing understanding of the development of nutritive sucking skills has emerged, shedding light on how and why infants may encounter oral feeding difficulties due to the immaturity of specific physiologic functions. Unfortunately, this knowledge has yet to be translated to the clinical practice to improve the diagnoses of oral feeding problems through the development of relevant assessment tools and to enhance infants’ oral feeding skills through the development of efficacious preventive and therapeutic interventions. This review focuses on the maturation of the various physiologic functions implicated in the transport of a bolus from the oral cavity to the stomach. Although infants’ readiness for oral feeding is deemed attained when suck, swallow, and respiration are coordinated, we do not have a clear definition of what coordination implies. We have learned that each of these functions encompasses a number of elements that mature at different times and rates. Consequently, it would appear that the proper functioning of sucking, the swallow processing, and respiration need to occur at two levels: first, the elements within each function must reach an appropriate functional maturation that can work in synchrony with each other to generate an appropriate suck, swallow process, and respiration; and second, the elements of all these distinct functions, in turn, must be able to do the same at an integrative level to ensure the safe and efficient transport of a bolus from the mouth to the stomach” (p. 7).
Author	Credentials: PhD Position and Institution: Associate Professor of Pediatrics-Neonatology, Department of Pediatrics/Neonatology, Baylor College of Medicine, Houston, Tex., USA Publication History in Peer-Reviewed Journals: Extensive
Publication	Type of publication: Scholarly Peer-Reviewed Journal Publisher: Annals of Nutrition and Metabolism Journal
Date and Citation History	Date of publication: 2015 Cited By: 137
Stated Purpose or Research Question	“To better understand the complex interactions of all the above constituents, a ‘nutritive sucking pathway’ is proposed that encompasses two closely intertwined conduits with suck/pharyngeal swallow/respiration pertaining to safety and suck/pharyngeal swallow/esophageal activity pertaining to efficiency. The differentiation made between ‘swallow’ and ‘pharyngeal swallow’ in this context emphasizes the importance of the different phases of the swallowing process discussed below that are not routinely taken into consideration in clinical practice” (p. 8).
Author’s Conclusion	“This article offers a summary of our current understanding of the development of infant oral feeding skills. From the research presented, ‘readiness to oral feed’ may be better defined by the term ‘coordination of sucking, swallow processing, and respiration’ than ‘coordination of suck, swallow, and respiration’, as caregivers will be reminded of the negative impact that immature esophageal function can have. Indeed, the swallowing process does not only encompass the pharyngeal phase of swallowing, but also its oral and esophageal phases. As we now know that many components within each of these levels mature at different times and rates, unsafe and inefficient oral feeding may be caused at any or all levels of the nutritive

	sucking pathway. Such occurrences may be a reason why infants of similar GA and at similar postmenstrual age (PMA) demonstrate such wide variance in the maturation levels of their skills” (p. 13).
Overall Relevance to your Doctoral Capstone Project	Overall Relevance of Article: Good Rationale: This article discussed the development of oral feeding skills in infants and what “readiness to feed” means, which is helpful for my project as it will be necessary to have a thorough understanding of feeding development for my project.
Overall Quality of Article	Overall Quality of Article: Good Rationale: The article was published in the past 10 years, it has been cited by over 100 other studies, and the author has an extensive publishing history.
Your Focused Question and Clinical Bottom Line	<i>Question:</i> What does the maturation of feeding skills look like in infants and why is it difficult for premature infants to learn feeding? <i>Clinical Bottom Line:</i> Infants must coordinate sucking, swallow processing, and respiration in order to properly feed. While illness and conditions can impact feeding in premature infants, problems with feeding often result due to the continuously maturing physiologic function of the infant.
Your Lay Summary	This article looks at the different stages in eating in babies, including sucking, swallowing, and breathing. When babies are born too early, they can have problems with any parts of these stages. This is often because the babies have not physically matured in their abilities to complete these tasks. This article looks at each of the stages and how important it is that these stages work well together. Breathing is an important stage as it helps to make oral feeding safer. Premature infants often have breathing problems, which is a big reason they are unable to feed well. This article helps readers understand the physical issues to feeding in babies born early, which can help healthcare staff to develop better guides for interventions that are safe and helpful.
Your Professional Summary	This purpose of this article is to discuss the development of the “nutritive sucking pathway” in premature infants, which includes sucking, swallow processing, and respiration. Premature infants often have difficulty with feeding due to the immaturity of this pathway. The article discusses the development of each part of the pathway and how the sucking and swallowing must integrate well with the respiration in order to create coordinated and safe oral feeding for premature infants. This article helps to provide greater clarity on the mechanisms that underlie feeding in premature infants, which can help providers better develop interventions to enhance the safety and efficiency during oral feeding along with the development of more evidence-based feeding guidelines.

#4	Overview of Article
Type of article	Overall Type: Primary Research Study Specific Type: Randomized controlled trial
APA Reference	Younesian, S., Yadegari, F., & Soleimani, F. (2015). Impact of oral sensory motor stimulation on feeding performance, length of hospital stay, and weight gain of preterm infants in NICU. <i>Iranian Red Crescent Medical Journal</i> , 17(7). https://doi.org/10.5812/ircmj.17(5)2015.13515
Abstract	“Background: One of the limiting factors for early hospital discharge in preterm infants is their inability to feed sufficiently to obtain consistent weight gain. Therefore, feeding difficulty is one of the most significant issues with which a preterm infant is faced. Objectives: The purpose of this study was to examine the effect of oral sensory motor stimulation on feeding performance, length of hospital stay, and weight gain in preterm infants at 30 - 32 weeks of gestational age. Patients and Methods: Premature infants (n = 20) were randomly assigned to experimental and control groups. The experimental group received oral sensory motor stimulation of the oral structures (15 minutes / day) for 10 successive days, while these stimulations were not offered to the control group. Days elapsed to achieve oral feeding, length of hospital stay, and weight gain in the two groups were assessed. Results: Transition to oral feeding was acquired significantly earlier in the infants in the experimental group than in the controls: 13 and 26 days, respectively (P < 0.001). Likewise, the length of hospitalization was significantly shorter in the experimental group than in the control group: 32 days and 38 days, correspondingly (P < 0.05). The two groups showed no significant difference in terms of weight gain in the first, second, third, and fourth weeks of birth: first week: 100 vs. 110; second week: 99 vs. 111; third week: 120 vs. 135; and fourth week: 129 vs. 140. Conclusions: The present research revealed that the number of days to reach oral feeding in our preterm babies was decreased by oral motor stimulation, which in turn conferred earlier hospital discharge” (p. 1).
Author	Credentials: N/A Position and Institution: Department of Speech Therapy, School of Rehabilitation, University of Social Welfare and Rehabilitation Sciences, Iran Publication History in Peer-Reviewed Journals: moderate
Publication	Type of publication: Scholarly peer-reviewed journal Publisher: Iranian Red Crescent Medical Journal
Date and Citation History	Date of publication: 2015 Cited By: 52
Stated Purpose or Research Question	“The purpose of this study was to examine the effect of oral sensory motor stimulation on feeding performance, length of hospital stay, and weight gain in preterm infants at 30 - 32 weeks of gestational age” (p. 1).
Author’s Conclusion	“The present research revealed that the number of days to reach oral feeding in our preterm babies was decreased by oral motor stimulation, which in turn conferred earlier hospital discharge” (p. 1).
Overall Relevance to your Doctoral Capstone Project	Overall Relevance of Article: Good Rationale: This article directly addresses part of my doctoral project, as it examines the effectiveness of oral motor stimulation on feeding performance, length of stay, and weight gain in premature infants. I will be assessing the impact of oral motor stimulations and creating a guide based on outcomes we find.
Overall Quality of Article	Overall Quality of Article: Moderate Rationale: Published within the last 10 years, author has moderate publication history, credentials of the author are unavailable
Your Focused Question and Clinical Bottom Line	<i>Question:</i> What are the effects of oral motor stimulation on premature infants in the NICU? <i>Clinical Bottom Line:</i> Oral motor stimulation in premature infants leads to earlier discharge from the hospital and earlier achievement of full oral feeding.

Your Lay Summary	This study looked at the impact of oral motor interventions on premature infants' feeding performance, how long they stay in the hospital, and weight gain. 20 babies were included that were born at 32 weeks. 10 babies had oral motor stimulation for 10 days and 10 babies did not. Those babies who received it learned to eat earlier than those who did not. They also left the hospital earlier than those who did not. Weight gain was unchanged. This study shows that oral motor stimulation can positively impact health and feeding skills of babies in the NICU.
Your Professional Summary	The purpose of this study was to examine the effectiveness of oral motor interventions on feeding performance, length of stay in the hospital, and weight gain in premature infants (30-32 weeks of gestational age). 20 premature infants were randomly assigned to a control or experimental group. The infants in the experimental group received 10 days of 15-minute sensory motor stimulation of oral structures while the control group did not receive it. The infants in the experimental group achieved full oral feeding significantly earlier than infants in the control group and the length of hospital stay was also significantly less in the experimental group than control group. There were no differences in terms of weight gain. One strength of the study is that it used randomized groups. Weaknesses include a small sample size and using a convenience method of sampling. This study has implications for the type of interventions premature infants receive in the hospital. Routine oral motor stimulation may be beneficial for both the quality of life of infants and the financial and emotional burden on families, as it decreases time to full oral feeding and therefore the amount of time in the hospital.

#5	Overview of Article
Type of article	Overall Type: Primary Research Study Specific Type: Randomized clinical trial
APA Reference	Lessen Knoll, B. S., Daramas, T., & Drake, V. (2019). Randomized controlled trial of a prefeeding oral motor therapy and its effect on feeding improvement in a Thai NICU. <i>JOGNN: Journal of Obstetric, Gynecologic & Neonatal Nursing</i> , 48(2), 176–188. https://doi-org.pearl.stkate.edu/10.1016/j.jogn.2019.01.003
Abstract	“Objective: To evaluate the effect of the Premature Infant Oral Motor Intervention (PIOMI) on preterm newborns’ feeding efficiency and rates of improvement across Days 1, 3, and 5 of oral feeding in a Thai NICU. Design: Randomized controlled trial. Setting: A 20-bed special neonatal ward and 8-bed NICU in urban Thailand. Participants: Stable newborns (N=30) born between 26- and 34-weeks postmenstrual age (PMA) without comorbidities. Methods: After they reached 32 to 34 weeks PMA, participants were randomly assigned to groups. The experimental group (n/415) received the PIOMI once daily for 7 consecutive days, and the control group (n/415) received routine care only. After oral feedings were initiated, the mean volume (MV) of oral intake of two consecutive oral feedings was calculated on Days 1, 3, and 5 to assess feeding efficiency and compare the groups. Results: The MV of oral intake (percentage of prescribed feeding) was significantly greater in the experimental group versus the control group on all days of measurement. The MV consumed on Day 1 of oral feeding was 44.9%7.33% in the experimental group versus 29.7%9.55% in the control group (P<.001), 53.9%8.01% versus 30.4%11.07% on Day 3 (P<.001), and 61.7%7.44% versus 34.8%8.76 on Day 5 (P<.001). The rate of improvement was also accelerated in the intervention group. Conclusion: The improved feeding efficiency that we found in our participants is consistent with results from other published studies and supports the use of the PIOMI as an effective oral motor therapy for newborns ages 32 to 34 weeks PMA” (p. 176).
Author	Credentials: PhD, RN Position and Institution: Illinois Wesleyan University Publication History in Peer-Reviewed Journals: Extensive
Publication	Type of publication: Scholarly peer-reviewed journal Publisher: JOGNN - Journal of Obstetric, Gynecologic, and Neonatal Nursing
Date and Citation History	Date of publication: 2019 Cited By: 4
Stated Purpose or Research Question	“To evaluate the effect of the Premature Infant Oral Motor Intervention (PIOMI) on preterm newborns’ feeding efficiency and rates of improvement across Days 1, 3, and 5 of oral feeding in a Thai NICU” (p. 176).
Author’s Conclusion	“In this Thailand NICU and special neonatal ward, on Days 1, 3, and 5 of oral feeding, use of the PIOMI significantly increased the MV of oral intake for newborns who received the intervention compared with newborns who received routine NICU care. The newborns who received the PIOMI also showed greater gains of oral intake across all three measured feedings, resulting in a final MV by Day 5 of more than 60% gain compared with less than 35% gain in the control group newborns. The improved feeding efficiency for the preterm newborns who received the intervention in our study is consistent with results of other published studies on the PIOMI” (p. 186).
Overall Relevance to your Doctoral Capstone Project	Overall Relevance of Article: Good Rationale: This article directly relates to my project as it examines the impact of a specific oral motor intervention made for premature infants in the NICU. During my project, I may be using this method of stimulation.

Overall Quality of Article	<p>Overall Quality of Article: Good</p> <p>Rationale: The author has an extensive publication history, it is a randomized controlled trial, and has been published in the last 5 years.</p>
Your Focused Question and Clinical Bottom Line	<p><i>Question:</i> Does a specific oral motor stimulation intervention lead to greater feeding efficiency in newborn in the NICU?</p> <p><i>Clinical Bottom Line:</i> Oral motor interventions, such as the PIOMI, lead to significantly increased oral intake during feeding.</p>
Your Lay Summary	<p>This study looked at whether a specific oral motor intervention can help babies in the NICU learn to eat better. Infants who were born early, between 26-34 weeks, were assigned randomly into a group that did oral motor intervention and a group that did not. When infants in the experimental group reached 32-34 weeks, they had 5 minutes of oral stimulation for 7 days. On day 1, 3, and 5, researchers looked at how much milk or formula they were eating. The infants that had the intervention had greater intake of food compared to those that did not on days 1, 3, and 5. They also had a greater rate of improvement of feeding during those days. This study shows that simple oral motor stimulation for babies born early can lead to better eating and therefore better health outcomes.</p>
Your Professional Summary	<p>The purpose of this study was to examine whether an oral motor intervention, the Premature Infant Oral Motor Intervention, leads to greater feeding efficiency. The study randomly assigned 30 premature infants between the ages of 26-34 weeks to an experimental or control group. Between the ages of 32-34 weeks, the infants in the experimental group received the PIOMI once daily for 7 days, while the infants in the control group did not. During the 7 days, all infants' mean volume intake of fluids was assessed on days 1, 3, and 5. Infants in the experimental group had significantly greater oral intake than those who did not receive the intervention. Additionally, those who received the PIOMI had a greater rate of improvement across the three days compared to those in the control group. A strength of the study is only implementing the study between the ages of 32-34 weeks, random group assignment, and establishing intervention fidelity in another culture (ensuring proper translation, proper training). A potential limitation was the lack of data on formula vs. human milk used, as research has shown human milk can lead to greater developmental outcomes. This study reveals that oral motor interventions such as the PIOMI can lead to greater intake of milk and therefore greater feeding efficiency, and better health outcomes.</p>

#6	Overview of Article
Type of article	Overall Type: Primary Research Study Specific Type: Quality Improvement Project
APA Reference	Digal, K. C., Upadhyay, J., Singh, P., Shubham, S., Grover, R., & Basu, S. (2021). Oral care with mother's own milk in sick and preterm neonates: a quality improvement initiative. <i>The Indian Journal of Pediatrics</i> , 88(1), 50-57. https://doi.10.1007/s12098-020-03434-5
Abstract	“Objective: Oral care with mother’s own milk (OC-MOM) in sick and preterm neonates provides immune protection, improves feed tolerance and helps in earlier achievement of full enteral nutrition. This quality improvement (QI) initiative was undertaken when authors documented scanty awareness regarding neonatal oral care practices among caregivers in their neonatal unit. The project aimed to improve the proportion of OC-MOM in sick and preterm neonates from the baseline of 5.9% to 80%. Methods: The QI project was designed as per Point of Care Quality Improvement (POCQI) model and conducted over 6 mo (January 14, 2019 to July 12, 2019). Preterm and sick term neonates on enteral fasting or gavage feeding were included. Neonates with major congenital malformation and whose MOM was not available were excluded. An OC-MOM team was formed and baseline data were collected. Flow charts and fish-bone diagrams were used to analyse the problem and identify the key issues. Mouth assessment tool (MAT) was customized and adapted as one of the outcome measures. An OC-MOM protocol was designed and implemented as a part of routine neonatal care. Results: Four Plan-Do-Study-Act (PDSA) cycles were conducted to achieve the target. After successful implementation of OC-MOM protocol, proportion of neonates receiving OC-MOM increased to 83.3% from a baseline of 5.9% and proportion of neonates having MAT score “0” improved to 94.4% from a baseline of 24.4%. Conclusions: This QI initiative using POCQI model resulted in a significant and sustained improvement in the proportion of neonatal oral care with MOM using locally available resources” (page numbers not indicated).
Author	Credentials: DM Neonatology Position and Institution: All India Institute of Medical Sciences Rishikesh Publication History in Peer-Reviewed Journals: Moderate
Publication	Type of publication: Scholarly peer-reviewed journal Publisher: Indian Journal of Pediatrics
Date and Citation History	Date of publication: 2021 Cited By: 3
Stated Purpose or Research Question	“This quality improvement (QI) initiative was undertaken to consolidate the practice of oral care and improve the proportion of OC-MOM among eligible neonates admitted in authors’ NICU” (page numbers not indicated).
Author’s Conclusion	“This QI initiative using the POCQI model resulted in significant and sustained improvement in the proportion of oral care with MOM with the locally available resources in a NICU setup. A marked improvement in oral hygiene was also noted with this initiative” (page numbers not indicated).
Overall Relevance to your Doctoral Capstone Project	Overall Relevance of Article: Good Rationale: This article is a QI project, similar to my project, that examines the impact of using mother’s own milk to improve feeding skills in premature infants. For my project, I will be looking at the impact of using mother’s milk during our oral motor interventions.

Overall Quality of Article	Overall Quality of Article: Good Rationale: The article was published in the last year in a scholarly peer-reviewed journal.
Your Focused Question and Clinical Bottom Line	<i>Question:</i> Can using a mother's own milk during oral cares improve oral health and feeding outcomes in infants in the NICU? <i>Clinical Bottom Line:</i> Using mother's own milk in the NICU with premature infants can improve their MAT (Mouth Assessment Tool) score, which has positive impacts on oral cavity health and oral feeding.
Your Lay Summary	This study looked at how a quality improvement project on using the milk from mothers can improve the health of babies' mouths in the NICU. The project was completed over 6 months. 146 babies were included in the study. Data on mouth health was collected by using a tool that examines the appearance of lips, tongue, gums, etc. Data was collected before starting the project and data was collected after the project ended. The number of babies receiving mother's milk increased to 83.3% from 5.9% after the project and the percentage of babies with a good MAT score improved to 94.4% from 24.4%. This shows that mothers milk can improve baby's health in the NICU, which can lead to greater oral health and better overall health, feeding tolerance, and achievement of feeding.
Your Professional Summary	The purpose of this quality improvement study was to examine the effectiveness of using oral care with mother's own milk (OC-MOM) on neonatal oral care and improve the proportion of OC-MOM among eligible neonates to 80%. This project was a Point of Care Quality Improvement Project conducted over 6 months. The Mouth Assessment Tool (MAT) was used as criterion for oral cavity appearance. Baseline data was collected, the protocol was implemented as part of routine care, and then neonates were assessed post-implementation. 146 neonates enrolled. The proportion of neonates receiving OC-MOM increased to 83.3% from a baseline of 5.9% and they percentage of neonates with a good MAT improved to 94.4% from a baseline of 24.4%. This has implications for the kind of routine care neonates receive in the NICU. Having greater oral cavity health is related to better immunity, feeding tolerance, and achievement of full oral feeding.

#7	Overview of Article
Type of article	Overall Type: Review of Research Study Specific Type: Scoping Review
APA Reference	Lubbe, W. (2018). Clinicians guide for cue-based transition to oral feeding in preterm infants: An easy-to-use clinical guide. <i>Journal of evaluation in clinical practice</i> , 24(1), 80-88. https://doi.org/10.1111/jep.12721
Abstract	“Rationale, aims and objectives: This article aims to provide evidence to guide multidisciplinary clinical practitioners towards successful initiation and long-term maintenance of oral feeding in preterm infants, directed by the individual infant maturity. Method: A comprehensive review of primary research, explorative work, existing guidelines, and evidence-based opinions regarding the transition to oral feeding in preterm infants was studied to compile this document. Results: Current clinical hospital practices are described and challenged and the principles of cue-based feeding are explored. “Traditional” feeding regimes use criteria, such as the infant’s weight, gestational age and being free of illness, and even caregiver intuition to initiate or delay oral feeding. However, these criteria could compromise the infant and increase anxiety levels and frustration for parents and caregivers. Cue-based feeding, opposed to volume-driven feeding, lead to improved feeding success, including increased weight gain, shorter hospital stay, fewer adverse events, without increasing staff workload while simultaneously improving parents’ skills regarding infant feeding. Although research is available on cue-based feeding, an easy-to-use clinical guide for practitioners could not be found. A cue-based infant feeding regime, for clinical decision making on providing opportunities to support feeding success in preterm infants, is provided in this article as a framework for clinical reasoning. Conclusions: Cue-based feeding of preterm infants requires care providers who are trained in and sensitive to infant cues, to ensure optimal feeding success. An easy-to-use clinical guideline is presented for implementation by multidisciplinary team members. This evidence-based guideline aims to improve feeding outcomes for the newborn infant and to facilitate the tasks of nurses and caregivers” (p. 80).
Author	Credentials: PhD, MTech, BCur Honors, B Soc Sc Position and Institution: Associate Professor, School of Nursing Science, INSINQ, North-West University (Potchefstroom Campus), South Africa Publication History in Peer-Reviewed Journals: Extensive
Publication	Type of publication: Peer-reviewed journal Publisher: Journal of evaluation in clinical practice
Date and Citation History	Date of publication: 2018 Cited By: 57
Stated Purpose or Research Question	“Therefore, a need was identified to explore the evidence to support a good clinical regime to guide the transition to the oral feeding process on the basis of the infant’s maturity and abilities, while providing the caregiver with measurable milestones to progress through the transition process” (p. 81).
Author’s Conclusion	“Transition from gavage to oral feeding in preterm infants based on infant maturity may result in more successful oral feeding with less energy expenditure, higher rates of success, and even better parental functioning. Clear, evidence-based guidelines should be available for the healthcare professional/care giver to enable effective assessment of infant maturity and readiness for oral feeding. Clear recommendations must be available to healthcare professionals to direct the transition process ensuring optimal feeding success. Findings portrayed in this article should be summarized in the for-mat of an informational pamphlet understandable by mother and infant caregivers” (p. 86).
Overall Relevance to	Overall Relevance of Article: Good

your Doctoral Capstone Project	Rationale: This purpose of this article is creating evidence-based guidelines for oral feeding in premature infants, focusing on cue-based feeding guidelines that also include oral motor stimulation. This article is helpful as I think about the guidelines I will be creating for oral motor stimulation, which will include a cue-based feeding approach.
Overall Quality of Article	Overall Quality of Article: Good Rationale: This article was published in the last 5 years, the author has extensive publishing history, and it is from a peer-reviewed journal.
Your Focused Question and Clinical Bottom Line	<i>Question:</i> What should be included in oral feeding clinical guidelines for premature infants in the NICU? <i>Clinical Bottom Line:</i> Oral feeding guidelines should include information on cue-based feeding, positive oral stimulation, nonnutritive sucking, proper pacifiers, transitioning to oral feeding/readiness to feed, safety measures, and guidelines for feeding after discharge.
Your Lay Summary	This study reviews the research on different practices for feeding premature infants in the NICU. Authors looked at different evidence, including research studies, current guides, and evidence-based opinions. Results found that best practice is cue-based feeding, providing practice sucking, and stimulation of infant mouths and cheeks. These practices can lead to shorter time in the hospital, more weight gain, and better eating overall.
Your Professional Summary	This article reviews the necessary evidence for clinical guidelines on oral feeding in premature infants in the NICU. Authors reviewed evidence from a variety of sources, including primary research, exploratory research, existing guidelines on the subject, and evidence-based opinions. Results of the review found that evidence is showing a change from volume-driven feeding to cue-based feeding, along with a focus on nonnutritive sucking and oral motor stimulation. Outcomes associated with these practices include shorter length of hospital stay, increased weight gain, and improved feeding success overall. This article provided a framework on cue-based feeding, including oral motor stimulation, for providers to use as a framework. This review has implications for the types of routine feeding care in the NICU, and can lead to less variability in care and better outcomes for infants.

#8	Overview of Article
Type of article	Overall Type: Review of Research Study Specific Type: Systematic Review and Meta-Analysis
APA Reference	Chen, D., Yang, Z., Chen, C., & Wang, P. (2021). Effect of oral motor intervention on oral feeding in preterm infants: A systematic review and meta-analysis. <i>American Journal of Speech-Language Pathology</i> , 30(5), 2318-2328. https://doi.org/10.1044/2021_AJSLP-20-00322
Abstract	“Objective: This review article aimed to explore the effect of oral motor intervention on oral feeding in preterm infants through a meta-analysis. Method: Eligible studies were retrieved from four databases (PubMed, Embase, Cochrane Library, and Web of Science) up to July 2020 and screened based on established selection criteria. Thereafter, relevant data were extracted and heterogeneity tests were conducted to select appropriate effect models according to the chi-square test and I ² statistics. Assessment of risk of bias was performed among the included studies. Finally, a meta-analysis was carried out to evaluate the effect of oral motor intervention in preterm infants according to four clinical indicators: transition time for oral feeding, length of hospital stay, feeding efficiency, and weight gain. Results: Eighteen randomized controlled trials with 848 participants were selected to evaluate the effect of oral motor intervention on preterm infants. The meta-analysis results revealed that oral motor intervention could effectively reduce the transition time to full oral feeds and the length of hospital stay as well as increase feeding efficiency and weight gain. Conclusions: Oral motor intervention was an effective way to improve oral feeding in preterm infants. It is worthy to be used widely in hospitals to improve the clinical outcomes of preterm infants and reduce the economic burdens of families and society. Future studies should seek to identify detailed intervention processes and intervention durations for clinical application” (p. 238).
Author	Credentials: Not able to find

	<p>Position and Institution: Department of Rehabilitation Medicine, The Seventh Affiliated Hospital, Sun Yatsen University, Shenzhen, China</p> <p>Publication History in Peer-Reviewed Journals: Extensive</p>
Publication	<p>Type of publication: Peer-reviewed journal</p> <p>Publisher: American Journal of Speech-Language Pathology</p>
Date and Citation History	<p>Date of publication: 2021</p> <p>Cited By: 3</p>
Stated Purpose or Research Question	<p>“This review article aimed to explore the effect of oral motor intervention on oral feeding in preterm infants through a meta-analysis” (p. 2318).</p>
Author’s Conclusion	<p>“In conclusion, OMI could effectively reduce the transition time and length of hospital stay and increase feeding efficiency and weight. It is worth applying in hospitals to promote oral feeding. To investigate the impact of OMI on preterm infants, more high-quality and large-scale trials are needed” (p. 2327).</p>
Overall Relevance to your Doctoral Capstone Project	<p>Overall Relevance of Article: Good</p> <p>Rationale: This article is relevant to my project as it looks specifically at oral motor interventions in the NICU and their impact on feeding outcomes, which is what I will be doing as part of my project.</p>
Overall Quality of Article	<p>Overall Quality of Article: Good</p> <p>Rationale: This article was published in the last year in a peer-reviewed journal, is a systematic review of evidence, and the author’s publication history is extensive.</p>
Your Focused Question and Clinical Bottom Line	<p><i>Question:</i> How do oral motor interventions effect the quality of life of infants in the NICU?</p> <p><i>Clinical Bottom Line:</i> Oral motor interventions can decrease the transition time for oral feeding and length of hospital stay and increase feeding efficiency and weight gain.</p>
Your Lay Summary	<p>This article reviewed studies that implemented oral motor interventions and their impact on eating skills for babies in the NICU. All of the articles were chosen based on specific standards. 18 articles were found that met the standards. It was found that oral motor interventions in the 18 studies reduced transition time to eating by breast or bottle and the length of time in the hospital. They also increased weight gain in the babies and increased the efficiency of the babies’ eating. This study shows that oral motor interventions should be included as routine care in the NICU. These interventions can lead to better health and quality of life for the babies and their families.</p>
Your Professional Summary	<p>This systematic review and meta-analysis examined the effects of oral motor interventions (OMI) on oral feeding skills of premature infants in the NICU. Articles were retrieved from several different databases and were then screened based on specific criteria based on population, intervention, outcomes, and study design. All studies included were premature infants, the studies compared oral motor interventions with routine care or sham stimulation, outcomes included length of stay, feeding efficiency, weight gain, or other indicators related to oral feeding, and all studies were randomized controlled trials. 18 studies met inclusion criteria. A meta-analysis was completed on outcomes. Results found that oral motor interventions can reduce the transition time to full oral feeding and length of hospital stay and increase weight gain and feeding efficiency. Limitations include only reviewing articles in English and small sample sizes. One strength includes only using randomized controlled trials. This study reveals that oral motor interventions should be routine care in the NICU, as they can lead to better health outcomes and quality of life for NICU infants and their families.</p>

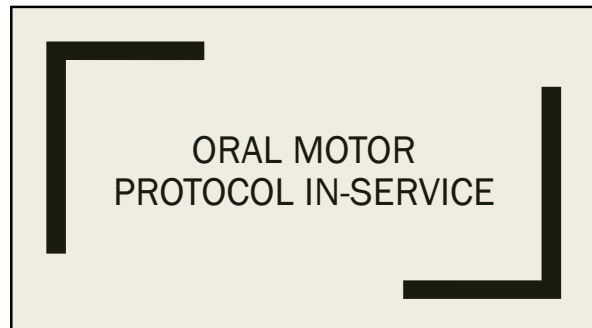
#9	Overview of Article
Type of article	Overall Type: Review of Research Study Specific Type: Critical Review
APA Reference	Ziadi, M., Héon, M., & Aita, M. (2016). A critical review of interventions supporting transition from gavage to direct breastfeeding in hospitalized preterm infants. <i>Newborn and Infant Nursing Reviews</i> , 16(2), 78-91. http://dx.doi.org/10.1053/j.nainr.2016.03.013
Abstract	“Even though direct breastfeeding holds many benefits for preterm infants, the transition from gavage to direct breastfeeding remains suboptimal in this population. Failing this transition can contribute to an early cessation of direct breastfeeding and jeopardize the preterm infants’ growth and development. Preterm infants could benefit from interventions that promote the transition to direct breastfeeding and thus facilitate this challenging step. This review identifies and analyzes interventions classified in four categories: non-nutritive sucking (NNS) and oral stimulation, promotion of direct breastfeeding experience and avoidance of bottles, cue-based feeding approach, and exposure to human milk odor. All of these interventions improved the preterm infants’ sucking competency, decreased their hospitalization length or increased the breastfeeding rates at discharge. NNS and oral stimulation, and promotion of direct breastfeeding experience and avoidance of bottles are the interventions with the highest evidence level, with the most potential for NICU implementation” (p. 78).
Author	Credentials: RN, MSc Position and Institution: Faculty of Nursing, University of Montréal. Publication History in Peer-Reviewed Journals: Limited
Publication	Type of publication: Peer-reviewed journal Publisher: Newborn and Infant Nursing Reviews
Date and Citation History	Date of publication: 2016 Cited By: 10
Stated Purpose or Research Question	“The aim of this manuscript is to offer a critical review by identifying and analyzing these interventions and their effects on the transition to direct breastfeeding in preterm infants” (p. 78).
Author’s Conclusion	“The aim of this review was to identify and analyze interventions that. promote the transition from gavage to direct breastfeeding in preterm infants hospitalized in the NICU. Even though the review identified only a limited number of research studies, the interventions brought positive benefits for preterm infants during the transition from gavage to direct breastfeeding, such as higher breastfeeding rates at discharge, an acceleration of the transition to direct breastfeeding, and a decrease of the length of hospitalization. Among the identified interventions, NNS and oral stimulation, as well as the promotion of direct breastfeeding and avoidance of bottles, were the interventions with the highest level of evidence” (p. 90).
Overall Relevance to your Doctoral Capstone Project	Overall Relevance of Article: Moderate Rationale: This article reviewed the various interventions that can improve the transition to breastfeeding in premature infants in the NICU, including oral motor stimulation. While some of the mothers I work with may not be breastfeeding, it provides a good overview of OMI benefits.
Overall Quality of Article	Overall Quality of Article: Good Rationale: This article was published in the last 10 years, the author has a limited publishing history, and it included all types of studies, not just RCTs
Your Focused Question and	<i>Question:</i> What interventions promote the transition to full oral feeding in premature infants, particularly to breastfeeding?

Clinical Bottom Line	<i>Clinical Bottom Line:</i> Nonnutritive sucking and oral motor stimulation can promote the transition to breastfeeding in the NICU.
Your Lay Summary	This article reviewed other studies looking at premature infants in the NICU and their ability to move from tube feeding to breastfeeding. Authors looked at different types of interventions and their impact on feeding outcomes. 14 studies were found that addressed this topic. Interventions found in the studies include: practice sucking without milk volume/oral stimulation, avoidance of bottles, feeding based on baby cues, and being exposed to human milk. Outcomes included better sucking ability, less time in the hospital, greater breastfeeding rates. This study shows the importance of using evidence-based practices to improve feeding outcomes, particularly for moms who want to breastfeed after leaving the NICU.
Your Professional Summary	The purpose of this review was to examine the types of interventions that can help premature infants transition from gavage feeding to breastfeeding while in the NICU. Authors searched for studies in different databases and found 14 that addressed interventions promoting transition from gavage to breastfeeding. Interventions found were classified into four different categories: non-nutritive sucking (NNS) and oral stimulation, promotion of direct breastfeeding experience and avoidance of bottles, cue-based feeding approach, and exposure to human milk odor. These interventions led to greater sucking competency, less hospital time, and greater breastfeeding rates by discharge. One limitation was the inability to decipher the exact methods of feeding in the studies (many studies lacked clarity on whether babies transitioned directly to breastfeeding or not). A strength was that it looked exclusively at three feeding outcomes to maintain consistency across study findings. This article has implications for the interventions given to premature infants in the NICU.

#10	Overview of Article
Type of article	Overall Type: Review of Research Study Specific Type: meta-analysis
APA Reference	Tian, X., Yi, L. J., Zhang, L., Zhou, J. G., Ma, L., Ou, Y. X., ... & Song, G. M. (2015). Oral motor intervention improved the oral feeding in preterm infants: evidence based on a meta-analysis with trial sequential analysis. <i>Medicine</i> , 94(31). https://doi.org/10.1097/MD.0000000000001310
Abstract	“Oral feeding for preterm infants has been a thorny problem worldwide. To improve the efficacy of oral feeding in preterm infants, oral motor intervention (OMI), which consists of nonnutritive sucking, oral stimulation, and oral support, was developed. Published studies demonstrated that OMI may be as an alternative treatment to solve this problem; however, these results remain controversial. We conducted a meta-analysis with trial sequential analysis (TSA) to objectively evaluate the potential of OMI for improving the current status of oral feeding in preterm infants. A search of PubMed, EMBASE, Web of Science, the Cochrane Library, and China National Knowledge Infrastructure was performed to capture relevant citations until at the end of October 2014. Lists of references of eligible studies and reviews were also hand-checked to include any latent studies. Two independent investigators screened literature, extracted data, and assessed the methodology, and then a meta-analysis and TSA was performed by using Reviewer Manager (RevMan) 5.3 and TSA 0.9 beta, respectively. A total of 11 randomized controlled trials (RCTs), which included 855 participants, were incorporated into our meta-analysis. The meta-analyses suggested that OMI is associated with the reduced transition time (ie, the time needed from tube feeding to totally oral feeding) (mean difference [MD],4.03; 95% confidence interval [CI],5.22 to2.84), shorten hospital stays (MD,3.64; 95% CI,5.57 to1.71),increased feeding efficiency (MD, 0.08; 95% CI, 0.36–1.27), and intake of milk (MD, 0.14; 95% CI, 0.06–0.21) rather than weight gain. Results of TSA for each outcomes of interest confirmed these pooled results. With present evidence, OMI can be as an alternative to improve the condition of transition time, length of hospital stays, feeding efficiency, and intake of milk in preterm infants. However, the pooled results may be impaired due to low quality included, and thus, well-designed and large RCTs were needed to further established effects” (p. 1).
Author	Credentials: MN, RN Position and Institution: Tianjin University, RN Publication History in Peer-Reviewed Journals: Extensive
Publication	Type of publication: Peer-reviewed scholarly journal Publisher: Medicine Journal
Date and Citation History	Date of publication: 2015 Cited By: 31
Stated Purpose or Research Question	“We conducted a meta-analysis with trial sequential analysis (TSA) to objectively evaluate the potential of OMI for improving the current status of oral feeding n preterm infants” (p. 1).
Author’s Conclusion	“In conclusion, OMI can effectively improve the condition of transition time, LOS, feeding efficiency, and intake of milk, so it is worthy to be used widely in hospitals to improve the clinical outcomes of preterm infants. While RCTs with large-scale and high-quality based on RIS are warranted to further investigate the effectiveness of OMI for weight gain and may explore whether it has the potential for other variable on preterm infants such as later growth and development” (p. 9).
Overall Relevance to your Doctoral Capstone Project	Overall Relevance of Article: Good Rationale: This article discusses the benefits and outcomes associated with oral motor intervention in the NICU, and the kinds of interventions and practices that lead to positive outcomes. This has implications for the kinds of interventions and practices that are important to address when educating NICU staff.

Overall Quality of Article	Overall Quality of Article: Good Rationale: It has been published in the last 10 years, it is from a peer-reviewed journal, it is a meta-analysis, and the author has an extensive publication history.
Your Focused Question and Clinical Bottom Line	<i>Question:</i> An oral motor stimulation improve feeding performance in premature infants? <i>Clinical Bottom Line:</i> Oral motor stimulation can improve feeding performance, along with hospital length of stay, and transition time to full oral feeding.
Your Lay Summary	This article reviewed evidence on oral motor interventions and their impact on feeding for babies born early in the NICU. Authors reviewed 11 randomized studies. It was found that oral motor interventions can reduce the time needed for babies to be able to eat on their own, can reduce time in the hospital, and increase the amount of milk during eating. This study shows that oral motor stimulation can be a beneficial intervention for babies in the NICU and can improve feeding outcomes.
Your Professional Summary	This meta-analysis examined whether oral motor intervention (OMI) can improve feeding performance in preterm infants in the NICU. A search of databases was conducted and a total of 11 randomized controlled trials fit inclusion criteria. The studies found that OMI is associated with reduced transition to full oral feeding, a shorter length of stay in the hospital, increased feeding efficiency and greater intake of milk. One limitation is that the study left out several databases that may have relevant sources, thereby leading to incomplete retrieval of studies. Additionally, only English and Chinese studies were included. One strength is that this review examined studies with the highest level of evidence, randomized-controlled trials. This study has implications for including oral motor interventions in care of premature infants in the NICU.

Appendix C: Training Presentations



1

Protocol Overview

- Stimulation of five major areas: **TMJ, cheeks, lips, gumline, hard palate**
- Oral motor stimulation on infants in the NICU can:
 - Activate muscle contraction and increase strength for oral feeding
 - Trigger activation of other muscles responsible for head and neck control, improving overall motor function
 - Help to normalize the sensation in the face by restoring reflexes to elicit normal active movements of facial structures for development of suck and swallow

2

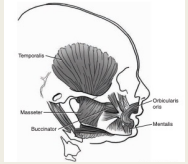
Standardized and structured OMI protocols in NICUs

- Evidence shows that structured protocols:
 - Reduce oral hypersensitivity
 - Improve the strength, ROM, and coordination needed for sucking
 - Increase neurobehavioral organization of sucking
 - Activate the reflexes necessary to facilitate nutritive sucking for oral feeding
 - Increase volume intake during feeding, feeding efficiency, and weight gain
 - Decrease time from gavage to oral feeding
 - Decrease length of stay
- Created to fit the needs of the UMMCH NICU, including the many premature infants who require pulmonary support during the time oral motor interventions would typically begin

3

Why chose to target these areas


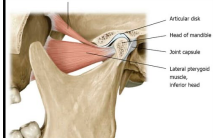
- Superficial muscles and joint to easily facilitate, particularly for infants on pulmonary support
 - TMJ, masseter, buccinator, orbicularis oris, mentalis, suprahyoid muscles
- Muscles and joints that infants need to activate for breast AND bottle feeding
- Intraoral stimulation that allows for increased tongue movement
 - Gumlines and hard palate



Facial muscles involved in feeding

4

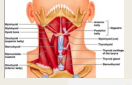


Step 1: TMJ

- **WHAT:** Input in front of the ear through facilitation of the Temporomandibular Joint (TMJ)
- **WHY:**
 - Connects the lower jawbone to the temporal bone of the skull
 - Sliding ball and socket joint that works with the muscles surrounding the joint to control mandible position and the opening and closing of the mouth
 - Important for oral feeding, as it supports the mandible to move forward and up to latch to breast or bottle
 - Gentle input to the TMJ can help stimulate synovial fluid, improve jaw mobility, and prepare baby for mouth opening and closing
- **HOW:** Place finger in front of ear and gently apply pressure in downward circular motion with finger to each side of mandible

5

Step 2: CHEEKS (technique 1)

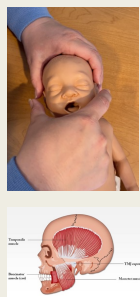





- **WHAT:** Stimulation of lower cheek/jawline and under the chin
- **WHY:**
 - **Masseter**
 - Responsible for mandibular elevation and protrusion/retraction
 - Masseter facilitation in a parallel and perpendicular fashion can help to bring the jaw forward and up and promote lip seal required for oral feeding
 - **Suprahyoid muscle group (including digastric muscles)**
 - Critical for pulling the mandible down and the hyoid bone up to intensify sucking pressure, as well as stabilizing the hyoid bone during swallowing, protecting the airway
- **HOW:** Gently stroke from the TMJ down along the jawline and under the chin

6

Step 2: CHEEKS (technique 2)


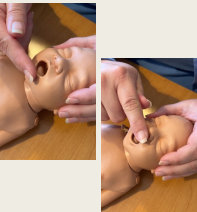
- WHAT:** Stimulation of middle cheek
- WHY:**
 - Improve ROM and strength of the cheeks through facilitation of the buccinator muscles
 - Full-term infants typically have fat pads, which guard against collapse of cheeks when the oral cavity is enlarged by tongue depression and provide lateral support to tongue to keep it in midline for sucking
 - Preterm infants often do not have fully formed fat pads. Facilitation of buccinator muscles in preterm infants can help strengthen the cheeks to better compress them to make contact between the nipple and cheeks during feeding, promoting lip seal
- HOW:** Gently stroke from the TMJ across the middle cheek to the side/opening of the mouth.

7

Step 3: LIPS

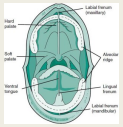
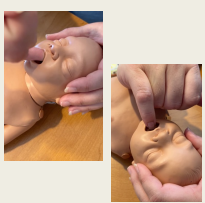
- WHAT:** Gentle stretches of the upper and lower lips.
- WHY:**
 - Facilitation of orbicularis oris muscle can improve lip ROM and strength to close the mouth together
 - Partial contraction of this muscle helps to maintain lip seal on bottle or breast. Stretching under the lip also facilitates the mentalis muscle of the chin, which helps to elevate and protrude the lower lip during oral feeding
- HOW:** Place finger horizontally on outside of upper lip. Gently compress and stretch by bringing finger down toward mouth. Repeat for lower lip by placing finger horizontally under the lip and stretch upward.

8

Step 4: GUMLINE



- WHAT:** Stimulation of the upper and lower gumlines
- WHY:**
 - Facilitates tongue movement, as the tongue should come up to the finger and follow the finger movement along the gumline
 - When outer gum ridge is stroked from midline to right or left, this helps the infant with the ability to lateralize their tongue
 - Stroking of the upper gumline facilitates tongue elevation, which is required to create positive pressure when compressing the nipple against the hard palate to expel liquid into the oral cavity
 - Technique can promote improved tongue ROM and strength, improved sucking, and stimulate swallowing.
- HOW:** Place finger on midline of upper gums and roll finger back to alveolar ridge. Baby should lift tongue to finger. If baby lifts tongue: proceed inside mouth and with firm, sustained pressure, move from midline along the upper gum line to the left side, then bring over to right side. Repeat for lower gumline.

9

Step 5: HARD PALATE

- WHAT:** Stimulation of the hard palate behind the gumline
- WHY:**
 - The tongue is the main active organ involved in swallowing
 - Like the gumline, stimulation of the hard palate contributes to improved ROM and strength of the tongue through tongue elevation and lateralization, which promotes improved sucking and swallowing
 - Providing sustained input to the midline of the palate first before moving along the gumline allows the infant to respond to the sustained pressure with their tongue and build the strength required to express milk from the nipple
- HOW:** Place pad of finger on hard palate at midline and sustain gentle pressure for 3 seconds. Move to the left of midline, back to midline, and then to the right.

10


Recommendations

- When moving infant skin, the recommendation is 3cm for every 10 seconds
- Provide less repetitions and slow movement to allow for sensory adaptation
- A general guideline is five strokes per area, but read baby's cues
- Follow with non-nutritive sucking to promote activation of soft palate and work on organizing infant's sucking after muscle activation!

11

QI Study

- Looking for everyone to submit patients on caseload that meet inclusion criteria
- Inclusion criteria
 - 20-30 premature infants, 26-32 weeks
 - Any pulmonary support
- Exclusion criteria
 - NPO between 32 and 36 weeks
- Tracker sheet to track variables (type of pulmonary support interface, how they performed, etc.)
- Data analysis on these variables and other variables on flowsheet to monitor short and long term outcomes, including oral feeding readiness
- Use data and other components (survey, focus group, etc.) to update guidelines



12

References

- Berth, M., Poon, E., Jorde, J., Walker, W., & Laurits, A. (2014). Effects of pre-feeding oral stimulation on oral feeding in preterm infants: a randomized clinical trial. *Early human development*, 95(3), 125-130.
- Capobianco, G. J., Cunningham, T., Freeman, C., Sutton-Brantingham, E., Dines, N., & Butterfield, T. A. (2014). Comparison of tongue muscle characteristics of preterm and full-term infants during nutritive and non-nutritive sucking. *Motor Behavior and Development*, 37(3), 425-440.
- Capobianco, G. J., Cunningham, T. J., Remback, B. R., & Wells, L. L. (2011). Real time analysis of sucking waveform to assess oral feeding practice and improve patient care outcomes. *International Journal of Nursing Health Care and Research*, 4, 1-7. <http://www.ijnhc.com/abstracts/ijnhc-4-1-1-7>
- Capobianco, G. J., Cunningham, T. J., Gannon, P. J., & Greer, D. (2015). A comparison of the nutritive sucking performance of full-term and preterm neonates at hospital discharge: a prospective study. *Early Human Development*, 134, 28-30. <http://dx.doi.org/10.1016/j.earlhumdev.2015.07.004>
- Kenny, M., Barlow, S. W., Verghese, R., Froom, D., & Lee, J. (2008). Non-nutritive suck parameters in preterm infants with RDS. *Journal of Neonatal Nursing*, 14(1), 28-34. <http://dx.doi.org/10.1016/j.jnn.2007.09.001>
- French, E. C., Swain, C. B., Anglin, V. C., & Capra, L. B. (2014). Electromyographic analysis of tracheal muscle in newborns during suction in breast, bottle or cup feeding. *BMC pregnancy and childbirth*, 14(1), 1-7. <http://dx.doi.org/10.1186/s12884-014-0140-4>
- Fuchs, P., Oweh, E., & Liu, C. (2000). Oral stimulation accelerates the transition from tube to oral feeding in preterm infants. *The Journal of pediatrics*, 141(2), 230-236. <http://dx.doi.org/10.1054/jped.2000.36349>
- Geddes, D. T., & Sawada, V. S. (2016). Ultrasound imaging of breastfeeding—a window to the inside: methodology, normal appearance, and application. *Journal of Human Lactation*, 32(2), 340-349. <http://dx.doi.org/10.1177/0890019315601400>
- Genov, C. W. (2016). Supporting sucking skills in breastfeeding infants. *James & Bartlett Learning*.
- Genov, C. F., Tracta, E., Murad, E., & Paboussi, C. R. (2006). Surface electromyography of facial muscles during natural and artificial feeding of infants. *Journal de pediatria*, 82, 103-109. <http://dx.doi.org/10.1016/j.jped.2006.03.004>
- Lee, C. (2012). Development of suck and swallow mechanisms in infants. *Annals of Harbor and Mecklenburg*, 65(Suppl. 5), 7-14. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3400007/>
- Leson-Kroff, R. S., DeSarna, T., & Clark, V. (2019). Randomized controlled trial of a prefeeding oral motor therapy and its effect on feeding improvement in a Thai NICU. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, 48(2), 174-188. <http://dx.doi.org/10.1016/j.jogn.2018.09.004>
- Martensson, M., & Hove, M. (2019). A comparison of the movement of the mandible in infants between breastfeeding and bottle-feeding. *Journal of Nursing Science and Engineering*, 6(2), 54-62. <http://dx.doi.org/10.1016/j.jnse.2019.03.001>
- DeBarn, E. K., & Juchacz, S. B. (2022). Developing a quality improvement feeding program for NICU patients. *NurseWaves*, 23(5), 423-424. <http://www.nursewaves.com/10.1016/j.nursewaves.2022.05.001>
- Nussbaum, S., Yabger, F., & Salzman, T. (2013). Impact of oral sensory motor stimulation on feeding performance, length of hospital stay, and weight gain of preterm infants in NICU. *Iranian Red Crescent Medical Journal*, 17(1). <http://dx.doi.org/10.5812/ircmj.12443>

13

PACIFIERS

1

- ## BENEFITS OF PACIFIERS
- Suck Central Power Generator (sCPG) controls NNS
 - Specialized network of interneurons that produce rhythmic motor patterns
 - Oral mechanoreceptors on the tongue and lip encode information
 - Sensory input can sequence and activate motor neurons to produce patterns that allow for quick adaptation to changes in task dynamics, such as mechanical properties of a nipple or bolus volume
 - Infants who engage in NNS earlier tend to
 - Develop organized sucking behaviors earlier
 - Better maturation and growth
 - Improved vital signs
 - Improved gastric motility
 - Reduced time to oral feedings
 - Decreased stress, and enhanced state control

2

PACIFIER PROPERTIES AND BENEFITS OF SOOTHIE PACIFIERS

- Pacifier properties can impact NNS characteristics, including NNS amplitude, NNS burst number, and NNS structure

Properties		
Smoothness	Stiffness/pull and compression (squeeze) integrity	Shape
Smooth pacifiers, like Soothie pacifiers, are preferred over textured pacifiers	Durable silicone, but not too stiff, as more compliant pacifiers allow for more rigorous sucking which enhances NNS amplitude	Cylindrical shape encourages tongue cupping

3

- ## PACIFIERS AND OT ORAL MOTOR PROTOCOL
- **Wee Thumbie**
 - Modeled after preemie thumb to facilitate sucking behaviors
 - For very low birth weight babies, typically **under 30 weeks**
 - Able to use with intubated infants as nipple has bulb and then thins to support space for ET tube
 - We will use this pacifier for all intubated babies and babies under 30 weeks, or if baby has chin strap and is unable to fit Wee Soothie in mouth
 - May use with infants over 30 weeks if they do not demonstrate ability to advance
 - **Wee Soothie**
 - Advance babies to Wee Soothie with non-intubated babies **over 30 weeks**
 - However, this varies based on infant factors, such as oral cavity structure, mouth opening, vertical gap
 - Might need suck on pacifier while doing protocol (extubated infants, infants who need calming sensory input during intervention)



4

- ## CHARTING AND BILLING
- Blue sticky notes
 - "OT Oral Motor Protocol"
 - Within the NNS flowsheet section
 - Insert comment under Intervention: "OT Oral Motor Protocol" and mention it in the NNS open-ended comment section.
- Example:**
 "OT: Infant continues with oral intubation, conv vent and Neobar for securement device. Therapist provided OT Oral Motor Protocol, advanced to use of Wee Thumbie pacifier and infant demo active rooting, latch and NNS at 2-3 sucks per burst with emerging quiet/alert state and high SpO2"


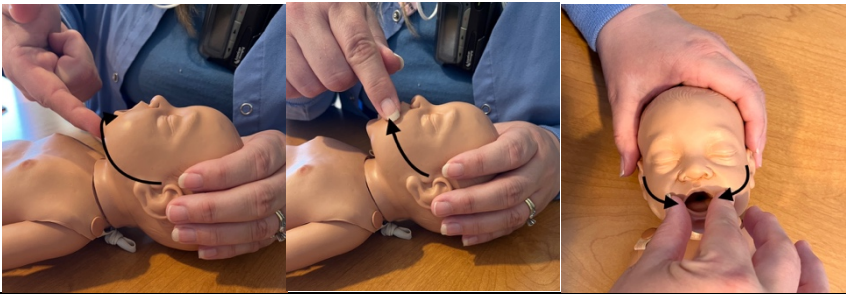

5



REFERENCES

- Calik, C., & Esenyi, F. (2019). The clinical effect of pacifier use on orogastric tube-fed preterm infants: A randomized controlled trial. *J Pak Med Assoc*, 69(6), 771-4. <https://www.jpma.org.pk/PdfDownload/9183>
- Kaya, V., & Aytelkin, A. (2017). Effects of pacifier use on transition to full breastfeeding and sucking skills in preterm infants: a randomised controlled trial. *Journal of Clinical Nursing*, 26(13-14), 2055-2063. <https://doi.org/10.1111/jocn.13617>
- Tesini, D.A. (2022). Design, sizing, and ergonomics of infant pacifiers: A biometric basis for pacifier fit. *pediatric nursing*, 46(1), 36-41. <https://www.proquest.com/openview/8257f3cd92c1238879f982df575abcfd/1?pq-origsite=scholar&cbi=47659>
- Tonkin, S. L., Lui, D., McIntosh, C. G., Rowley, S., Knight, D. B., & Gunn, A. J. (2007). Effect of pacifier use on mandibular position in preterm infants. *Acta Paediatrica*, 96(10), 1433-1436. <https://doi.org/10.1111/j.1651-2227.2007.00444.x>
- Ziegler, A., Maron, J. L., Barlow, S. M., & Davis, J. M. (2020). Effect of pacifier design on nonnutritive suck maturation and weight gain in preterm infants: A pilot study. *Current Therapeutic Research*, 93, 100617. <https://doi.org/10.1016/j.curtheres.2020.100617>
- Zimmerman, E., & Barlow, S. M. (2008). Pacifier stiffness alters the dynamics of the suck central pattern generator. *Journal of Neonatal Nursing*, 14(3), 79-86. <https://doi.org/10.1016/j.jnn.2007.12.013>
- Zimmerman, E., Forlano, J., & Gouldstone, A. (2017). Not all pacifiers are created equal: a mechanical examination of pacifiers and their influence on suck patterning. *American Journal of Speech-Language Pathology*, 26(4), 1202-1212. https://doi.org/10.1044/2017_AJSLP-16-0226

6

Appendix D: Protocol Handouts

STEPS	TECHNIQUE	PURPOSE	DEMO PHOTO
TMJ	Facilitate the TMJ by gently applying pressure in downward circular motion with finger to each side of mandible.	Stimulate synovial fluid, improve jaw mobility, release tension, and prepare baby for mouth open and close.	
Cheeks	<p>First: Gently stroke from the TMJ down along the jawline and under the chin.</p> <p>Second: Gently stroke from the TMJ across the buccinator muscle to the side/opening of mouth.</p>	<p>Masseter facilitation in parallel and perpendicular fashion for mandibular elevation to promote lip seal; facilitation of suprahyoid muscles to promote mandible movement and stabilization of hyoid bone for swallowing. Buccinator facilitation to improve ROM and strength of cheek muscles to promote lip seal.</p>	
Lips	Place finger horizontally on outside of upper lip. Gently compress and stretch by bringing finger down toward mouth. Repeat for lower lip.	Facilitation of orbicularis oris muscle to improve lip ROM and strength to close mouth together. Partial contraction of the orbicularis oris helps to maintain lip seal around the nipple.	

Gums	<p>Place finger on midline of upper gums and roll finger back to alveolar ridge. Baby should lift tongue to finger.</p> <p>If baby lifts tongue: proceed inside mouth and with firm, sustained pressure, move from midline along the upper gum line to the left side; then bring over to right side. Repeat for lower gumline.</p>	<p>Stroking of gumline promotes tongue elevation and lateralization. This technique can promote improved tongue ROM and strength, improved sucking, and stimulate swallowing.</p>	
Palate	<p>Place pad of finger on hard palate at midline and sustain gentle pressure for 3 seconds. Move to the left and then to the right.</p>	<p>Similar to facilitation of the gumline, this also promotes tongue elevation. In sucking, the tongue must elevate to compress the nipple against the hard palate, creating positive pressure to expel liquid into the oral cavity and propel it to the back of the mouth.</p>	

* Follow with non-nutritive sucking

General considerations:

- When moving infant skin, the recommendation is 3cm for every 10 seconds
- Provide less repetitions and slow movement to allow for sensory adaptation
- A general guideline is five strokes per area, but read baby's cues

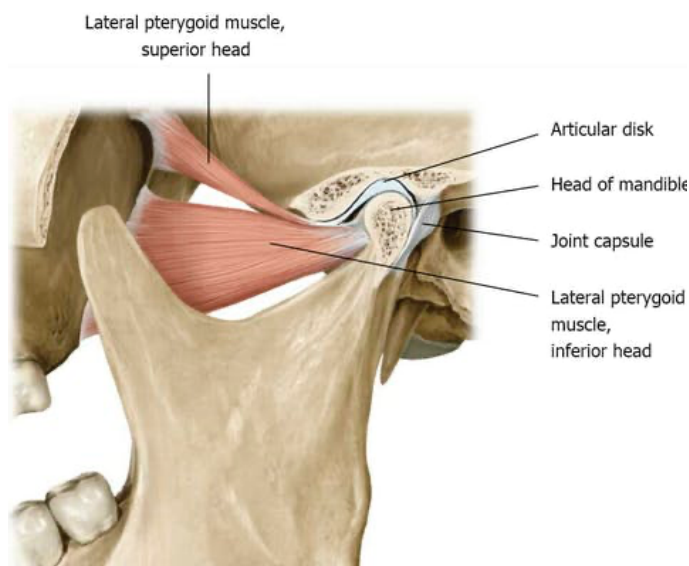
ORAL MOTOR PROTOCOL

Step 1: Temporomandibular Joint (TMJ)

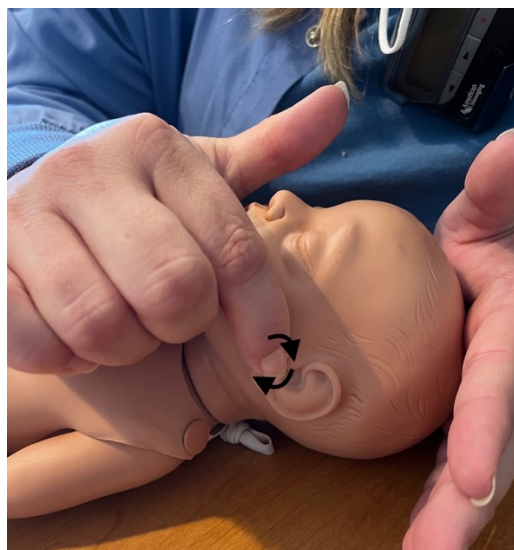
WHAT: Input in front of the ear through facilitation of the Temporomandibular Joint (TMJ).

WHY: The TMJ connects the lower jawbone to the temporal bone of the skull. It is a sliding ball and socket joint that works with the muscles surrounding the joint to control mandible position and the opening and closing of the mouth. The TMJ is important for oral feeding, as it supports the mandible to move forward and up to latch to breast or bottle. Gentle input to the TMJ can help stimulate synovial fluid, improve jaw mobility, and prepare baby for mouth opening and closing.

HOW: Place finger in front of ear and gently apply pressure in downward circular motion with finger to each side of mandible.



<https://mskneurology.com/true-cause-solution-temporomandibular-dysfunction-tmd/>



ORAL MOTOR PROTOCOL

Step 2: Cheeks

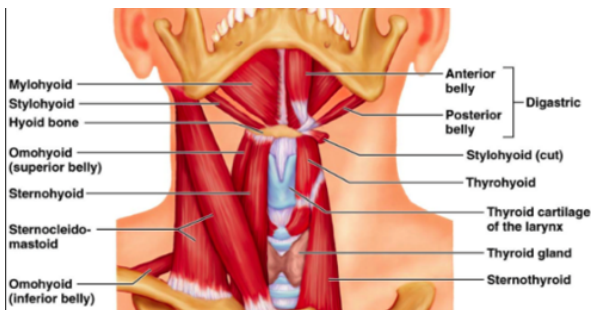
TECHNIQUE 1

WHAT: Stimulation of lower cheek/jawline and under the chin

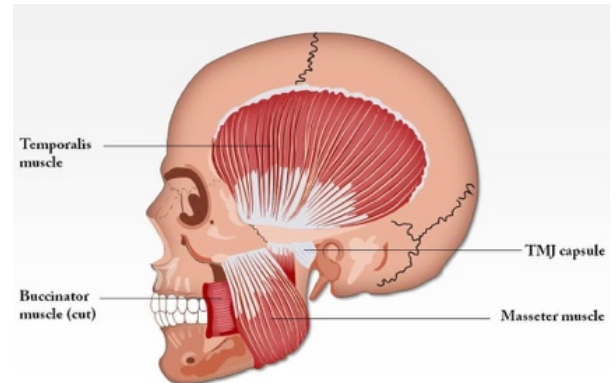
WHY: The lower cheeks include the *masseter muscle*, which is responsible for mandibular elevation and protrusion/retrusion. Masseter facilitation in a parallel and perpendicular fashion can help to bring the jaw forward and up and promote lip seal required for oral feeding. This muscle is necessary for breast and bottle feeding, and especially for breast feeding due to the amount of mandible elevation needed.

Under the chin is the suprahyoid muscle group, including the two digastric muscles stimulated in this technique. They are critical for pulling the mandible down and the hyoid bone up to intensify sucking pressure, as well as stabilizing the hyoid bone during swallowing, protecting the airway.

HOW: Gently stroke from the TMJ down along the jawline and under the chin.



<https://quizlet.com/216005845/35-suprahyoid-and-infrahyoid-muscles-flash-cards/>



<http://what-when-how.com/dental-anatomy-physiology-and-occlusion/the-temporomandibular-joints-teeth-and-muscles-and-their-functions-dental-anatomy-physiology-and-occlusion-part-3/>

TECHNIQUE 2

WHAT: Stimulation of middle cheek

WHY: This technique helps to improve ROM and strength of the cheeks through facilitation of the Buccinator muscles. Full-term infants typically have fat pads, which guard against collapse of cheeks when the oral cavity is enlarged by tongue depression and provide lateral support to tongue to keep it in midline for sucking. Preterm infants often do not have fully formed fat pads. Facilitation of buccinator muscles in preterm infants can help strengthen the cheeks to better compress them to make contact between the nipple and cheeks during feeding, promoting lip seal.

HOW: Gently stroke from the TMJ across the middle cheek to the side/opening of the mouth.



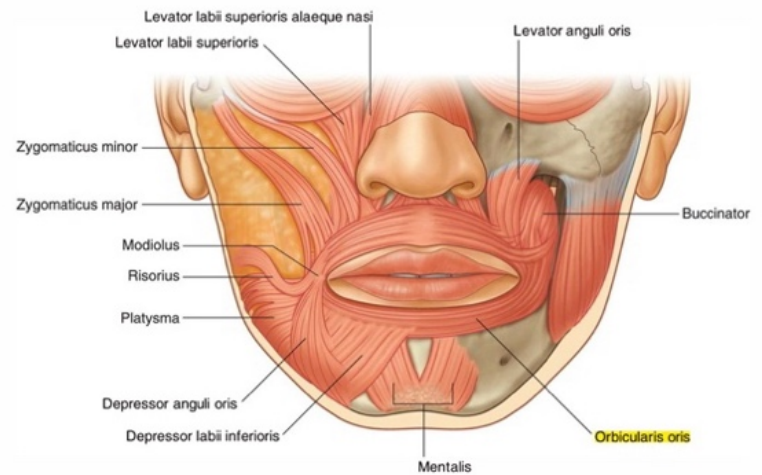
ORAL MOTOR PROTOCOL

Step 3: UPPER AND LOWER LIPS

WHAT: Gentle stretches of the upper and lower lips.

WHY: The muscle around the lips is the orbicularis oris. Facilitation of orbicularis oris muscle can improve lip ROM and strength to close the mouth together. Partial contraction of this muscle helps to maintain lip seal on bottle or breast.

Stretching under the lip also facilitates the mentalis muscle in the chin, which helps to elevate and protrude the lower lip during oral feeding.



<https://www.earthslab.com/anatomy/orbicularis-oris/>

HOW: Place finger horizontally on outside of upper lip. Gently compress and stretch by bringing finger down toward mouth. Repeat for lower lip by placing finger horizontally under the lip and stretch upward.

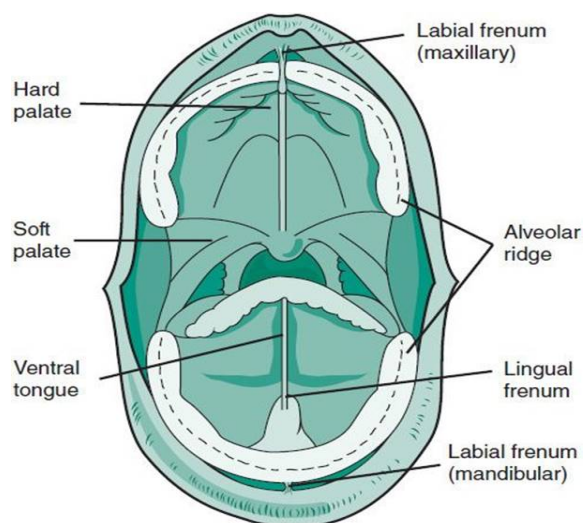


ORAL MOTOR PROTOCOL

Step 4: UPPER AND LOWER GUMLINES

WHAT: Stimulation of the upper and lower gumlines

WHY: Providing input to the upper and lower gumlines facilitates tongue movement, as the tongue should come up to the finger and follow the finger movement along the gumline. When the outer gum ridge is stroked from midline to right or left, this helps the infant with the ability to lateralize their tongue. Stroking of the upper gumline facilitates tongue elevation, which is required to create positive pressure when compressing the nipple against the hard palate. This technique can promote improved tongue ROM and strength, improved sucking, and stimulate swallowing.



<https://doctorlib.info/pediatric/diagnosis/18.html>

HOW: Place finger on midline of upper gums and roll finger back to alveolar ridge. Baby should lift tongue to finger. If baby lifts tongue: proceed inside mouth and with firm, sustained pressure, move from midline along the upper gum line to the left side; then bring over to right side. Repeat for lower gumline.



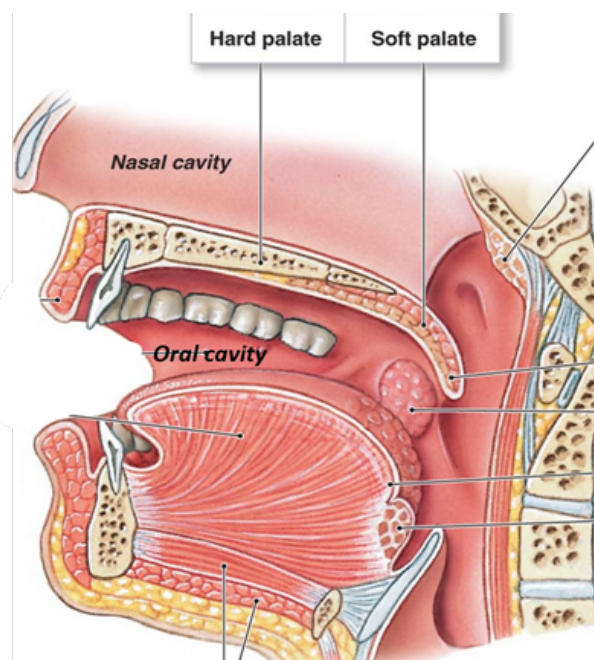
ORAL MOTOR PROTOCOL

Step 5: HARD PALATE

WHAT: Stimulation of the hard palate behind the gumline.

WHY: The tongue is the main active organ involved in swallowing. Similar to the gumline, stimulation of the hard palate contributes to improved ROM and strength of the tongue, which promotes improved sucking and swallowing. In sucking, the tongue must elevate to compress the nipple against the hard palate, creating positive pressure to expel liquid into the oral cavity and propel it to the back of the mouth. Providing sustained input to the midline of the palate before moving along the gumline allows the infant to respond to the sustained pressure with their tongue and build the strength required to express milk from the nipple.

HOW: Place pad of finger on hard palate at midline and sustain gentle pressure for 3 seconds. Move to the left of midline, back to midline, and then to the right.



Appendix E: Clinical Guidelines

M Health: University of Minnesota Masonic Children’s Hospital

Neonatal Intensive Care Unit (NICU): Occupational Therapy Department

Clinical Guideline: Oral motor interventions including manual stimulation, non-nutritive suck (NNS), and oral cares

Table of Contents

Overview	2
Rationale	2
Developmental considerations.....	3
Indications	3
Contraindications.....	3
Staff training	3
Assessment.....	4
Treatment.....	4
Oral motor protocol for premature infants.....	5
Protocol Steps	6
General protocol considerations	8
Precautions and considerations based on respiratory interface.....	8
Frequency	9
Advancing an infant to a pacifier	9
Oral cares/drops of milk.....	10
Oral motor skills and speech	11
References	12

Overview

This clinical guideline provides information for occupational therapists on the assessment and treatment of oral motor skills for infants in the NICU. It has been developed based on an extensive review of literature and evidence-based practices on oral motor development, oral motor interventions, and pre-feeding skills, as well as a quality improvement project within the UMMCH NICU.

Goal: To provide safe evidence-based oral motor interventions that support the neurodevelopment of oral motor skills, improve breast- and bottle-feeding outcomes, and promote positive feeding experiences for premature and medically compromised infants.

Rationale

Premature infants can be born before their sucking mechanism is fully developed. In addition, their oral motor musculature can be hypotonic secondary to underdevelopment, placing them at high risk for developmental delay with the maturation of the suck swallow breathe (SSB) mechanism. These immature patterns can significantly influence their future feeding abilities and put them at higher risk for oral aversion and oral motor and swallow dysfunction.

Critically ill term infants often have a significant history of oral intubation, medical complications, sedation, and immobility. These factors can affect the ability of the infant to reflexively activate their sucking pattern. The co-morbidities of their medical condition can lead to poor oral motor skills for management of their secretions, alterations in oral motor anatomy, poor pharyngeal development, and high risk for aspiration.

Utilizing an occupation-based frame of reference, the occupational therapists in the NICU will create a personalized oral motor stimulation program for each infant to reduce the risk of developmental delay. This program will also take into consideration the medical complications (oral intubation, anatomical anomalies) surrounding oral motor skills and be modified to meet the needs of these infants.

Improved development of oral motor skills and pre-feeding skills can promote more successful and functional bottling experiences as well as nuzzling experiences at breast that promote let down, milk production, and increase bonding for maternal mental health.

Sources: Capilouto et al. (2014); Gonzalez et al. (2021); Greene et al. (2017); Lau (2015); UC San Diego Health SPIN program

Developmental considerations

- 4-8 weeks: structures of swallowing begin to develop
- 9-12 weeks gestation: initial development of in-utero sucking reflex, hard and soft palate, pharyngeal swallow is developing
- 17 weeks: Beginning to swallow amniotic fluid
- 26-29 weeks: Primitive reflexes begin (gagging, phasic biting)
- 28 weeks: maturation of SSB coordination, but preferred elevation/depression of mandible
- 32-34 weeks: maturation of SSB to allow for fluid introduction
- 36 weeks: protective cough matures

Sources: Chen et al. (2021); Lau (2015); Stumm et al. (2007)

Indications

- Premature infants prior to 34 weeks gestation (prior to oral feeding)
- Infants indicating dysfunctional sucking, swallowing, and breathing coordination, regardless of gestational age
- Infants intubated greater than 72 hours
- OG placement greater than 72 hours
- Anatomical anomalies of the face, intra-oral region, peri oral region, neck, GI system

Contraindications

- For intubated infants: Endotracheal tube (ETT) is not secure
- Physiological instability (apnea episodes during routine cares, etc.)
- Unstable facial integrity

Staff training

- Clinicians have completed the NICU competency, including reading evidence-based practice guidelines, observations of staff, supervised interventions, and return-demonstration of skills to validator. These skills can include, but not limited to: Beckman Protocol and Premature Infant Oral Motor intervention (PIOMI), Rona Alexander, Catherine Shaker, sensory interventions, manual therapy, etc.
- Clinicians have been trained in the updated premature infant oral motor protocol described in this guideline, developed through a Summer 2022 quality improvement project.

Assessment

1. Assess oral anatomy including palpation of hard palate, tone assessment of masseter, orbicularis oris, buccinators, and tongue, TMJ mobilization for excursion; monitor preferred tongue positioning; vertical gapping
2. Consider positioning of the infant
 - Supine: Gives the therapist the most accurate assessment of oral motor skills, as the effects of gravity are not reduced on either side of the mouth
 - Side lying: Reduces the effects of gravity and reduces activation of orbicularis oris
 - Supported upright: Will increase infant effort as they will need to isometrically sustain pacifier in mouth with orbicularis oris
 - Prone: Provides positive impact on respiratory mechanics, including improved oxygenation, more consistent breathing patterns, and increased tongue extension
3. Use of oral motor readiness assessment with gloved finger, elicit lingual cupping and sucking to gloved finger
4. Provide external cues as needed for appropriate seal, chin/cheek support or traction
5. Advance infant to pacifier (per parent consent)
6. Facilitate mandibular motion for protraction and retraction of jaw with limited elevation and depression of jaw. Ensure activation of buccinators and orbicularis oris
7. Document number of sucks per breath, vitals, and accuracy of movement pattern
8. Monitor infant management of secretions during swallow and blanching of lips when sucking on pacifier or gloved finger
9. Monitor infant for signs of stress and watch vital signs

Sources: Capilouto et al. (2014); Capilouto et al. (2021); Queensland Clinical Guidelines (2020), Yi et al. (2018)

Treatment

Oral motor stimulation, or the stroking and/or pressure applied to structures in and around the mouth, helps to activate muscle contraction and increase strength for oral feeding, trigger activation of other muscles responsible for head and neck control, and help to normalize the sensation in the face by restoring reflexes to elicit normal active movements of facial structures for development of suck and swallow. For premature infants, evidence demonstrates that 5-10 minutes of oral stimulation of the facial structures five times per week can:

- Reduce oral hypersensitivity
- Increase the organization of sucking
- Activate the reflexes necessary for oral feeding


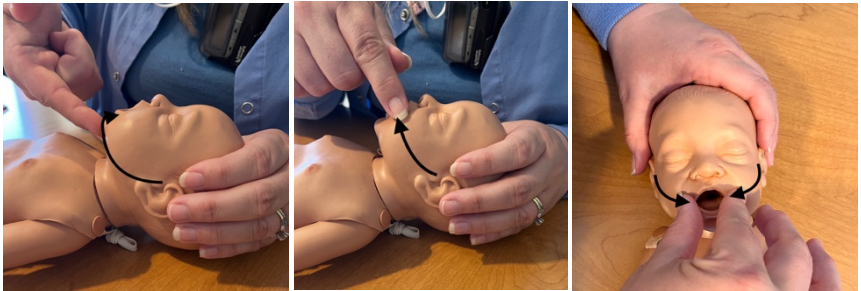
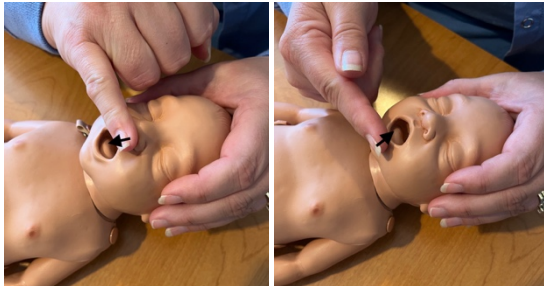
- Increase feed efficiency and volume intake during feeding
- Increase weight gain
- Decrease time from gavage to oral feeding
- Decrease length of stay



Sources: Aguilar-Rodríguez (2020); Bache et al. (2014); Chen et al. (2021); Fucile et al. (2002); Greene et al. (2017); Lessen Knoll et al. (2019); Rodríguez Gonzalez et al. (2021); Younesian (2015)

Oral motor protocol for premature infants

This protocol has been modified from evidence-based manual therapy protocols and techniques to fit the needs and routines of the University of Masonic Children's Hospital NICU. Techniques include modification for invasive and non-invasive pulmonary support devices. It involves stimulation of five major areas: temporomandibular joint, cheeks, lips, gumline, and hard palate. Provide the following oral motor stimulation with gloved finger for 5-10 minutes, as tolerated, ending with non-nutritive sucking for at least 2 minutes.

Protocol Steps

STEPS	TECHNIQUE	PURPOSE	DEMO PHOTO
TMJ	Facilitate the TMJ by gently applying pressure in downward circular motion with finger to each side of mandible.	Stimulate synovial fluid, improve jaw mobility, release tension, and prepare baby for mouth open and close.	
Cheeks	<p>First: Gently stroke from the TMJ down along the jawline and under the chin.</p> <p>Second: Gently stroke from the TMJ across the buccinator muscle to the side/opening of mouth.</p>	<p>Masseter facilitation in parallel and perpendicular fashion for mandibular elevation to promote lip seal; facilitation of suprahyoid muscles to promote mandible movement and stabilization of hyoid bone for swallowing.</p> <p>Buccinator facilitation to improve ROM and strength of cheek muscles to promote lip seal.</p>	
Lips	Place finger horizontally on outside of upper lip. Gently compress and stretch by bringing finger down toward mouth. Repeat for lower lip.	Facilitation of orbicularis oris muscle to improve lip ROM and strength to close mouth together. Partial contraction of the orbicularis oris helps to maintain lip seal around the nipple.	

Gums	<p>Place finger on midline of upper gums and roll finger back to alveolar ridge. Baby should lift tongue to finger.</p> <p>If baby lifts tongue: proceed inside mouth and with firm, sustained pressure, move from midline along the upper gum line to the left side; then bring over to right side. Repeat for lower gumline.</p>	<p>Stroking of gumline promotes tongue elevation and lateralization. This technique can promote improved tongue ROM and strength, improved sucking, and stimulate swallowing.</p>	
Palate	<p>Place pad of finger on hard palate at midline and sustain gentle pressure for 3 seconds. Move to the left and then to the right.</p>	<p>Similar to facilitation of the gumline, this also promotes tongue elevation. In sucking, the tongue must elevate to compress the nipple against the hard palate, creating positive pressure to expel liquid into the oral cavity and propel it to the back of the mouth.</p>	

*** Follow oral motor protocol with NNS for at least 2 minutes with gloved finger or pacifier**

General protocol considerations

- When moving infant skin, the recommendation is 3cm for every 10 seconds
- Provide less repetitions and slow movement to allow for sensory adaptation
- A general guideline is five strokes per area, but read baby's cues, consider positioning of the infant, and monitor vital signs
- If possible, begin session with lower extremity interventions, move to upper extremities and end with the face so that the infant can get used to progressive touch
- If emesis or gagging, proceed cautiously with intraoral stimulation
- Proceed cautiously with H-taping, ensure ETT is fully secured

Precautions and considerations based on respiratory interface

- CPAP with prongs or mask:
 - Assess for skin integrity and monitor for pressure injuries
 - Focus on stimulation of TMJ, cheeks (below buccinator straps), chin, lower lips, hard palate
 - Stimulate upper lip if area if possible, depending on mask or prong placement and size of baby's philtrum
 - Ensure mouth closure during perioral stimulation and lip seal during intraoral and pacifier use to reduce leakage of air and to maintain functional residual capacity (FRC) and physiological stability
 - Consider use of chin strap in collaboration with nursing if infant unable to maintain mouth closure
 - Closely monitor vital signs
- Intubated with NeoBar:
 - Protection of the securement device is critical
 - Ask RN how secure the tube is and check stability (do not provide manual therapy techniques if ETT is not secured well)
 - Ensure there is no water in tubing
 - Is the tube located high or low in the mouth?
 - Keep static hand on cranium of infant and on hydrocolloid adhesive of NeoBar. The warmth of the therapist's hands help to activate the adhesive, working as a protective strategy to maintain stability of ETT
 - Focus on perioral stimulation of TMJ and soft tissues of cheek, chin, and lower lips while supporting the hydrocolloid dressing
 - If infant demonstrates good vertical gap, therapist may offer Wee Thumbie pacifier (take off outer plastic part to ensure proper fit under ETT)

- Following extubation, therapists should focus more on facilitation of the upper gumline and hard palate and advance pacifier
 - Perform intraoral anatomical assessment, including assessing mild, moderate, or severe intubation ridge, seal, lip and tongue movements, and determine appropriate pacifier
 - Pacifier: Assess seal, integrity needed, gagging and retching, motor movements
- Closely monitor vital signs
- RAM Cannula
 - Ensure that the infant's neck is in good flexion, as the pressure of the securement bead on RAM cannula at C1 can cause hyperextension
 - Closely monitor vital signs
 - Monitor blanching of nares
 - Work on lip seal
- Tracheostomy tube
 - Protocol should be completed in supine until first tube change
 - Higher risk for gagging and retching after intubation for so long
 - Closely monitor vital signs and need for suctioning of tracheostomy tube

Sources: Estep et al. (2008); Queensland Clinical Guidelines (2020)

Frequency

- Determine frequency per infant cues and needs, but generally:
 - Premature infants 26-29 weeks: 3-4x per week
 - Premature infants 30 weeks until orally feeding: 4-5x per week
 - If infant demonstrates dysfunction and inability to manage and swallow secretions, increase frequency
 - Premature infants that are orally feeding: prior to bottle or breast if needed and during feeds if sucking is disorganized

Advancing an infant to a pacifier

Non-nutritive sucking is one of the earliest developed motor reflexes and is controlled by the CPGs (suck central power generator), a specialized network of interneurons that produce rhythmic motor patterns. Oral mechanoreceptors on the tongue and lip encode information used by the infant to modulate the timing and magnitude of sCPG output. Sensory input can

sequence and activate motor neurons to produce patterns that allow for quick adaptation to changes in the environment or task dynamics, such as mechanical properties of a nipple or bolus volume. Tubes and tapes of respiratory devices can negatively impact the development of the sCPG. Therapists can help infants develop more organized sucking by providing positive oral motor experiences with pacifiers that are properly fitted to the infant.

- Wee Thumbie (clear)
 - Infants up to 30 weeks gestation
 - Modeled after preemie thumb to facilitate sucking behaviors; in utero infant would be bringing hand to face for sucking
 - All intubated infants
 - Able to use with intubated infants as nipple has bulb and then thins to support space for ET tube
 - Take outer hard part off so that it is flexible to fit under tube
 - Shape does not put pressure on ETT
 - Ends at mid to posterior tongue blade for lingual grooving to move fluid anterior to posterior
 - If infant has chin strap and is unable to fit Wee Soothie in mouth
 - May use with infants over 30 weeks if they do not demonstrate ability to advance
- Wee Soothie (purple)
 - Generally, infants 30-32 weeks gestation
 - Advancement to Wee Soothie is based on infant factors, including oral cavity structure, mouth opening, vertical gap
- Soothie (green)
 - Infants 33 weeks or older
- Consideration for use of orthodontic shaped pacifier for infants with hypotonia, ankyloglossia, poor lingual cupping, high palatal groove/severe intubation ridge, or severe gagging/retching with other pacifiers.
 - Assess for intubation palatal groove prior to fitting of pacifier
 - For infants post-extubation, if hard palate shows significant grooving, ensure pacifier nipple is large and stiff enough so nipple does not get stuck in groove. Consider use of orthodontic pacifier to allow for pressure on either side of groove and provide input and traction.

Sources: Calik and Esenay (2019); Estep et al. (2008); Kaya and Aytekin (2017); Tesini et al. (2022); Tonkin et al. (2007); Ziegler et al. (2020); Zimmerman et al. (2008); Zimmerman et al., (2017)

Oral cares/drops of milk

- A neuroprotective intervention that provides positive oral enjoyment while working on oral motor skills and help the infant work on swallowing to prepare for oral feeding
- Position infant in swaddled sidelying following all other cares and interventions
- Evidence demonstrates that syringe administration is best, one drop at a time, but may use swab dipped in milk to control the flow for infants who demonstrate difficulty managing secretions or are intubated
- First, add drop milk on lower lip using syringe or swab without the pacifier and wait for the infant to respond
- If infant starts to root, offer pacifier, wait for infant to latch and offer another drop and continue as infant cues or until drops gone
- If infant licks but does not root, offer another drop on lip—continue in this manner if infant continues to lick and smack but does not root
- If infant does nothing, then stop— the infant had a positive oral and taste experience and can have another opportunity at next session or care time with nursing

CGA	Maximum Volume with NG Feedings
24-26wks	≤0.2 ml (~4 drops from tubing/breast)
27-28wks	≤0.2 ml (~4 drops from tubing/breast)
29-30wks	≤0.3 ml (~6 drops from tubing/breast)
31-33wks	≤0.5 ml (~10 drops from tubing/breast)
34-36wks	≤1.0 ml
>37wks	≤2.0 ml

- Oral immune therapy
 - Highly beneficial for systemic immunity and the development of taste and smell and can lead to reduction in time to reach full feeds
 - .2mL of colostrum - .1mL in each buccal pocket; every 3 hours during the first 7 days of life. After 7 days of life, begin milk drop protocol as tolerated
 - Can use small 1mL syringe and coat entire buccal pouch for increased exposure to colostrum or therapist can use cotton tip applicator to control flow

Sources: Digal et al. (2020); Lee et al. (2015); O'Rourke and Butler (2018); Sohn et al. (2015); Wetzel et al. (2020); UC San Diego SPIN

Oral motor skills and speech

- Oral motor and oral sensory development interact and contribute toward development of motor processing for speech.
- Premature infants are at greater risk for speech impairments. Decreased oral motor control has been linked to problems with early speech development, as children learn to rely on jaw movements instead of lip and tongue movements for sound production.
- Early oral motor control lays a foundation for movement patterns of chewing, sucking, and speech later on.

- Neonatal therapists play a vital role in providing positive oral motor and sensory experiences that promote development of both feeding and speech skills in childhood

Sources: Castro et al. (2007); Green and Wilson (2006); Nip et al. (2009)

References

- Aguilar-Rodríguez, M., León-Castro, J. C., Álvarez-Cerezo, M., Aledón-Andújar, N., Escrig-Fernández, R., Rodríguez de Dios-Benlloch, J. L., ... & Vento-Torres, M. (2020). The effectiveness of an oral sensorimotor stimulation protocol for the early achievement of exclusive oral feeding in premature infants. A randomized, controlled trial. *Physical & Occupational Therapy in Pediatrics, 40*(4), 371-383. <https://doi.org/10.1080/01942638.2019.1698688>
- Bache, M., Pizon, E., Jacobs, J., Vaillant, M., & Lecomte, A. (2014). Effects of pre-feeding oral stimulation on oral feeding in preterm infants: a randomized clinical trial. *Early human development, 90*(3), 125-129. <http://dx.doi.org/10.1016/j.earlhumdev.2013.12.011>
- Calik, C., & Esenay, F. (2019). The clinical effect of pacifier use on orogastric tube-fed preterm infants: A randomized controlled trial. *J Pak Med Assoc, 69*(6), 771-6. <https://www.jpma.org.pk/PdfDownload/9183>
- Capilouto, G. J., Cunningham, T., Frederick, E., Dupont-Versteegden, E., Desai, N., & Butterfield, T. A. (2014). Comparison of tongue muscle characteristics of preterm and full term infants during nutritive and nonnutritive sucking. *Infant Behavior and Development, 37*(3), 435-445. <https://doi.org/10.1016/j.infbeh.2014.05.010>
- Capilouto, G. J., Cunningham, T. J., Rembecki, R. R., & Wells, E. L. (2021). Real-time analyses of sucking waveforms to drive oral feeding practice and improve patient care outcomes. *International Journal of Nursing Health Care and Research, 4*, 1-7. <https://doi.10.29011/2688-9501.101209>
- Capilouto, G. J., Cunningham, T. J., Giannone, P. J., & Grider, D. (2019). A comparison of the nutritive sucking performance of full term and preterm neonates at hospital discharge: a prospective study. *Early Human Development, 134*, 26-30. <https://doi.org/10.1016/j.earlhumdev.2019.05.007>
- Castro, A. G. D., Lima, M. D. C., Aquino, R. R. D., & Eickmann, S. H. (2007). Sensory oral motor and global motor development of preterm infants. *Pró-Fono Revista de Atualização Científica, 19*, 29-38. <https://www.scielo.br/j/pfono/a/Nn5tWs9Qhn55JTVbxLQvh4N/?format=pdf&lang=en>
- Chen, D., Yang, Z., Chen, C., & Wang, P. (2021). Effect of oral motor intervention on oral feeding in preterm infants: A systematic review and meta-analysis. *American journal of speech-language pathology, 30*(5), 2318-2328. https://doi.org/10.1044/2021_AJSLP-20-00322
- Digal, K. C., Upadhyay, J., Singh, P., Shubham, S., Grover, R., & Basu, S. (2021). Oral care with mother's own milk in sick and preterm neonates: a quality improvement initiative. *The Indian Journal of Pediatrics, 88*(1), 50-57. <https://doi.10.1007/s12098-020-03434-5>
- Estep, M., Barlow, S. M., Vantipalli, R., Finan, D., & Lee, J. (2008). Non-nutritive suck parameters in preterm infants with RDS. *Journal of Neonatal Nursing, 14*(1), 28-34. <https://doi.org/10.1016/j.jnn.2007.12.005>
- França, E. C., Sousa, C. B., Aragão, L. C., & Costa, L. R. (2014). Electromyographic analysis of masseter muscle in newborns during suction in breast, bottle or cup feeding. *BMC pregnancy and childbirth, 14*(1), 1-7. <https://link.springer.com/article/10.1186/1471-2393-14-154>
- Fucile, S., Gisel, E., & Lau, C. (2002). Oral stimulation accelerates the transition from tube to oral feeding in preterm infants. *The Journal of pediatrics, 141*(2), 230-236. <https://doi.org/doi:10.1067/mpd.2002.125731>
- Geddes, D. T., & Sakalidis, V. S. (2016). Ultrasound imaging of breastfeeding—A window to the inside: methodology, normal appearances, and application. *Journal of Human Lactation, 32*(2), 340-349. <https://doi.org/10.1177/0890334415626152>
- Genna, C. W. (2016). *Supporting sucking skills in breastfeeding infants*. Jones & Bartlett Learning.
- Gomes, C. F., Trezza, E., Murade, E., & Padovani, C. R. (2006). Surface electromyography of facial muscles during natural and artificial feeding of infants. *Jornal de pediatria, 82*, 103-109. <https://doi.org/10.2223/JPED.1456>
- Gonzalez, P. R., Perez-Cabezas, V., Chamorro-Moriana, G., Molinero, C. R., Vazquez-Casares, A. M., & Gonzalez-Medina, G. (2021). Effectiveness of oral sensory-motor stimulation in premature infants in the neonatal intensive care unit (NICU), systematic review. *Children, 8*(9). <https://doi.10.3390/children8090758>
- Green, J. R., & Wilson, E. M. (2006). Spontaneous facial motility in infancy: A 3D kinematic analysis. *Developmental Psychobiology: The Journal of the International Society for Developmental Psychobiology, 48*(1), 16-28. <https://doi.10.1002/dev.20112>

- Kaya, V., & Aytakin, A. (2017). Effects of pacifier use on transition to full breastfeeding and sucking skills in preterm infants: a randomised controlled trial. *Journal of Clinical Nursing*, 26(13-14), 2055-2063. <https://doi.10.1111/jocn.13617>
- Lau, C. (2015). Development of suck and swallow mechanisms in infants. *Annals of Nutrition and Metabolism*, 66(Suppl. 5), 7-14. <https://doi.org/10.1159/000381361>; <https://doi.org/10.1159/000381361>
- Lessen Knoll, B. S., Daramas, T., & Drake, V. (2019). Randomized controlled trial of a prefeeding oral motor therapy and its effect on feeding improvement in a Thai NICU. *JOGNN: Journal of Obstetric, Gynecologic & Neonatal Nursing*, 48(2), 176–188. <https://doi-org.pearl.stkate.edu/10.1016/j.jogn.2019.01.003>
- Matsubara, M., & Inoue, M. (2019). A comparison of the movement of the mandible in infants between breastfeeding and bottle-feeding. *Journal of Nursing Science and Engineering*, 6(2), 54-62. https://doi.org/10.24462/jinse.6.2_54
- Nip, I. S., Green, J. R., & Marx, D. B. (2009). Early speech motor development: Cognitive and linguistic considerations. *Journal of communication disorders*, 42(4), 286-298. <https://doi.org/10.1016/j.jcomdis.2009.03.008>
- O'Rourke & Butler, C. (2018). Promoting oral feeding readiness with milk drops. *Journal of Women's Health*, 7. <https://doi.10.4172/2325-9795.C1-008>
- Osborn, E. K., & Jadcherla, S. R. (2022). Developing a quality improvement feeding program for NICU patients. *NeoReviews*, 23(1), e23-e35. <https://doi.org/10.1542/neo.23-1-e23>
- Queensland Clinical Guidelines. (2020). Respiratory distress and CPAP. https://www.health.qld.gov.au/data/assets/pdf_file/0012/141150/g-cpap.pdf
- Rodriguez Gonzalez, P., Perez-Cabezas, V., Chamorro-Moriana, G., Ruiz Molinero, C., Vazquez-Casares, A. M., & Gonzalez-Medina, G. (2021). Effectiveness of oral sensory-motor stimulation in premature infants in the neonatal intensive care unit (NICU) systematic review. *Children*, 8(9), 758. <https://doi.org/10.3390/children8090758>
- Stumm, S. L., Barlow, S. M., Estep, M., Lee, J., Cannon, S., Carlson, J., & Finan, D. (2008). Respiratory distress syndrome degrades the fine structure of the non-nutritive suck in preterm infants. *Journal of Neonatal Nursing*, 14(1), 9-16. <https://doi.org/10.1016/j.jnn.2007.11.001>
- Tesini, D. A. (2022). Design, sizing, and ergonomics of infant pacifiers: A biometric basis for pacifier fit. *pediatric nursing*, 48(1), 36-41. <https://www.proquest.com/openview/8257f3cd92c1238879f982df575abcf/1?pq-origsite=gscholar&cbl=47659>
- Tonkin, S. L., Lui, D., McIntosh, C. G., Rowley, S., Knight, D. B., & Gunn, A. J. (2007). Effect of pacifier use on mandibular position in preterm infants. *Acta Paediatrica*, 96(10), 1433-1436. <https://doi.10.1111/j.1651-2227.2007.00444.x>
- Younesian, S., Yadegari, F., & Soleimani, F. (2015). Impact of oral sensory motor stimulation on feeding performance, length of hospital stay, and weight gain of preterm infants in NICU. *Iranian Red Crescent Medical Journal*, 17(7). [https://doi.org/10.5812/ircmj.17\(5\)2015.13515](https://doi.org/10.5812/ircmj.17(5)2015.13515)
- Ziegler, A., Maron, J. L., Barlow, S. M., & Davis, J. M. (2020). Effect of pacifier design on nonnutritive suck maturation and weight gain in preterm infants: A pilot study. *Current Therapeutic Research*, 93, 100617. <https://doi.10.1016/j.curtheres.2020.100617>
- Zimmerman, E., & Barlow, S. M. (2008). Pacifier stiffness alters the dynamics of the suck central pattern generator. *Journal of Neonatal Nursing*, 14(3), 79-86. <https://doi.10.1016/j.jnn.2007.12.013>
- Zimmerman, E., Forlano, J., & Gouldstone, A. (2017). Not all pacifiers are created equal: a mechanical examination of pacifiers and their influence on suck patterning. *American Journal of Speech-Language Pathology*, 26(4), 1202-1212. https://doi.10.1044/2017_AJSLP-16-0226

Created: March 22, 2012

Reviewed: March 4, 2013; March 10, 2014; March 1, 2015

Updated: August 2022 by Holly Schifsky, OTR/L, CNT; Joy Berthelsen, OTS

Appendix F: Nursing Guidelines

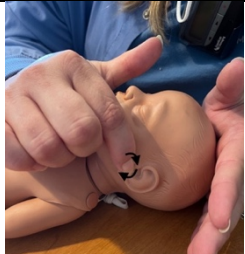

M Health: University of Minnesota Masonic Children's Hospital, Neonatal Intensive Care Unit (NICU)


Clinical Guideline for Nursing: 5-minute Oral Motor Protocol and Milk Drops During Cares

This guideline provides information for nurses on targeting oral motor skills during cares. It has been developed based on an extensive review of evidence-based practices on oral motor interventions and pre-feeding skills, UC San Diego's Supporting Infant Nutrition Program (SPIN), as well as a quality improvement project within the UMMCH NICU. A collaborative partnership between nursing and occupational therapy can help support standardized practices and improve quality of care. The goal is to provide safe evidence-based oral motor interventions that support the neurodevelopment of oral motor skills, improve breast- and bottle-feeding outcomes, and promote positive feeding experiences for premature and medically compromised infants.

Three-step oral motor stimulation protocol:

Provide the following techniques with gloved finger for a few minutes after cares, as tolerated, ending with milk drops.

STEPS	TECHNIQUE	PURPOSE	DEMO PHOTO
TMJ	Facilitate the temporomandibular joint (TMJ) by gently applying pressure in downward circular motion with finger	To improve jaw mobility, release tension and promote mouth opening	
Cheeks	Gently stroke from the TMJ down across jawline, under the chin and up to bottom lip Gently stroke from the TMJ across the cheek to the side of the mouth	To improve cheek range of motion and strength and improve lip seal	

Lips	Place finger horizontally on outside of upper lip. Gently compress and stretch by bringing finger down toward mouth. Repeat for lower lip.	To improve lip range of motion and strength and improve lip seal	
------	--	--	--

General protocol considerations

- When moving infant skin, the recommendation is 3cm for every 10 seconds
- Provide less repetitions and slow movement to allow for sensory adaptation
- A general guideline is five strokes per area, but read baby's cues, consider positioning of the infant, and monitor vital signs

Milk drops

Provider writes active order for “Milk Drops for Oral Enjoyment”

- Offer milk drops after completing routine oral cares each care time the infant does not eat by mouth
- Preferred position: sidelying, preferred time: once all cares are completed
- Offer even if infant is sleeping, as it provides a positive oral experience while allowing the infant to practice swallowing
- Evidence demonstrates that syringe (1mL syringe preferred) administration is best, one drop at a time, but may use swab dipped in milk to control the flow for infants who demonstrate difficulty managing secretions or are intubated
- Drop milk on lower lip without the pacifier and wait for the infant to respond
- If infant starts to root, offer pacifier, wait for infant to latch and offer another drop and continue as infant cues or until drops gone
- If infant licks but does not root, offer another drop on lip—continue in this manner if infant continues to lick and smack but does not root
- If infant does nothing, then stop— the infant had a positive oral and taste experience and can have another opportunity at next care time
- Give infant positive and calming touch during drops

CGA	Maximum Volume with NG Feedings
24-26wks	≤0.2 ml (~4 drops from tubing/breast)
27-28wks	≤0.2 ml (~4 drops from tubing/breast)
29-30wks	≤0.3 ml (~6 drops from tubing/breast)
31-33wks	≤0.5 ml (~10 drops from tubing/breast)
34-36wks	≤1.0 ml
>37wks	≤2.0 ml

Wee Thumbie pacifier:

- Intended for infants up to 30 weeks gestation, as it is modeled after preemie thumb to facilitate sucking behaviors; in utero infant would be bringing hand to face for sucking
- Can use with intubated infants as nipple has bulb and then thins to support space for ETT. Take outer hard part off so that it is flexible to fit under tube. The shape does not put pressure on ETT
- Can use if infant has chin strap and is unable to fit Wee Soothie in mouth and may use with infants over 30 weeks if they do not demonstrate ability to advance

Appendix G: Education Presentation

Development and Implementation of an Oral Motor Protocol and Clinical Guidelines in the UMMCH NICU: A Quality Improvement Project

Joy Berthelsen, OTS

1

Case Study 1

Impact on Intubated Infants

Infant Without Protocol	Infant With Protocol
<ul style="list-style-type: none"> Born at 26+2 Intubated for ~5 weeks Developed oral aversion and uncoordinated swallow, requiring G-tube Did not receive any oral motor intervention while intubated for 5 weeks Missed opportunities for positive oral input while intubated 	<ul style="list-style-type: none"> Born at 26+2 Intubated for ~10 weeks Received protocol from 31+3 weeks on, including while intubated for ~6 weeks (ideally would have started protocol right away at birth as tolerated) Provided positive sensory and oral motor experiences while intubated Latched to pacifier 72% of times and activated a swallow 89% of time while participating in the protocol

2

Case Study 2

Impact on Bottling and Discharge

5 infants from retrospective group with similar gestational ages

- Born between 30+4 and 31+0 weeks
- Weights ranging from 1060 grams and 2000 grams
- Respiratory supports ranged from RA only after birth to 5 days of CPAP
- PMA start of oral feeding: 34+1 to 35+3
- PMAS of 100% oral feeding: 35+1 to 38+4
- Days in NICU: 32, 51, 52, 53, 53

Infant with Oral Motor Protocol

- Born at 30+5
- 1830 grams at birth
- RA upon birth
- Started protocol 3 days after birth and received for 3 weeks until began orally feeding
- PMA start of oral feeding: 33+4
- PMA of 100% oral feeding: 34+6
- Days in NICU: 30

3

Objectives

Understand:

- Project process and methods for pilot study and creating guidelines
- Quality improvement process
- Outcomes from pilot protocol and survey
- Recommendations for UMMCH NICU moving forward

4

PDSA Cycle

	Plan	Needs assessment and conversations with mentor prior to on-site Focus group and survey Extensive literature review
	Do	Developed protocol and trained therapists Implemented protocol with patients Collected data on outcomes
	Study	Assessed implementation for signs of success and improvement Post-survey Analyzed data
	Act	Standardization of protocol through updated clinical guidelines Reflect on outcomes and adjust as needed Continue cycle as new evidence arises and protocol continues

5

PLAN

6

Literature Review

- Development of suck, swallow, breathe, facial muscle activation during feeding, secretion management
- Oral motor protocols and manual therapy
- Standardized and structured oral motor protocols
- Pacifier use
- Drops of milk and oral immune therapy
- NNS and oral motor stimulation for infants on pulmonary support (non-invasive and invasive)
- Quality improvement initiatives in the NICU

7

Focus group and survey

“Feeding more buy in from RNs... Would be wonderful to have RNs provide more thoughtful interventions, including oral motor exercises in conjunction with oral care rather than only using a green toothette to swab out their mouth with milk.”

More education on how to engage facial muscles in general would be helpful as well as important manual activities for lingual mobility

17. Barriers to providing oral motor interventions include (Select all that apply)

Most Details

Present condition(s) (check all)	12
Lack of supplies	6
Inadequate knowledge/skills	6
Provider preference	3
Inadequate training	5
Time constraints	6
Other	0

8

DO

9

Developed Updated Protocol

- 5-10 minute manual facial stimulation protocol
- TMJ, lips, cheeks and chin, gumline, hard palate
 - Superficial muscles and joint to easily facilitate and can be modified easily for intubated infants
 - Important for breast and bottle feeding

10

Training and Education

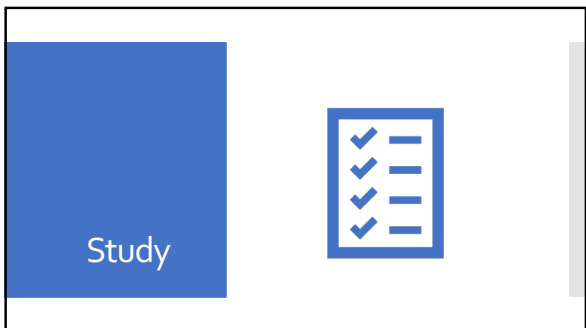
- Protocol overview handout
- Handouts for each technique going over muscle activation and purpose behind each technique
- Two in-service presentations on the protocol and pacifier use

11

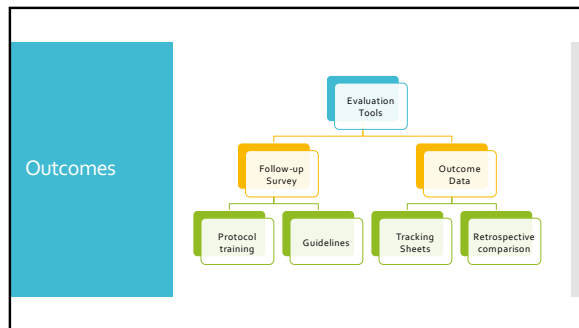
Implementation into UMMCH NICU

- Inclusion criteria: Can begin with infants between 26-32 weeks on any pulmonary support and continue until orally feeding
- Tracking sheets for each infant to monitor important variables that may impact the protocol, such as respiratory interface, or oral motor skill outcome variables, such as swallow activation and latching to a pacifier
- 15 infants participated in the pilot

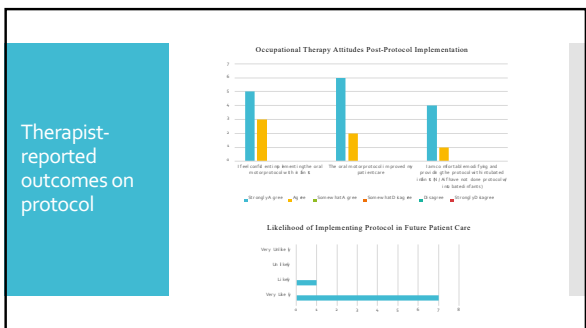
12



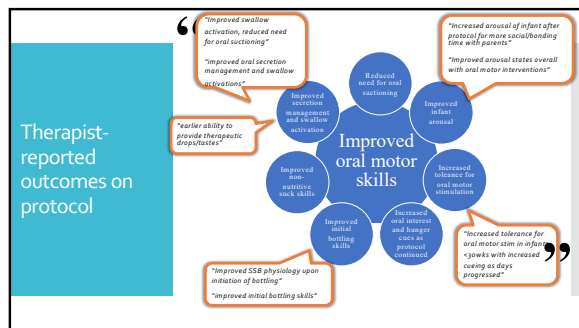
13



14



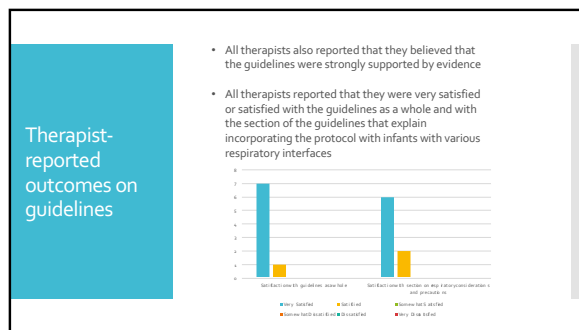
15



16

- Therapist-reported impact on patient care and skill set
- More structured and focused sessions
 - Standardization of practice
 - Increased opportunity to provide safe and developmentally appropriate interventions for younger infants and intubated infants
 - Improved observation skills of infant responses and oral motor skills
 - Improved family involvement

17



18

Guideline Improvements and Modifications

- Incorporating guidelines for reintegrating the protocol when infants begin oral feeding but go NPO or backslide in their progress
- Additional clarification on whether protocol allows for drops of milk for intubated infants
- Additional information in the nursing guidelines on pacifier selection and appropriate utilization of pacifiers

19

Additional Training

Intubated infants	"Integration for infants with H-tapping" "More training with protocol for infants who are intubated"
Milk drops	"would like to hear more about specifics of offering drops/bites to intubated infants"
Parent teaching	"I think teaching parents could potentially be helpful"
Orofacial anomalies	"I would like to learn more about how to incorporate with orofacial anomalies if possible"
Advancing protocol	"more regarding advancement (at what point would you recommend moving from sidelying to upright, Biering/C, tummy COO, etc)" "Facial MEM advanced skill to support implementation of advancing oral motor interventions, both intubated and non-intubated patients"

20

Tracking Sheet Trends

- 82% of the time, infants latched to a pacifier during protocol
- 77% of the time infants managed secretions well during the protocol, with infants activating a swallow during the protocol 80% of the time
- 96% of the time therapists performed 5-10 mins of the protocol when attempted:
 - Physiological instability/apneic events during handling or cares
 - Lethargy or poor tolerance to touch
 - Poor seal on BC PAP interfaces or ETT not secured
- Zero unplanned extubations reported while completing protocol throughout pilot

21

ACT

22

Updated OT Clinical Guidelines

- Rationale
- Assessment and Treatment
- Oral motor protocol for premature infants
 - Precautions and considerations for each respiratory interface
- Advancing pacifiers
- Milk drops and oral immune therapy

Objective	Table of Contents
Rationale	1
Assessment and treatment	2
Oral motor protocol	3
Precautions and considerations for each respiratory interface	4
Advancing pacifiers	5
Milk drops and oral immune therapy	6
Appendix	7
Table of Contents	8
Rationale	9
Assessment and treatment	10
Oral motor protocol	11
Precautions and considerations for each respiratory interface	12
Advancing pacifiers	13
Milk drops and oral immune therapy	14
Appendix	15
Table of Contents	16

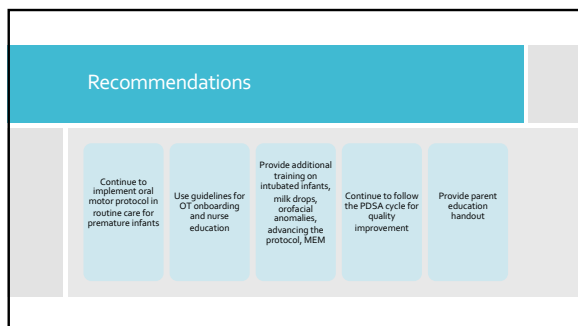
23

Nursing Guideline

- Goal to advance the oral motor protocol to be interdisciplinary by creating mini guidelines for nursing to incorporate modified protocol to intertwine with care times
- Collaborated with lead OT at UC San Diego Health, creator of the Supporting Premature Infant Nutrition Program (SPIN)

CGA/Status	Maximum Volume with NG Feedings
24-26wks	≤0.2 ml (~4 drops from tubing/breast)
27-28wks	≤0.2 ml (~4 drops from tubing/breast)
29-30wks	≤0.3 ml (~6 drops from tubing/breast)
31-33wks	≤0.5 ml (~10 drops from tubing/breast)
34-36wks	≤1.0 ml
>37wks	≤2.0 ml

24

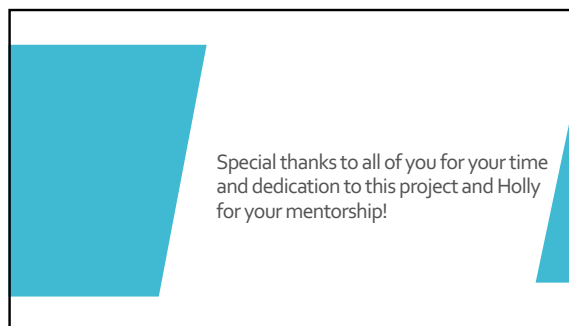


Slide 25 features a teal header with the word "Recommendations" in white. Below the header, five light blue rectangular boxes are arranged horizontally, each containing a specific recommendation. The slide has a light gray background with a white border.

Recommendations

- Continue to implement oral motor protocol in routine care for premature infants
- Use guidelines for OT onboarding and nurse education
- Provide additional training on intubated infants, milk drops, orofacial anomalies, advancing the protocol, MEM
- Continue to follow the PDSA cycle for quality improvement
- Provide parent education handout

25



Slide 26 features a teal header with the text "Special thanks to all of you for your time and dedication to this project and Holly for your mentorship!". The slide has a light gray background with a white border.

Special thanks to all of you for your time and dedication to this project and Holly for your mentorship!

26

Appendix H: Pre-Survey Questions

Oral Motor Interventions in Fairview NICUs

This survey is part of my (Joy Berthelsen) doctoral capstone quality improvement project with Holly Schifsky on oral motor interventions in the NICU. This survey is to gauge the current state and understanding of occupational therapists providing oral motor interventions. The goal of this project is to update the current Fairview NICU oral motor guidelines for occupational therapists. For the purpose of this survey, oral motor interventions are defined as any oral cares, oral support, or oral motor stimulation provided with your patients in order to facilitate oral feeding readiness. Thank you for taking the time to complete this survey!

Estimated time to complete: Less than 5 minutes

* Required

1. Years of NICU experience *

- 0-5 years
- 6-10 years
- 11-15 years
- 16+ years

2. How do you assess oral motor skills? (select all that apply) *

- Reflexes
- Secretion management
- Oral skills during oral cares
- Lips, cheek, tongue activation
- The seal on nipple
- Rhythmicity
- Physiological stability
- Pulmonary support
- NOMAS
- Other formal assessments
- Other

3. Which oral motor interventions do you implement routinely in patient care? Select all that apply. *

- Nonnutritive suck (NNS) on pacifier or finger
- Drops of milk in syringe
- Perioral stimulation through stroking of cheeks and lips
- Intraoral stimulation of gums and cheeks
- Proper positioning and external supports of cheeks and mandible during feeds
- Other

Comfort level (scale 1-10) in performing these oral motor interventions:

1 being not comfortable at all, 10 being the most comfortable

4. Nonnutritive suck (NNS) on pacifier or finger *

1 2 3 4 5 6 7 8 9 10

5. Offering drops of milk in syringe *

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

6. Perioral stimulation through stroking of cheeks, lips, jaw *

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

7. Intraoral stimulation of gums, inner cheeks, tongue *

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

8. Proper positioning and external supports of cheeks and mandible during feeds *

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

On average, how many times do you provide formal oral motor interventions to:

9. Premature infants under 25 weeks *

1-2x per week
 3-4x per week
 5-7x per week

10. Premature infants 26-29 weeks *

1-2x per week
 3-4x per week
 5-7x per week

11. Premature infants 30-32 weeks *

1-2x per week
 3-4x per week
 5-7x per week

12. Premature infants 33-37 weeks *

- 1-2x per week
- 3-4x per week
- 5-7x per week

13. Rate on a scale from Strongly Agree to Strongly Disagree *

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Providing oral motor interventions is an important part of my patient care	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know what oral motor interventions are and how to appropriately implement them in patient care	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I provide oral motor interventions with all of my patients	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Oral motor interventions and feeding readiness are a priority in my unit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My unit has the necessary supplies to provide oral motor interventions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

I feel I have the necessary training to appropriately provide oral motor interventions

14. How many minutes on average do you implement oral motor interventions when with a patient? *

- <3 minutes
- 4-6 minutes
- 7-9 minutes
- 10 minutes or more

15. At what PMA do you typically begin oral motor interventions? *

- 24-26 weeks
- 27-29 weeks
- 30-32 weeks
- 33-35 weeks
- 36-38 weeks

16. When do you typically offer oral motor interventions during your session? *

- Right away at the beginning
- At the end of the session
- After cares or other developmental interventions
- Before a feeding session in babies that have started oral feeding
- Other

17. Barriers to providing oral motor interventions include (Select all that apply) *

- Patient condition/acuity (including respiratory status)
- Lack of supplies
- Inadequate knowledge/skills
- Provider preference
- Inadequate training
- Time constraints
- Other

18. I have advanced experience with any of the following: *

- Beckman Oral Motor Intervention (BOMI)
- Premature Infant Oral Motor Intervention (PIOMI)
- Neonatal Oral Motor Assessment Scale (NOMAS)
- Other

19. **How do you advance a patient's pacifier? ***

20. **Please share any thoughts you have on oral motor interventions in the NICU or your thoughts on updated clinical guidelines**

This content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.

Appendix I: Focus Group Questions

1. How do you all assess oral motor skills in infants?
2. What are the routine oral motor interventions you implement with your patients?
3. What results do you see from using oral motor interventions, both during the session and long-term outcomes?
4. What barriers are there for you providing oral motor interventions with patients?
5. What about oral motor interventions do you want more evidence-based guidance on?/what kinds of information would you find valuable in an updated oral motor clinical guidelines?
6. In the QI study we are conducting, we will have the OTs involved use a tracking sheet to track different factors about the session each time they perform the specific oral motor protocol on their patient in order to get a picture of the infant, how they tolerated the intervention, potential variables involved, and outcomes. Which factors would you all find important to track?

2. How helpful were the handouts and presentations in supporting your learning of the protocol?

- Very helpful
- Somewhat helpful
- Somewhat unhelpful
- Very unhelpful

3. What is the likelihood that you would continue to implement this protocol in your future patient care?

- Very likely
- Likely
- Unlikely
- Very unlikely

4. **In your own personal experience with the protocol, what impact did it have on patient outcomes?**

5. **How did learning and implementing this protocol affect your own patient care and skill set?**

SECTION 2: OT Oral Motor Guidelines and Nursing Guidelines Questions

The following questions pertain to the OT Oral Motor Clinical Guidelines and Nursing Oral Motor Guidelines on a modified peri-oral and milk drop protocol sent via email. Recall that we met for a focus group and a survey was sent out to gain information on current oral motor practices in the NICU and how to enhance and standardize care, particularly for intubated babies. An extensive literature review was completed on best practices and preliminary data continues to be collected to

6. How satisfied are you with the Oral Motor Guidelines as a whole?

- Very satisfied
- Satisfied
- Somewhat satisfied
- Somewhat dissatisfied
- Dissatisfied
- Very dissatisfied

7. How satisfied are you with the section of the guidelines explaining the precautions to consider for each respiratory interface?

- Very satisfied
- Satisfied
- Somewhat satisfied
- Somewhat dissatisfied
- Dissatisfied
- Very dissatisfied

8. To what extent do you believe the clinical guidelines are supported by evidence?

- Strongly supported
- Somewhat supported
- Weakly supported
- Not at all supported

9. **Are there any modifications or improvements you would make to the OT or nursing guidelines? If so, please describe.**

10. **Is there any additional training you would like in the future related to the protocol or oral motor assessment/intervention?**

11. **Please add any other thoughts about the quality improvement study, protocol, or guidelines.**

Appendix K: Final Poster Presentation

Promoting Pre-Feeding Skills: Development and Implementation of an Oral Motor Protocol and Clinical Guidelines in a Level IV NICU

Joy Berthelsen, OTS
 Faculty Advisor: Stephanie de Sam Lazaro, OTD, MA, OTR/L, Capstone Mentor: Holly Schifsky, OTR/L, CNT, NTMTC, CBIS
 St. Catherine University

BACKGROUND

- Oral feeding difficulty is a leading cause of extended hospital stay²
- Medical advances are increasing survival for younger infants who have not achieved developmental milestones to support oral feeding³
- Preterm infants lack motor practice they would receive in utero when swallowing amniotic fluid and have underdeveloped physiological systems and oral structures, delaying feeding skills²
- Manual stimulation of oral structures can improve feeding efficiency and decrease transition time to full oral feeding and length of stay^{3,4,5}
- The Masonic Children's Hospital level IV NICU has many infants on respiratory support
- Integration of a new intubation interface: increased access to facial structures and opportunity for oral motor interventions for intubated infants

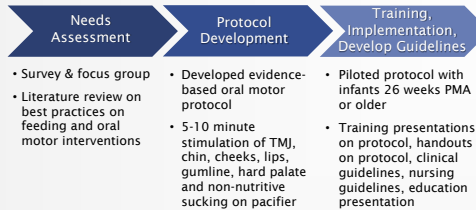


NeoBar on premature infant

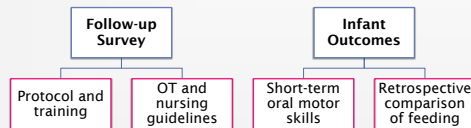
PURPOSE

To update the clinical guidelines on oral motor interventions in the University of Minnesota Masonic Children's Hospital (UMMCH) NICU in order to improve the neurodevelopmental outcomes of premature infants by targeting oral motor skills through a new protocol to enhance breastfeeding and bottle feeding.

APPROACH

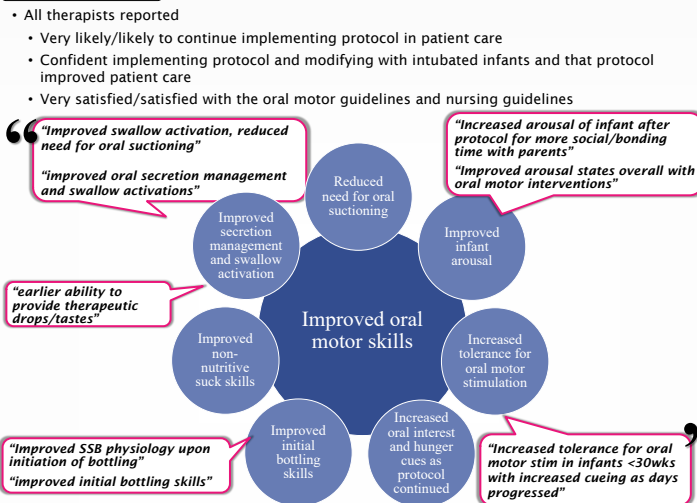


Evaluation Process:



OUTCOMES

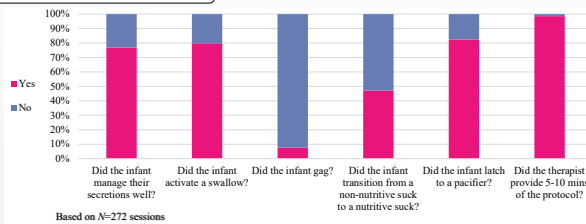
Survey Results:



Impact on patient care and therapist skills:

- More structured sessions and standardization of practice
- Increased opportunity for safe and developmentally appropriate interventions for younger infants and intubated infants
- Improved observation skills of infant responses and oral motor skills
- More family involvement

Oral Motor Skill Outcomes:



Based on N=272 sessions

IMPLICATIONS

- More consistent approach across therapists to support development and best practices in neuroprotective care
- Positive, safe, and developmentally appropriate oral motor stimulation for infants on pulmonary support or intubated
- Interdisciplinary and parent involvement
- The provision of oral motor therapy during a critical period of neuroplasticity and development can better prepare premature infants to succeed at oral feeding

RECOMMENDATIONS

UMMCH NICU:

- Continue to implement protocol in patient care
- Use guidelines for OT onboarding and nurse education
- Provide additional training on intubated infants, milk drops, orofacial anomalies, advancing the protocol as infants age
- Continue to follow quality improvement cycle for best practice
- Provide parent education handout

OT Profession:

- Partner with nursing to provide more consistent care across disciplines
- Therapists can provide oral motor interventions earlier and in a more standardized and developmentally appropriate manner to support oral feeding skills and earlier discharge

ACKNOWLEDGEMENT

Thank you to the University of Minnesota Masonic Children's Hospital NICU therapists for your time and dedication to this project. Special thanks to my mentor, Holly Schifsky, OTR/L, CNT, my faculty advisor, Dr. de Sam Lazaro, OTD, OTR/L, and my capstone coordinator, Dr. Ginny Green, OTD, OTR/L.

REFERENCES

- Chen, D., Yang, Z., Chen, C., & Wang, P. (2021). Effect of oral motor intervention on oral feeding in preterm infants: A systematic review and meta-analysis. *American Journal of Speech-Language Pathology*, 30(5), 2318-2328. https://doi.org/10.1044/2021_AJSLP20-00322
- Fry, T. J., Marfurt, S., & Wengier, S. (2018). Systematic review of quality improvement initiatives related to cue-based feeding in preterm infants. *Nursing for women's health*, 22(5), 401-410. <https://doi.org/10.1016/j.nwh.2018.07.006>
- Lessen Knoll, B. S., Daramas, T., & Drake, V. (2019). Randomized controlled trial of a prefeeding oral motor therapy and its effect on feeding improvement in a Thai NICU. *JOGNN: Journal of Obstetric, Gynecologic & Neonatal Nursing*, 48(2), 176-188. <https://doi.org/pearl.stcath.edu/10.1016/j.jogn.2019.01.003>
- Tian, X., Yi, L. J., Zhang, L., Zhou, J. G., Ma, L., Ou, Y. X., ... & Song, G. M. (2015). Oral motor intervention improved the oral feeding in preterm infants: evidence based on a meta-analysis with trial sequential analysis. *Medicine*, 94(13). <https://doi.org/10.1097/MD.0000000000001310>
- Younesian, S., Yadegari, F., & Soleimani, F. (2015). Impact of oral sensory motor stimulation on feeding performance, length of hospital stay, and weight gain of preterm infants in NICU. *Iranian Red Crescent Medical Journal*, 17(7). [https://doi.org/10.5812/ircmj.17\(5\)2015.13515](https://doi.org/10.5812/ircmj.17(5)2015.13515)

* Complete reference list upon request

