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**Oral Development and Breastfeeding: An Assessment of the Lactation Care
Provider Approach**

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THESIS

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ABSTRACT

Breastfeeding influences the infant's oral development in many ways. Lactation care providers work closely with the mother-infant pair and may be the first to provide information on oral health. The purpose of this study is to assess lactation care provider's perception, attitude and behavior on the relationship between breastfeeding and oral development; including oral malocclusion, breathing patterns, tethered oral tissues and dental caries. A survey sent to lactation care providers who are members of The United States Lactation Consultant Association. A total of 12 members participated in the survey. Of that, 11 were International Board Certified Lactation Consultants (IBCLCs) and 1 was a Non-IBCLC. The results determined that lactation care providers who responded have resources available to them that describe the relationship between breastfeeding and oral development. However, it was unclear

whether they receive training on this during their initial training while earning their credentials. Lactation care providers discuss this relationship with their patients more than 50% of the time and state they feel comfortable discussing this relationship. This level of comfort could describe why lactation care providers refer to dental professionals less than 50% of the time. Although, lactation care providers perceive breastfeeding to positively influence the infant's oral development.

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Chapter I: Introduction

Introduction:

Lactation care providers are professionals who specialize in human lactation and the clinical management of breastfeeding. They often provide support to breastfeeding mothers and their babies and provide educational training to medical personnel. They prevent, recognize, and solve breastfeeding difficulties as well as advocate, conduct research, provide leadership and professional development for the lactation community. Lactation care providers work in a variety of settings including hospitals, clinics, private medical practices, community health departments, federally qualified health centers, home health agencies, and private practices.

Lactation care providers use evidence-based practice behind their teachings, even though human lactation, or breastfeeding, is natural. Lactation care providers use the science of breastfeeding to assist the mother with latching and the physical act itself. They provide information on the benefits for both the mother and the infant; typically focusing on physical, mental and social health.

In respect to the mother's health, breastfeeding can help release hormones, such as prolactin and oxytocin, which help the mother bond with the infant as well as aid with postpartum recovery. Studies have also shown that women who breastfeed tend to experience decreased rates of breast and ovarian cancer later in life as well as reduce the risk for

developing type 2 diabetes, rheumatoid arthritis and cardiovascular disease¹. Breastfeeding also provides the convenience of feeding an infant with minimal cost and supplies.²

As far as infant health is concerned, the most common information provided revolves around the infant's physical health. The physical benefits of breastfeeding an infant include ideal nutrition, the transfer of antibodies, the prevention of SIDS, and the reduced risk for allergies, asthma, and other medical conditions.

Breastfeeding influences the infant's oral development in many ways. Studies have shown breastfeeding influences oral development by impacting the formation of the dental arch, dentition, occlusion, and facial profile. It also plays a role in palate formation which is believed to contribute to the infant's breathing patterns.³ Breastfeeding also strengthens the sucking and swallowing mechanisms and can lead to early detection for tongue and lip ties; also helping with articulation during speech development. Lastly, breastfeeding influences the oral microbiome which is a contributor to caries formation.

Statement of the Problem:

With so many beneficial aspects of breastfeeding on oral development, it raises the questions:

Q1. Do lactation care providers receive training on the relationship between breastfeeding and oral development while earning their credentials?

Q2. Do lactation care providers present their patients with information on the relationship between breastfeeding and the infant's oral development?

Q3. How comfortable do lactation care providers feel discussing this relationship with their patients?

Which pose the hypotheses:

H1. Lactation care providers do not receive training on the relationship between breastfeeding and oral development while earning their credentials.

H2. Lactation care providers do not present their patients with information on the relationship between breastfeeding and the infant's oral development.

H3. Lactation care providers do not feel comfortable discussing this relationship with their patients.

Significance of the Problem:

Dental hygienists are healthcare professionals who specialize in prevention and work in private and public settings to meet the oral health needs of patients. This is achieved by conducting various assessments of the head and neck region, performing specific procedures within their scope of practice, and providing oral health education.

Since, the oral cavity is the main area dental hygienists work in and treat, it is important to understand what can influence oral development. During dental hygiene school,

the student is required to take courses which cover dental anatomy and anatomy of the head and neck. However, these courses don't cover the relationship between breastfeeding and oral development. With that being said, it becomes the dental hygienist's responsibility to learn this relationship on their own, as patients may ask them for advice. Often times, patients feel comfortable asking their dental hygienist for advice since they develop a trusting relationship with them.

A dental hygienist should also feel comfortable referring out to a lactation care provider when the conversation extends past their knowledge. Being able to collaborate with and refer to other healthcare providers is essential to provide the patient with comprehensive care. Therefore, knowing who lactation care providers are and what services they offer can be beneficial for patients.

An interprofessional relationship between lactation care providers and dental hygienists may prove to be beneficial for the infant. Often times, the mothers who are receiving their pre- and post- natal care through public health settings, such as federally qualified health centers, are interacting with lactation care providers for their breastfeeding support. Lactation care providers may be the first to recognize a developmental problem, such as tethered oral tissues, since this will present as a challenge when the infant tries to latch. When the infant transitions to eating solids, the child becomes at risk for developing dental caries without proper home care. The child and mother pair are then in need of oral health education. Having family involved in the child's oral health early on could lead to a decrease in oral disease(s) and an increase in preventive measures. In the long run, the infant will be healthier from this relationship which is the goal of both healthcare professions.

Operational Definitions:

- **Lactation Care Provider:** Professionals who specialize in human lactation and the clinical management of breastfeeding.
- **Human Lactation:** The secretion of milk by the mammary glands in humans; also known as breastfeeding.
- **Oral Development:** The development of the oral cavity which includes the lips, the inside lining of the lips and cheeks, the teeth, the gums, the front two-thirds of the tongue, the floor of the mouth below the tongue, and the bony roof of the mouth.
- **Dental Hygienist:** Healthcare professionals who specialize in prevention and work to meet the oral health needs of patients.
- **World Health Organization:** WHO, is an international organization focused on achieving health by combating disease.
- **Peristalsis:** The involuntary constriction and relaxation of muscles creating wavelike movements that push contents forward.
- **Craniofacial:** Involving the head, skull, face, neck, jaws and associated structures.
- **Nutritive Sucking Behavior:** Behaviors involving a sucking mechanism for nutritive purposes, such as breast- or bottle- feeding.

- Non-nutritive Sucking Behavior: Behaviors involving a sucking mechanism for non-nutritive purposes, such as pacifier, digit and comfort sucking.
- Hyperdivergent growth: A skeletal pattern that deviates from the norm through excessive divergence of the skeletal planes; characterized by a steep mandibular plane angle, a long anterior lower face height with open bite tendency, lip incompetence and often associated with Class II malocclusion.

Chapter II: Literature Review

Introduction:

The aim of this literature review is to familiarize the reader with the current literature on infant nourishment, the impact lactation consultants have on breastfeeding success, and how breastfeeding influences oral development; specifically oral malocclusion, breathing patterns, tethered oral tissues, and dental caries. The literature was reviewed using the PubMed/MeSH search engines to access the database Medline. Further review was drawn from references of other studies.

Infant Nourishment:

According to the World Health Organization (WHO), breastfeeding is the normal way of providing infants the nutrients needed for healthy growth and development. The organization recommends exclusive breastfeeding up to 6 months of age and encourages continued breastfeeding with complimentary foods up to two years of age or as desired by the mother/child pair.⁴

The process of breastfeeding can be described as a peristaltic action and is often referred to as suckling. The infant will pull the nipple and part of the areola into the mouth as far back as the junction of the hard and soft palates and suck rhythmically. The tongue protrudes to keep constant contact with the lower lip while the floor of the mouth facilitates the squeezing action of the nipple. The masseter and medial pterygoid muscles facilitate the

movement of the mandible creating a low or negative pressure in the oral cavity. The airway is maintained during this process.⁵

In circumstances where breastfeeding cannot be achieved, bottle feeding is an alternative method of feeding the infant. An artificial nipple is placed on a bottle containing either breast- or formula- milk. Breast milk is a complex fluid that continually changes to meet the demands of the infant. Breast milk contains biological factors such as hormones, enzymes, prostaglandins, antibodies, antibacterial and antiviral factors, and growth factors.⁵ Whereas, formula milk is a type of fluid comprised of proteins, sugars, fats, and vitamins that combine to make a nutritious alternative to breast milk.⁵ Since formula is manufactured it cannot duplicate the complexity of breast milk and lacks biological factors. The artificial nipples are produced with various materials to customize the size, shape, compressibility, and elasticity as well as the rate of milk flow by altering the diameters of the holes on the top of the nipple.

The process of bottle feeding differs from breastfeeding and can be described as a piston-like action, commonly referred to as sucking. The infant exerts positive pressure in the oral cavity by placing the nipple between the tongue and the upper tooth pad. This facilitates the release of the milk.⁵


Breastfeeding Success:

Breastfeeding success starts with a good support system. For many women, this support system starts with a lactation care provider. Breastfeeding support can range from

basic encouragement and emotional support to guidance and assistance with complex clinical situations. There are many types of lactation care providers which can make it confusing for both families as well as healthcare providers.

Figure 1⁶ categorizes the different types of lactation care providers and gives a description of the training and scope of practice. Whereas, Figure 2⁶ provides a more in depth description of the types of credentials a lactation care provider may hold.

Figure 1



Lactation Provider Categories	Prerequisites	Training Required	Scope of Practice
<p>Consultant (<i>International Board Certified Lactation Consultant, IBCLC®</i>)</p>	<p>Recognized health professional or satisfactory completion of collegiate level health sciences coursework.</p>	<ul style="list-style-type: none"> • 90 hours of lactation-specific education • College level health science courses • 300-1000 clinical practice hours • Successful completion of a criterion-referenced exam offered by an independent international board of examiners. 	<p>Provide professional, evidence based, clinical lactation management; educate families, health professionals and others about human lactation.</p>
<p>Counselor/ Educator (<i>i.e. Certified Lactation Counselor, Certified Breastfeeding Educator, etc.</i>)</p>	<p>N/A</p>	<ul style="list-style-type: none"> • 20-120 hours of classroom training • Often includes a written exam or “certification” offered by the training organization 	<p>Provide education and guidance for families on basic breastfeeding issues.</p>
<p>Peer (<i>i.e. La Leche League, WIC Peer Counselor, etc.</i>)</p>	<p>Personal breastfeeding experience.</p>	<ul style="list-style-type: none"> • 18-50 hours of classroom training 	<p>Provide breastfeeding information, encouragement, and support to those in their community.</p>



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Figure 2
Lactation Care Provider Credentials

TITLE	TRAINING TIME	DESCRIPTION
International Board Certified Lactation Consultant® (IBCLC®)	90 hours lactation specific education, 300-1000 clinical practice hours	<ul style="list-style-type: none"> • 8 college level health professional courses (14 academic credits) • 6 health related continuing education courses. • Pass a criterion-reference exam <p>The International Board Certified Lactation Consultant possesses the necessary skills, knowledge, and attitudes to provide quality breastfeeding assistance to babies and mothers. IBCLCs specialize in the clinical management of breastfeeding which includes: preventive healthcare, patient education, nutrition counseling, and therapeutic treatment. Source: https://ibclce.org/step-1-prepare-for-ibclc-certification/</p>
Certified Lactation Specialist Course (CLSC)	45 hours	Designed for the aspiring lactation consultant or nurses, physicians, midwives, dietitians, breastfeeding assistants or others desirous of improving their knowledge base and skills in working with the breastfeeding dyad. This certification is a stepping stone to the IBCLC credential. Source: https://lactationeducation.com/clsc
Certified Breastfeeding Specialist	45 or 90 hours	In operation since 1990, this evidence-based, online lactation management course covers up-to-date clinical best practices and all topics from the IBLCE Detailed Content Outline and LEAARC curriculum. This self-paced program is taught by 25+ experienced and dedicated lactation consultants, authors, researchers, and educators. Education is provided through webinars and interactive learning sessions. Both the 45 and 90 hour courses earn a Certified Breastfeeding Specialist certificate, to be used as a stepping stone to IBLCE certification. Source: www.lactationtraining.com
Lactation Educator Counselor	45 hours	This university based program trains participants to be Lactation Educator Counselors. Lactation Educator Counselors are typically entry level practitioners and deal primarily with the normal process of lactation. This course is the required prerequisite to the Lactation Consultant course. Source: http://breastfeeding-education.com/home/lec-2/
Breastfeeding Counselor (BFC)	10-14 months, Provide 30 hours of support	2-3 day workshop, self-evaluation, one written paper & case studies, read and review 5 books, submit one survey on breastfeeding support available in your community, open book online tests (multiple choice) to cover physiology & anatomy. Source: https://childbirthinternational.com/portfolio/breastfeeding-counselor-training/
Breastfeeding Educator Certification (BEC)	120 hours online training	Qualified to teach, support, and educate the public on breastfeeding and related issues and policies. Workbook activities, required reading materials, attend 8 breastfeeding meetings, research paper, submit a class presentation, work for clients in their community. Prepares for the IBCLC exam. 120 hours includes 50 hours of health science and 75 hours self-directed study/mentorship Source: www.birtharts.com/lactation-educator-certification.htm
-Certified Lactation Counselor (CLC)	45 hours	<p>“This comprehensive, evidence-based, breastfeeding management course includes practical skills, theoretical foundations and competency verification.” Certification is accredited by the American National Standards Institute.</p> <p>Some, but not all, certificate holders may have college level academic coursework. Some, but not all, certificate holders may demonstrate 150 hours of supervised clinical experience and a nursing or bachelor’s degree.</p> <p>ANLC are licensed nurses as a pre-requisite to the examination. Source: https://www.alpp.org/</p>
-Advanced Lactation Consultant (ALC)	90 hours	
-Advanced Nurse Lactation Consultant (ANLC)	90 hours	
WIC Peer Counselor	30-50 hours, Varies by state, some states have quarterly training	Peer counselors are mothers who have personal experience with breastfeeding and are trained to provide basic breastfeeding information and support to other mothers with whom they share various characteristics, such as language, race/ethnicity, and socioeconomic status. In WIC, peer counselors are recruited and hired from WIC’s target population of low-income women and undergo training to provide mother-to-mother support in group settings and one-to-one counseling through telephone calls or visits in the home, clinic, or hospital. Refer mothers to IBCLCs who have challenging questions and concerns. Source: https://wicbreastfeeding.fns.usda.gov/become-wic-peer-counselor
Certified Lactation Educator (CLE)	20 hours total, some have 8 hours clinical	Qualified to teach, support, and educate the public on breastfeeding and related issues. Complete course training, attend support group meetings, observe consultation or videos, review research studies and other requirements, including a test. Source: http://www.cappa.net/lactation-educator
La Leche League Leader (volunteer)	Training is self-paced. Usually 4-12 months.	Has successfully breastfed an infant for at least 12 months, is familiar with research and current findings dealing with breastfeeding, offers practical information and encouragement to nursing families from pregnancy through weaning via one-on-one help and monthly meetings. Includes 50 – 90 hours of guided study including communication skills and completion of a series of case studies based on common situations. Source: https://www.llli.org/get-involved/
Baby Café Breastfeeding Counselor (BCBC)	About 2 years	<ul style="list-style-type: none"> • A prescribed mentored curriculum volunteering at weekly Baby Café meetings for approx 100 meetings, with 30-60 hrs self-study • Usually an experienced breastfeeding mother with strong profession-oriented interest and links to the community • Has an understanding of national health-related impacts of breastfeeding and challenges mothers face in achieving breastfeeding goals • Demonstrates ability to offer routine lactation support; trouble shoots a wide variety of breastfeeding issues from newborn to weaning <p>Source: http://www.babycafeusa.org/</p>



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Lactation care providers are often accessed through public health settings such as Federally Qualified Health centers and through programs like Women, Infants, and Children

(WIC). In 2016, approximately 7.7 million participants utilized WIC benefits. Of that, nearly 600,000 women were breastfeeding.⁷

Studies have shown improved outcomes for breastfeeding through involvement of a lactation care provider. A review of 16 studies with a total number of 5,084 participants found interventions using lactation care providers increased initiation of breastfeeding by 1.35 and an improved rate for any breastfeeding up to 1 month vs not breastfeeding by 1.49. There were also beneficial effects on exclusive breastfeeding rates up to 1 month vs not exclusive breastfeeding of 1.71.⁸ Lactation involvement has also shown to have long-term success. A study evaluating the role of lactation care provider involvement yielded results of more mothers continuing to breastfeed at the four-month mark than those who did not have involvement.⁹

Lactation care providers also contribute to breastfeeding success by identifying when the infant is having difficulties forming a proper latch. A proper latch will require initial suction to initiate milk flow but will continue to flow with a good seal. A poor latch will require repeated, additional suction in attempt to initiate milk flow until a good seal is formed. The repeated attempts of forming a proper latch will lead to pain or discomfort for the mother as well as inadequate nourishment for the infant.

Often times, lactation care providers are the first to identify ankyloglossia, or tongue-tie. Ankyloglossia is estimated to be a contributing factor in 12.8 percent of breastfeeding difficulties. Lactation care providers will use a method such as “Murphy Maneuver” or a classification system such as the Hazelbaker Assessment Tool for Lingual Frenulum Function when assessing infants for ankyloglossia. If the infant has been diagnosed with

ankyloglossia the infant is typically referred to a specialist for a frenuloplasty procedure. Experts agree that ankyloglossia does not resolve on its own. After treatment, the infant is able to successfully breastfeed through proper latching and mothers experience a decrease in pain.^{10,11} These results suggest involvement of lactation care providers in postpartum support programs can have a significant effect on breastfeeding success.

Oral Development:

Infants experience craniofacial growth involving a change in size, shape, proportion and orientation. The rate at which growth occurs involves a complex interaction influenced by genetic, functional and environmental factors. During growth, the bone is displaced and remodeled in different areas at different rates. At birth the cranium is slightly more developed than the face resulting in an underdeveloped mandible; this contributes to the obtuse shape of the facial profile.⁵

As the infant begins to grow, those genetic, functional and environmental factors influence the development of the mandible. These factors could lead to malocclusion, or misalignment of the teeth. Malocclusion can have negative effects on oral health as well as social and emotional health.¹² Malocclusion is a multifactorial disorder, so the chance of narrowing the cause down to one variable is highly unlikely. However, much research has been done on the influence breastfeeding has on occlusion; especially on feeding and sucking behaviors.

Most research shows a decreased risk of malocclusion with breastfeeding. Children who were breastfed had a decreased chance of developing malocclusion compared to those in the absence of breastfeeding. Those children were specifically at a decreased chance of developing a class II incisal relationship or an increased overjet. They tend to have a wider intercanine and intermolar width, resulting in proper primary dental arch development.^{13,14} Since the breast is soft, it can easily adapt to the shape of the infant's mouth resulting in a more natural formation of the craniofacial structures.

Children who were breastfed for a longer duration, greater than 6 months, generally exhibit the lowest risk for malocclusion. Children who were breastfed for a short duration, less than 6 months, are at a higher risk for malocclusion.^{15,16,17,18,19} And children who were in the absence of breastfeeding have the highest risk for malocclusion. Those children are specifically at a higher risk for class II malocclusion and posterior cross bite. Bottle fed children are also at an increased risk for a non-spaced dentition and lack maxillary space.^{14,15,16,18,20}

Unfortunately, a shift from breastfeeding to bottle feeding appears to take place as time progresses; especially at the 6 and 12 month mark. At this time, infants began to incorporate non-nutritive sucking behavior in addition to nutritive sucking behavior. Infants who experience a short duration or absence of breastfeeding are 4 times more likely to develop non-nutritive sucking behaviors such as pacifier or digit sucking.^{15,18,19}

With non-nutritive sucking behaviors, the chance of developing malocclusion is increased. Overjet, overbite, anterior open bite and the absence of lower arch space is a common presentation.^{15,19,21} The tongue thrusting action which takes place during bottle

feeding, pacifier sucking or digit sucking could be a possible explanation. Since artificial nipples and pacifiers are less compressible and much harder than the breast, the infant's mouth must change to accommodate them. The sucking action contracts the buccinator muscle causing the maxilla to narrow. During digit sucking, the digit is pressed against the palate causing it to narrow.¹⁷

Malocclusion is a type of disorder which could be lessened through breastfeeding. It can cause developmental disorders in the craniofacial structure ranging in extent, it can impair the quality of life and its treatment can be a financial hurdle.^{16,22} Children who are breastfed have greater facial muscle activity and more adequate craniofacial growth and development.

The growth and development of craniofacial structures can also influence the infants breathing patterns. With breastfeeding, the tongue cups the breast which allows the palate to become round and flat. This formation allows the oropharyngeal muscles to coordinate and develop in a manner which is required for efficient swallowing. Once efficient swallowing has been established, the oropharyngeal muscles will develop allowing for adequate functionality.²³

With bottle feeding, the tongue depresses and the lips remain slightly parted. Milk begins to flow with little oral stimulation. This can result in the formation of a high palate, constricted dental arch, posterior displacement of the base of the tongue and mandibular retro-positioning. This can reduce the oropharynx volume which increases the risk of collapse while sleeping. This can lead to oral or oronasal breathing which can contribute to sleep disordered breathing.²³

Sleep disordered breathing (SDB) is a group of conditions which can range in severity from snoring to obstructive sleep apnea. SDB can lead to hypoxia, increased respiratory efforts along with other conditions which increase the risk for hyperactivity or inability to focus, daytime sleepiness, high blood pressure, and failure to grow. Some risk factors for SDB include enlarged adenoids and/or tonsils, nasal allergies, frequent colds, prematurity, obesity, and facial morphological features associated with hyperdivergent growth.²³

Breastfeeding shows promising results as a possible protective factor against SDB. Studies have shown that breastfeeding the infant for at least 2 months has significantly reduced the severity of SDB when measured through the apnea-hypoxia index, oxyhemoglobin desaturation nadir, and respiratory arousal index.^{24,25} Breastfeeding allows the infant to develop a nasal breathing pattern.²⁶ It has been found that longer durations of breastfeeding allow the infant to establish a correct nasal breathing pattern.²⁷ Whereas, bottle feeding and non-nutritive sucking behaviors have been associated with predominate oral breathing patterns.²⁶

Breastfeeding has also shown to be useful when identifying tethered oral tissues or TOTs. TOTs are found in three forms in the oral cavity: buccal, labial and lingual. The most common of these is known as “tongue-tie” or ankyloglossia. The area of studying TOTs is a more recent specialty and often involves professionals from various backgrounds including lactation, speech pathology, oral surgery, orofacial myology and otolaryngology.²⁸ Frequently discussed topics involving TOTs are breastfeeding, sleep apnea, and speech development.

As mentioned earlier, the action of suckling is dependent on the correct placement of the tongue. If the tongue is restricted due to ankyloglossia, then breastfeeding for the mother/child pair becomes difficult since a proper latch cannot be established. Another cause for concern involves the restriction of the upper lip or labia. If the labia are restricted the infant will have difficulty creating a seal around the areola. This could lead to insufficient pressure inhibiting the milk flow or an increased intake of air causing the infant gastroesophageal reflux disease. It could also interfere with tongue placement during suckling.^{29,30}

If these conditions go undetected, the mother may terminate breastfeeding early due to pain and difficulty and transition the infant to bottle feeding. Mothers often seek help with breastfeeding from a lactation care provider when they experience difficulties.²⁹ It is also becoming more common for the mother/child pair to meet with a lactation care provider after delivery to establish a proper latch and provide aid with breastfeeding. The lactation care provider may detect the tethered oral tissue(s) and refer to a specialist as needed.

Tethered oral tissues can also contribute to SDB, especially obstructive sleep apnea. When ankyloglossia is present, the lingua is in a constant depressed position. As mentioned earlier, this allows for reduction in the oropharynx volume which increases the risk for sleep disordered breathing.

TOTs are of concern with speech development, specifically in articulation. Articulation involves the tongue, both the upper and lower lips, the upper teeth, the upper gum or alveolar ridge, the hard palate, the soft palate, the uvula, the pharyngeal wall, and the glottis; with the most important of these being the tongue.^{31,32} The tongue has a range of

movements including tip-elevation, retraction, grooving, and protrusion. Tongue-tie will restrict these movements making it difficult to articulate.³² Although, ankyloglossia doesn't impair speech, it will alter it; especially at speed.

Research has also suggested that ankyloglossia can lead to an increase in dental caries since food debris cannot be swept away by the tongue and minimizes the spread of saliva.^{30,32} Dental caries is the most common chronic childhood disease.³³ It is of bacterial origin and is the result of a high cariogenic diet involving sugars. The early oral microbiome of an infant will have a strong influence on the etiology of caries at the later developmental stages.

Breastfeeding has been shown to reduce the risk of early childhood caries. One explanation for this has to do with the biomechanics of breastfeeding. Since the milk is expressed into the soft palate, the milk is swallowed and does not remain on the teeth unlike with bottle feeding.³⁴ Breast milk has also been found to have a suppressive effect on cariogenic *S. mutans* by containing *Lactobacilli*, which has not been isolated in the oral cavity of formula fed children. This finding could potentially benefit the oral ecosystem.³³

Research has shown a decreased risk associated with breastfeeding when compared to bottle feeding. However, the risk of caries increases as the duration of breastfeeding increases. Therefore, the risk of caries is decreased with breastfeeding up to 12 months, but increases when breastfeeding takes place beyond 12 months. At this point, the status of oral hygiene is the biggest risk factor.^{35,36,37}

It has been shown that breastfeeding is of higher prevalence in low- and middle- class families. Therefore, healthcare professionals, including lactation care providers, should discuss the importance of proper oral hygiene with parents emphasizing the importance of beginning with the first tooth eruption and minimizing the intake of sugar in their diet.^{34,38}

Chapter III: Methods and Materials

Introduction:

This, descriptive, study assessed lactation care provider's perception, attitude, and behavior on the relationship between breastfeeding and the oral development; including oral malocclusion, breathing patterns, tethered oral tissues, and dental caries. Previous studies have focused on the benefits of breastfeeding, the positive effect of lactation care provider involvement, and the effects of breastfeeding on oral malocclusion, breathing patterns, tethered oral tissues and dental caries.

Sample Description:

The survey was sent to a convenience sample of lactation care providers who are members of The United States Lactation Consultant Association® (USLCA®). USLCA® membership is open to all who support and promote breastfeeding or aspire to learn more and connect with colleagues, including lactation care providers, students and advocates. Members may join at any time and do not need to be an International Board Certified Lactation Consultant, IBCLC® to be a member but can be.³⁹ The survey was distributed with the approval and permission from The Board of Directors of USLCA®.

Procedure and Design:

Upon approval from the University of New Mexico's Institutional Review Board, Human Research Protection Office (HRPO) (Appendix A), an initial email consisting of a Recruitment Letter (Appendix B), was sent to the USLCA® Membership Coordinator, who then forwarded the link to members of USLCA® through the Monthly Newsletter. The survey was disseminated in the September 2019 Monthly Newsletter and was sent to 7,975 emails. Of those, about 2,500 emails belong to active members of USLCA®. Members could participate in the survey beginning September 9, 2019 and was open for three weeks closing on September 30, 2019. The letter briefly explained the purpose of the survey and contained a link through REDCap® where the participant would give consent (Appendix C) prior to accessing the survey.

Although participants could take the survey multiple times, it was strongly encouraged for the participant to only respond to the survey once. The questions on the survey (Appendix D) were multiple-choice. Some questions branched into further questions depending on the response selected. The survey took approximately five to ten minutes to complete.

Data Collection and Analysis:

Lactation care provider responses were collected using REDCap.® REDCap® allowed the participants to respond to the survey via smart phone, tablet, or computer. The survey did not collect personal information and the responses were anonymous. The data collected was used to assess lactation care provider's perception, attitude, and behavior on the relationship between breastfeeding and the oral development; including oral malocclusion, breathing patterns, tethered oral tissues, and dental caries. This study's conclusions are based on the results of the completed, submitted surveys. Those members who held no credentials were excluded from the data. Responses to the survey were summarized using percentages.

Chapter IV: Results, Discussion, and Conclusion

Results:

A total number of thirty-one (31) surveys were received. Of those, eighteen (18) were not members of The United States Lactation Consultant Association (USLCA®) and one (1) was a “Supporter of” and held no credentials leaving a total number of twelve (12) participants whose data could be evaluated (N=12). The twelve participants can be further described as eleven (n=11) participants holding the credential title of International Board Certified Lactation Consultant (IBCLC®) and the remaining one (n=1) participant who held the credential titles of Lactation Educator Counselor, Certified Lactation Counselor, and Certified Lactation Educator. The overall response rate was less than one percent (>1%). Figure 3 shows the individual response rate by type of member: 92% IBCLC and 8% Non-IBCLC.

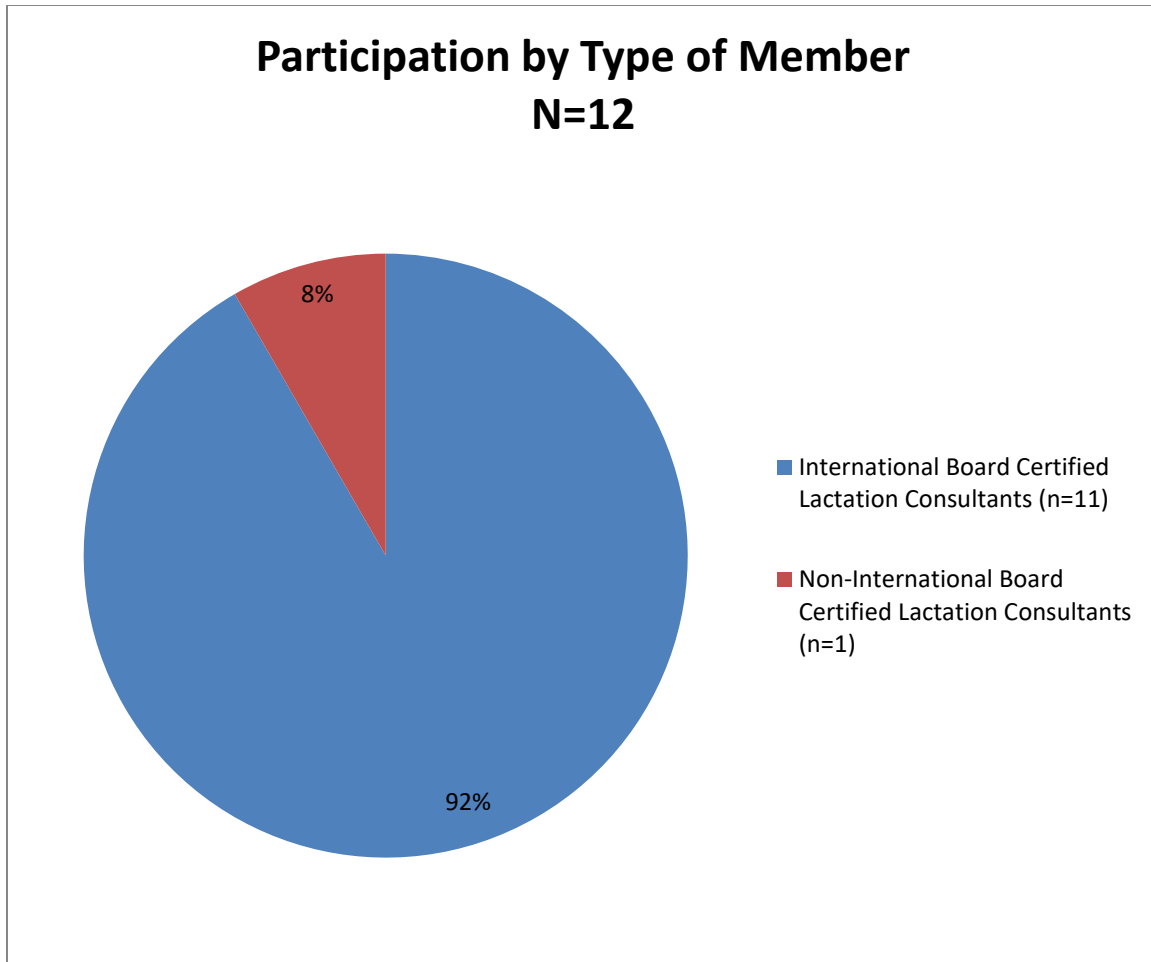


Figure 3. Individual response rate by type of member

Of the 12 participants, 41% (n=5) had been a Lactation Care Provider (LCP) for 0-5 years, 17% (n=2) had been a LCP for 6-10 years, 25% (n=3) had been a LCP for 11-20 years and 17% (n=2) had been a LCP for 20+ years. All the participants reported working in private practice as well as a hospital or public health setting. And 83% (n=10) reported working in the Western region of The United States.

The first set of questions asked the participants to reflect on the initial training they received while earning their credentials to become a LCP. They were asked to respond to the following statements using a Likert Scale.

I received training on the relationship between breastfeeding and

- *oral malocclusion (OM)*
- *breathing patterns (BP)*
- *tethered oral tissues (TOTs)*
- *dental caries (DC)*

The data were further divided into two response groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 4. For Oral Malocclusion, in the IBCLC group, 36% (n=4) Somewhat Agreed they received training, 9% (n=1) was neutral, 18% (n=2) Somewhat Disagreed, and 36% (n=4) Strongly Disagreed. For the Non-IBCLC group, 100% (n=1) Strongly Agreed to receive training. For Breathing Patterns, in the IBCLC group, 9% (n=1) Strongly Agreed they received training, 27% (n=3) Somewhat Agree, 27% (n=3) Somewhat Disagree, and 36% (n=4) Strongly Disagreed. For the Non-IBCLC group, 100% (n=1) Somewhat Agreed to receiving training. For Tethered Oral Tissues, in the IBCLC group, 27% (n=3) Strongly Agreed they received training, 18% (n=2) Somewhat Agreed, 18% (n=2) were Neutral, 18% (n=2) Somewhat Disagreed, and 18% (n=2) Strongly Disagreed to receiving training. For the Non-IBCLC group, 100% (n=1) Strongly Agreed to receive training. For Dental Caries, in the IBCLC group, 9% (n=1) Strongly Agreed they received training, 64% (n=7) Somewhat Agree, 18% (n=2) Somewhat Disagree, and 9%

(n=1) Strongly Disagree to receiving training. For the Non-IBCLC group, 100% (n=1) Somewhat Agree to receiving training.

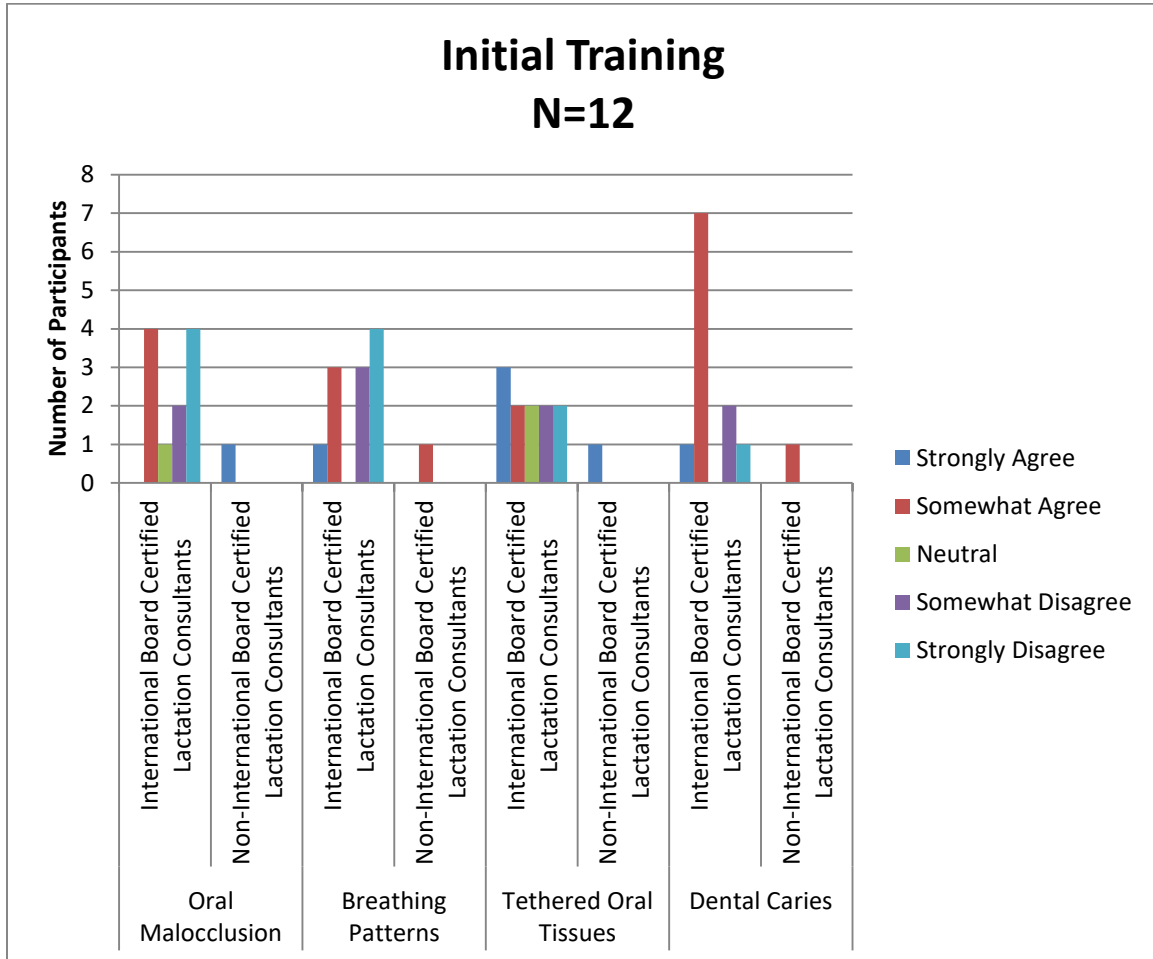


Figure 4. Initial training received on the relationship between breastfeeding and OM, BP, TOTs, and DC

The next set of questions asked the participants to reflect on their current level of knowledge on the relationship between breastfeeding and oral development, taking the following into consideration:

- *oral malocclusion (OM)*
- *breathing patterns (BP)*
- *tethered oral tissues (TOTs)*
- *dental caries (DC)*

Again, they were asked to respond to the following statements using a Likert Scale and the data were further divided into two response groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 5. For Oral Malocclusion, in the IBCLC group, 55% (n=6) Strongly Agree they are knowledgeable, 18% (n=4) Somewhat Agree, and 9% (n=1) Strongly Disagrees to being knowledgeable. For the Non-IBCLC group, 100% (n=1) Somewhat Agrees to being knowledgeable. For Breathing Patterns, in the IBCLC group, 64% (n=7) Strongly Agree they are knowledgeable, 18% (n=2) Somewhat Agree, 9% (n=1) Somewhat Disagrees, and 9% (n=1) Strongly Disagrees to being knowledgeable. For the Non-IBCLC group, 100% (n=1) is neutral to being knowledgeable. For Tethered Oral Tissues, in the IBCLC group, 91% (n=10) Strongly Agree they are knowledgeable and 9% (n=1) is Neutral. For the Non-IBCLC group, 100% (n=1) Somewhat Agrees to being knowledgeable. For Dental Caries, in the IBCLC group, 55% (n=6) Strongly Agree they are knowledgeable and 45% (n=5) Somewhat Agree to being knowledgeable. For the Non-IBCLC group, 100% (n=1) Somewhat Agrees to being knowledgeable.

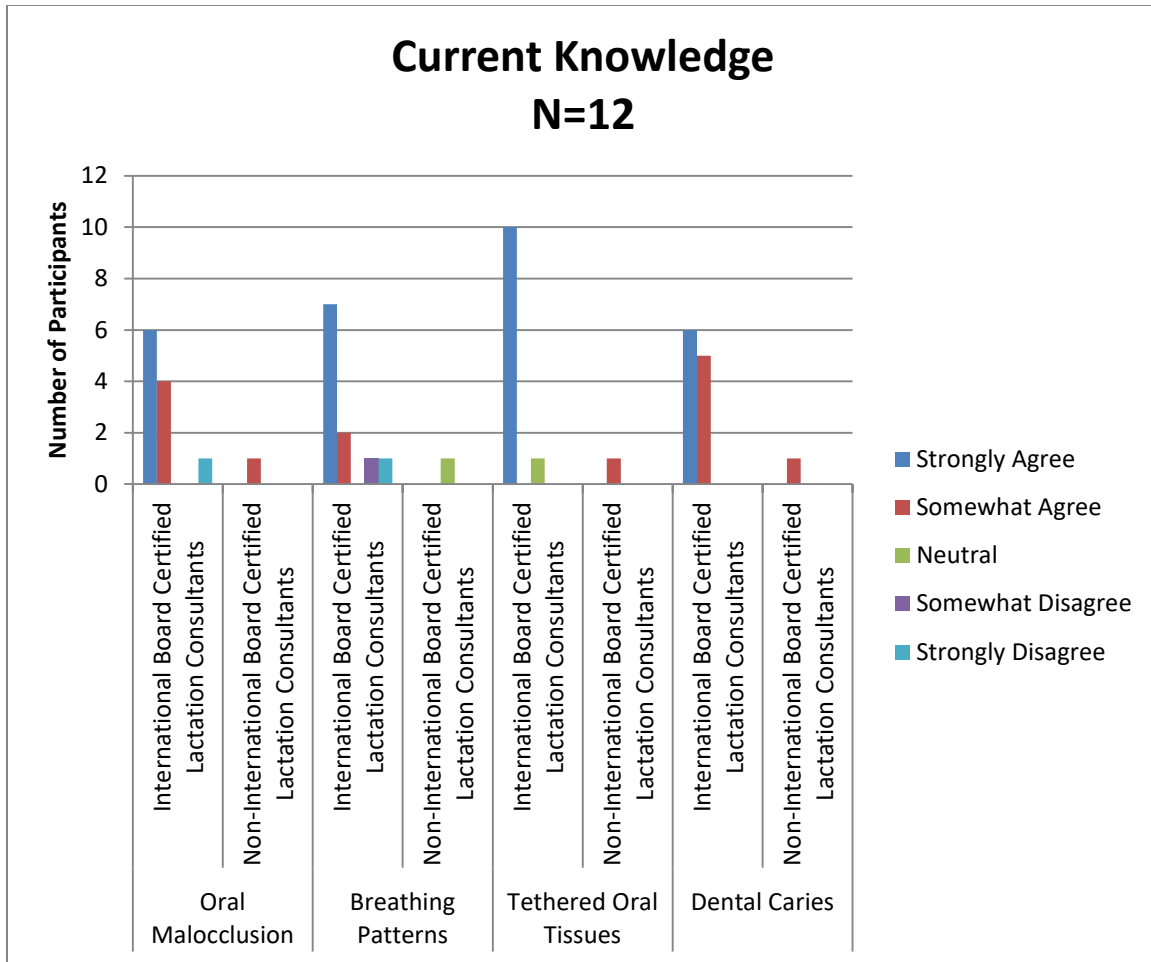


Figure 5. Current level of knowledge on the relationship between breastfeeding and OM, BP, TOTs, and DC

A follow up question asking the participants if they had taken additional training and/or courses on the following relationships was asked:

- *Breastfeeding and Oral Malocclusion*
- *Breastfeeding and Breathing Patterns*
- *Breastfeeding and Tethered Oral Tissues*

- *Breastfeeding and Dental Caries*

The participants responded by selecting *Yes* or *No* and the responses were further divided into two groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 6. For the IBCLC group, 73% (n=8) had taken additional training and/or courses in Oral Malocclusion, 55% (n=6) had taken in Breathing Patterns, 100% (n=11) had taken in Tethered Oral Tissues, and 55% (n=6) had taken in Dental Caries. For the Non-IBCLC group, 100% (n=1) did not take additional training and/or courses in any of the relationships asked.

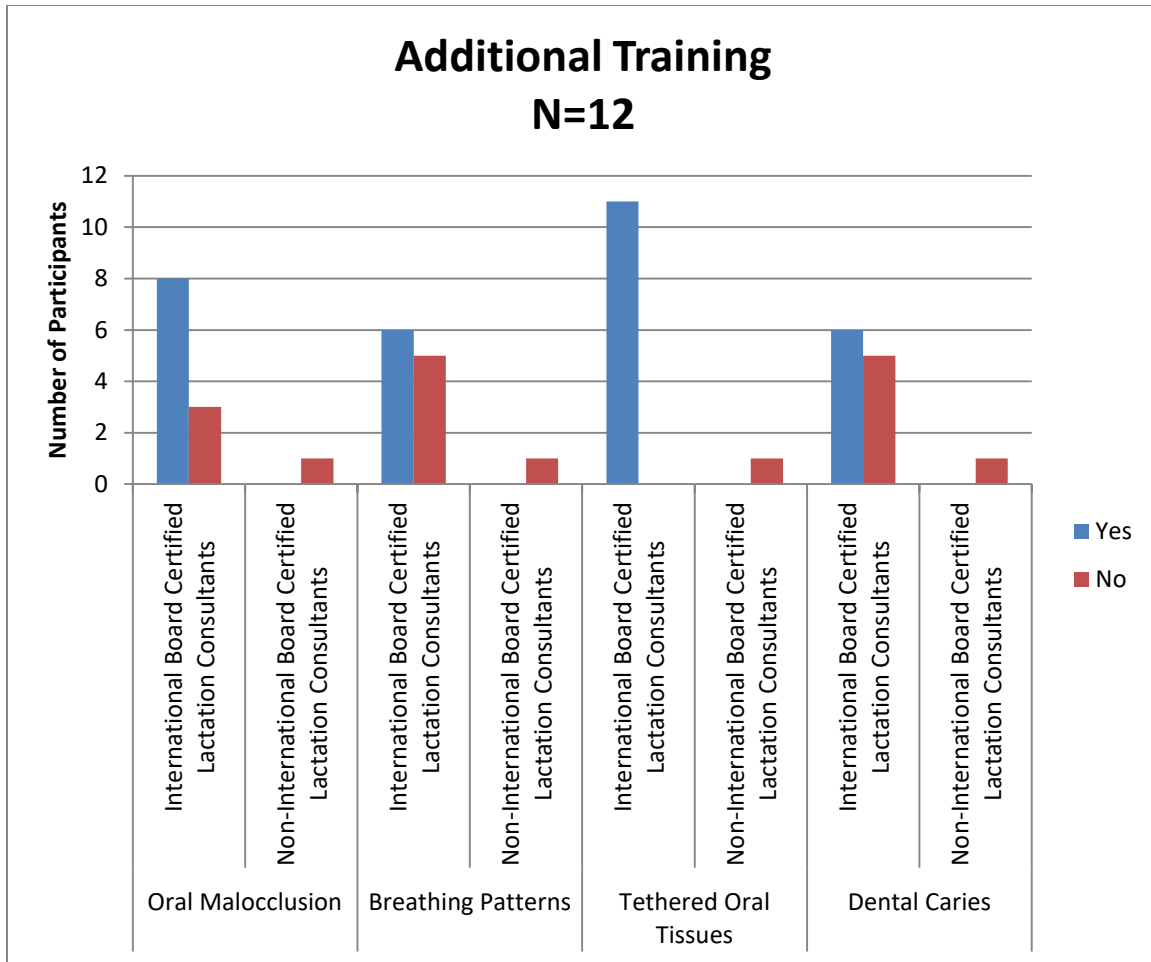


Figure 6. Additional Training taken on the relationship between breastfeeding and OM, BP, TOTs, and DC

Then the participants were asked about their current level of comfort in discussing the relationship between breastfeeding and oral development, taking the following into consideration:

- *oral malocclusion (OM)*
- *breathing patterns (BP)*

- *tethered oral tissues (TOTs)*
- *dental caries (DC)*

Again, they were asked to respond to the following statements using a Likert Scale and the data were further divided into two response groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 7. For Oral Malocclusion, in the IBCLC group, 27% (n=3) Strongly Agreed to being comfortable discussing, 55% (n=6) Somewhat Agreed, 9% (n=1) was Neutral, and 9% (n=1) Strongly Disagreed. For the Non-IBCLC group, 100% (n=1) Somewhat Agreed to being comfortable discussing. For Breathing Patterns, in the IBCLC group, 55% (n=6) Strongly Agree to being comfortable discussing, 27% (n=3) Somewhat Agreed, 9% (n=1) was Neutral, and 9% (n=1) Strongly Disagreed. For the Non-IBCLC group, 100% (n=1) was Neutral in comfortability. For Tethered Oral Tissues, in the IBCLC group, 91% (n=10) Strongly Agreed to being comfortable discussing and 9% (n=1) Somewhat Agreed. For the Non-IBCLC group, 100% (n=1) Somewhat Agreed to being comfortable discussing. For Dental Caries, in the IBCLC group, 45% (n=5) Strongly Agreed to being comfortable discussing, 45% (n=5) Somewhat Agreed, and 9% (n=1) was Neutral. For the Non-IBCLC group, 100% (n=1) was Neutral in comfortability.

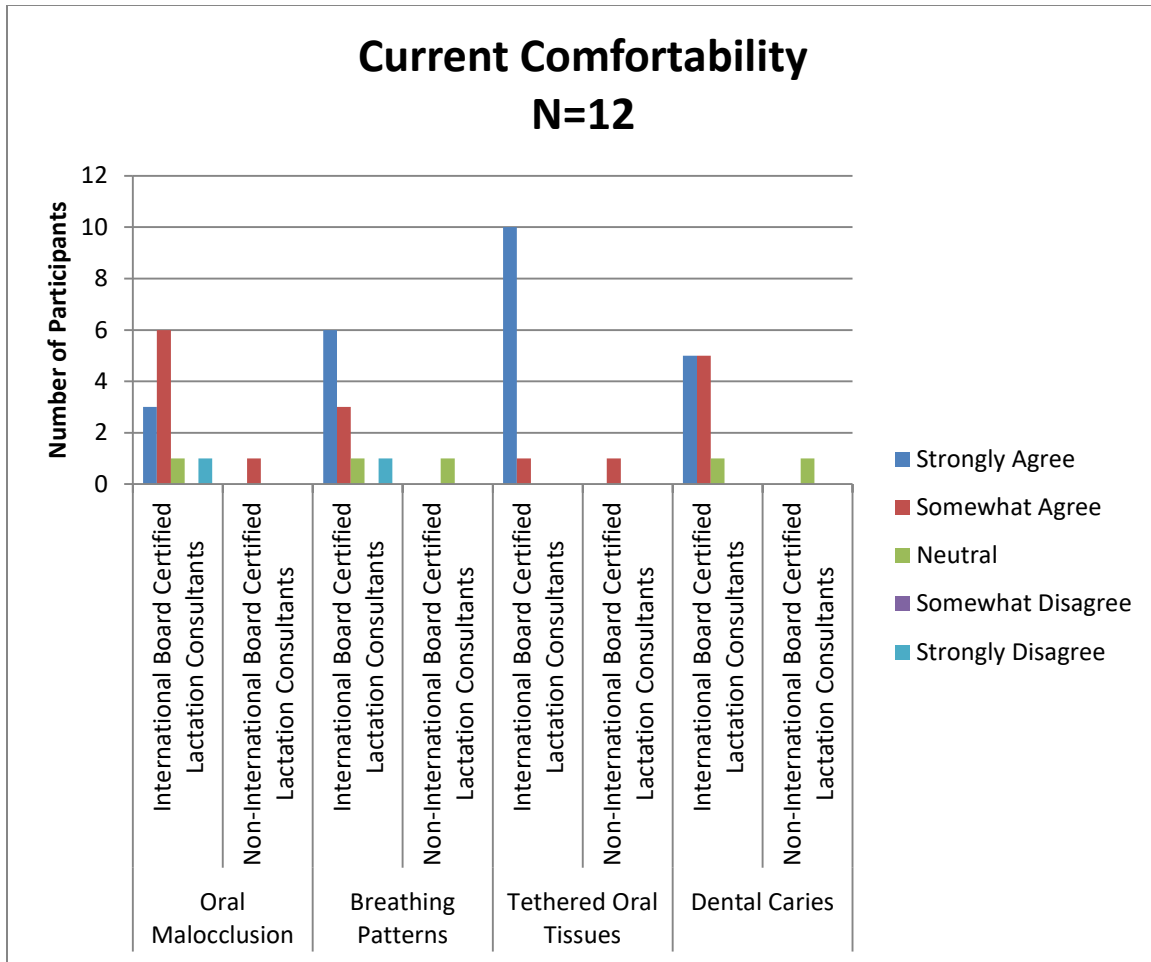


Figure 7. Current level of comfort in discussing the relationship between breastfeeding and OM, BP, TOTs, and DC

The participants were then asked to reflect on the interactions they had with their patients and give an average percentage of how often they discuss the relationship between breastfeeding and oral development. Data was further divided into two response groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 8. In the IBCLC group, 9% (n=1) stated they discuss the relationship 0-25% of the time, 18%

(n=2) discuss the relationship 26-50% of the time, 55% (n=6) discuss the relationship 51-75% of the time, and 18% (n=2) discuss the relationship 76-100% of the time. In the Non-IBCLC group, 100% (n=1) discuss the relationship 0-25% of the time.

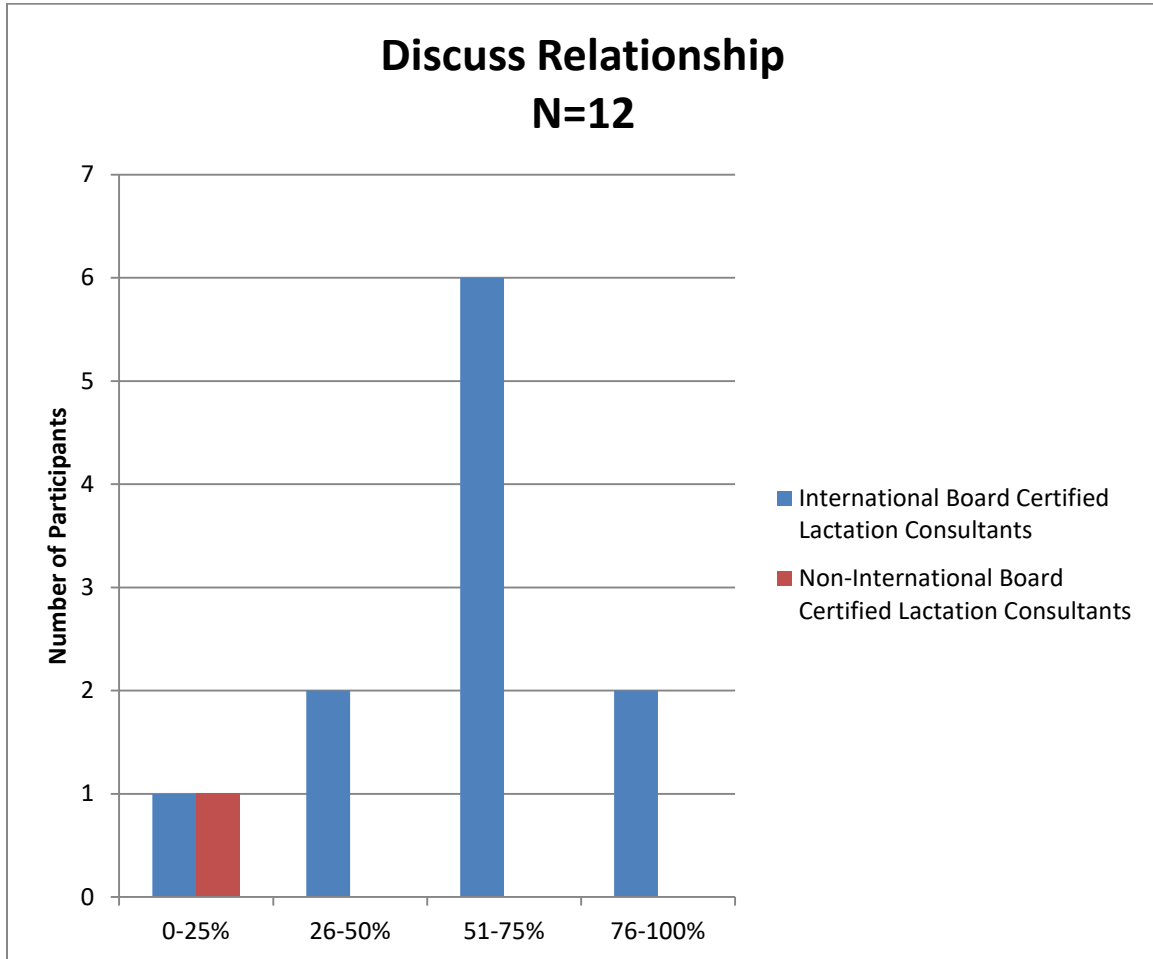


Figure 8. Frequency of LCPs discussing the relationship between breastfeeding and oral development during patient interactions

As a follow up question, the participants were asked to reflect on the interactions with their patients and how often they refer their patient to dental professionals when they have an oral health concern. Again, the data was divided into two response groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 9. In the IBCLC group, 55% (n=6) refer out 0-25% of the time, 18% (n=2) refer out 26-50% of the time, 9% (n=1) refer out 51-75% of the time, and 18% (n=2) refer out 76-100% of the time. In the Non-IBCLC group, 100% (n=1) refer out 76-100% of the time.

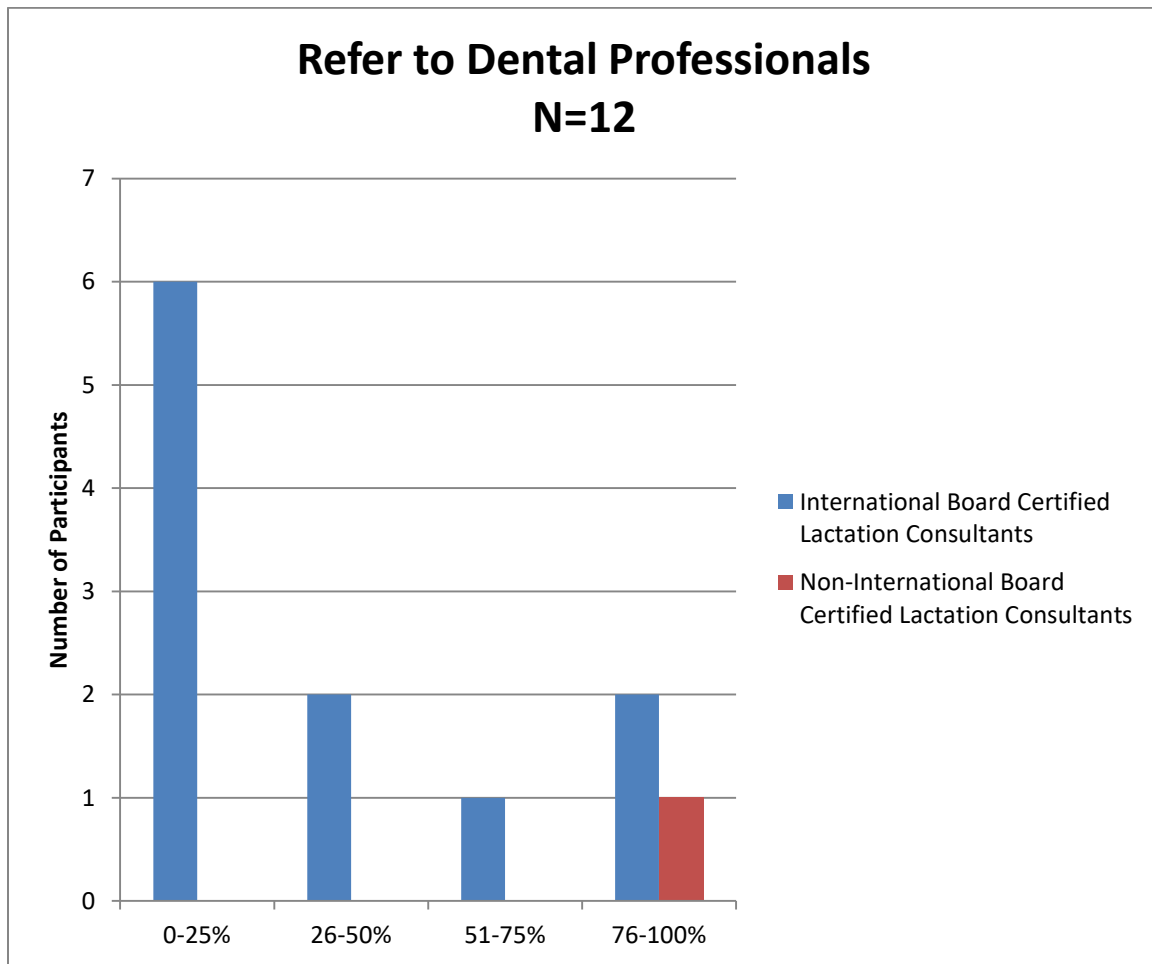


Figure 9. Frequency of LCPs referring out to dental professionals during patient interaction when there is an oral health concern

Lastly, the participant was asked to what extent they perceive breastfeeding to influence the infant’s oral development based on their training and experience. The data were further divided into two response groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 10. For the IBCLC group, 82% (n=9) responded “To a great extent” and 18% (n=2) responded “To a moderate extent.” For the Non-IBCLC group, 100% (n=1) responded “To a great extent.”

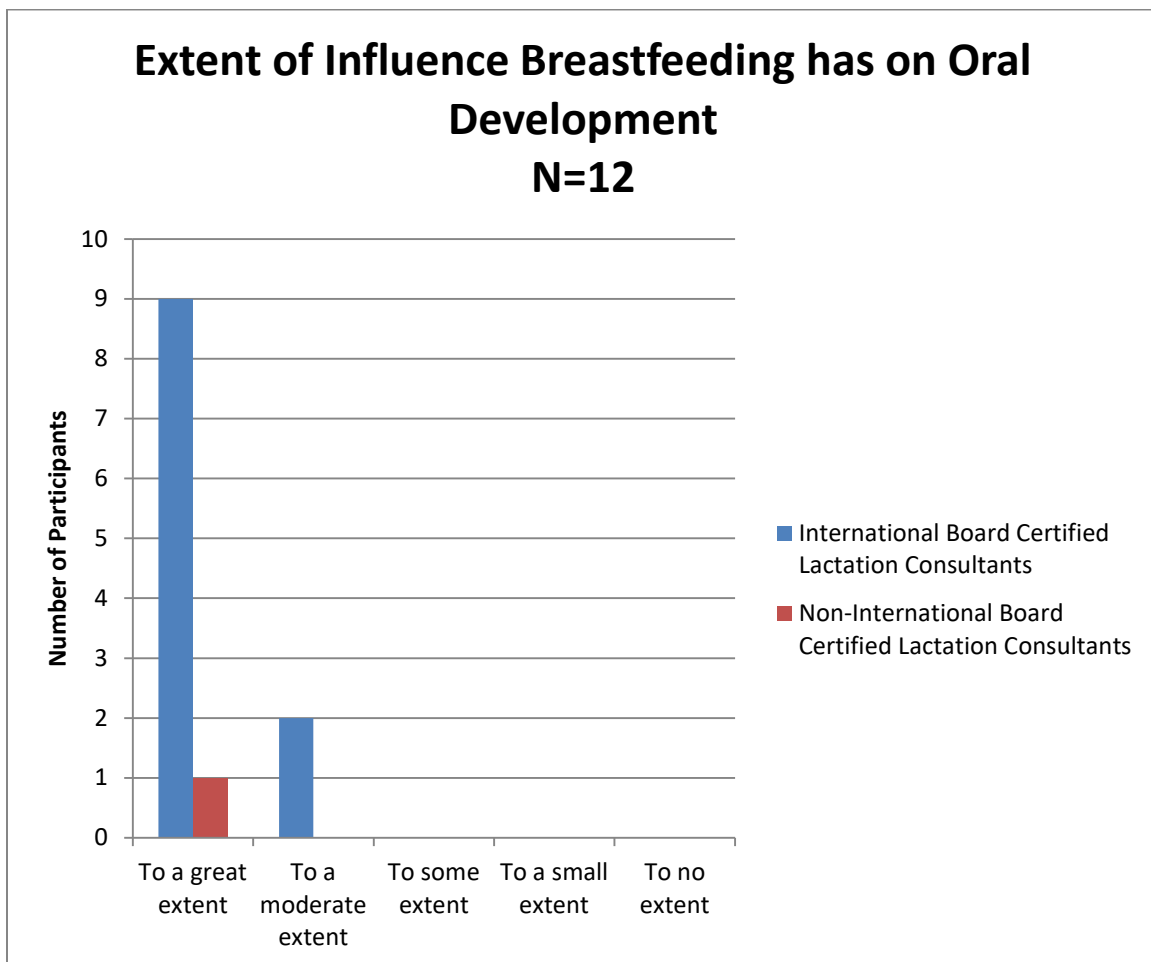


Figure 10. The extent LCPs perceive breastfeeding to influence oral development

A follow up question was asked of the participants to describe what kind of influence they perceive breastfeeding to have on the infant’s oral development. The data were further divided into two response groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 11. Both the IBCLC group and the Non-IBCLC group had a 100% response rate of breastfeeding having a positive influence on the infant’s oral development.

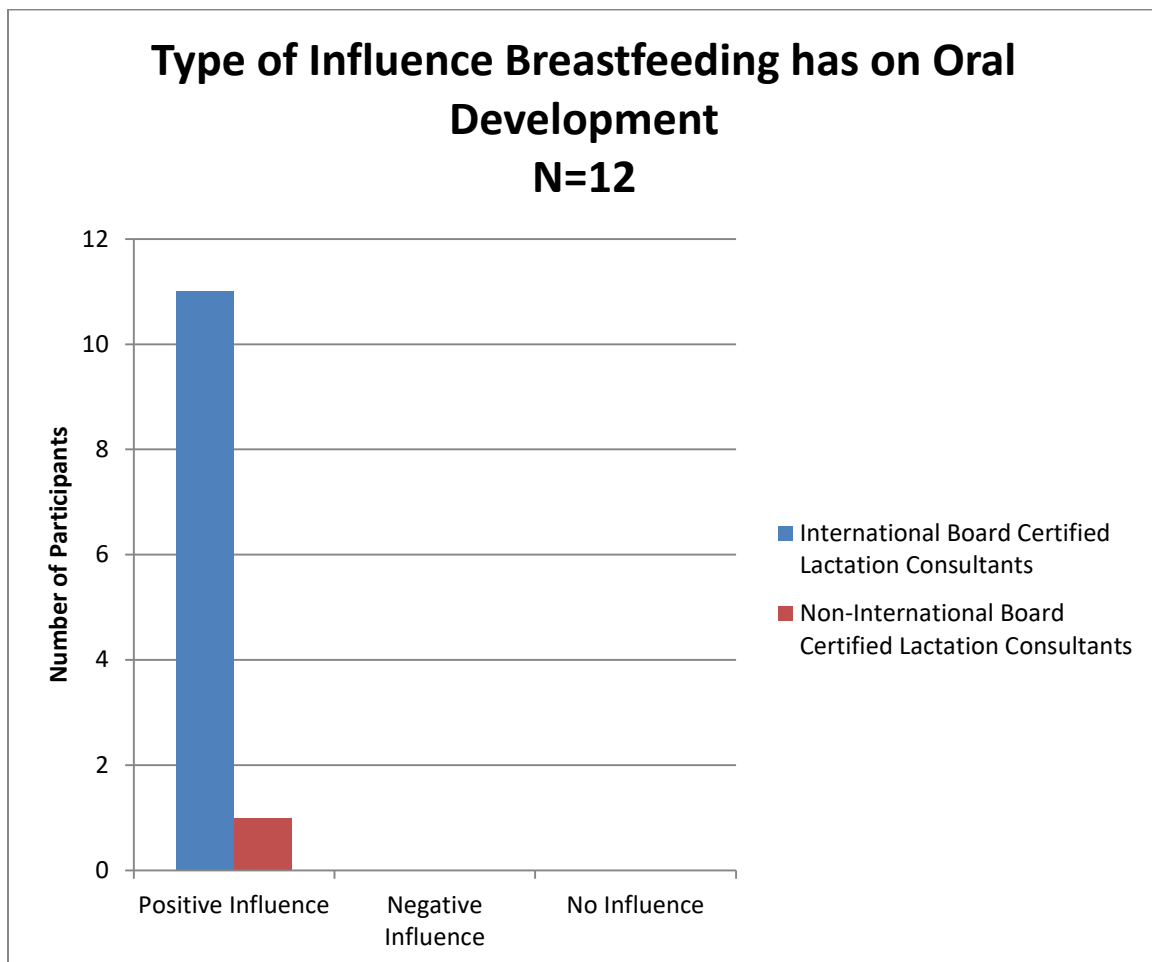


Figure 11. LCPs perception of influence breastfeeding has on the infant’s oral development

Discussion:

In terms of participants, there was about an equal response rate from the “years practicing” options and all participants worked in similar settings. The responses received on the “what region do you serve question” was interesting. 83% (n=10) said they served the Western region of The United States. This raises the questions, 1) Are there more LCPs in the Western region than other regions of The United States? Or 2) Do LCPs in the West value research more than other regions of The United States? Another demographic question which rose further questioning was “which type of member are you.” With 92% (n=11) of participants being IBCLCs it raises the questions 1) Do IBCLCs value research more than Non-IBCLCs? And 2) Can this be contributed to the requirement of being a healthcare professional or taking health science classes prior to being eligible to test for IBCLC certification?

In attempt to answer research question one “Do lactation care providers receive training on the relationship between breastfeeding and oral development while earning their credentials?” with the hypothesis of (H1) Lactation care providers do not receive training on the relationship between breastfeeding and oral development while earning their credentials cannot be accepted or rejected. With the response rate being small, statistical comparisons were unable to be conducted. Descriptive statistics of the sample population however suggest that at least half of the responses report receiving training on the relationship between breastfeeding and oral development while earning their credentials.

Had this research question been worded differently, leaving out the “while earning their credentials” part the results could have been different. For example, if this question just asked if LCPs receive training on the relationship the results would have been different. The questions asking about “Current Knowledge” (Figure 5) and “Additional Training” (Figure 6) illustrate that LCPs do have resources to train them on the relationship between breastfeeding and oral development. While they may or may not receive training on this relationship during their initial training to earn their credentials, they may take additional training and/or courses to learn more about this.

Research question two, “Do lactation care providers present their patients with information on the relationship between breastfeeding and the infant’s oral development?” had the hypothesis of H2. Lactation care providers do not present their patients with information on the relationship between breastfeeding and the infant’s oral development would be rejected using descriptive statistics. Based upon the responses, 66% (n=8) of the participants report discussing the relationship between breastfeeding and the infant’s oral development with their patients more than 50% of the time. The follow up question asking about “how often do you refer to dental professionals” showed that 66% (n=8) of the participants refer less than 50% of the time. This shows an inverse relationship of LCPs discussing the relationship with patients and how often they refer to dental professionals.

Lastly, research question three “How comfortable to lactation care providers feel discussing this relationship with their patients?” had the hypothesis of H3. Lactation care providers do not feel comfortable discussing this relationship with their patients which would be rejected utilizing descriptive statistics. Overall, all four factors evaluated determine

lactation care providers agree that they feel comfortable discussing the relationship between breastfeeding and oral development with their patients.

Limitations:

The biggest limitation with this study was the low response rate. With the response rate being less than one percent, generalizations about this population cannot be made and any made will not accurately reflect the population. The other challenge of a low response rate was analyzing the data. With N=12 and the two response groups of IBCLC (n=11) and Non-IBCLC (n=1) being of unequal proportions statistical analysis could not be completed.

A demographic question asking if they held credentials of another healthcare profession i.e. physician, dentist, occupational therapist, etc. could have also been beneficial in evaluating the data. This type of question could have provided information to evaluate if the LCPs current knowledge varied based on their profession. For example, a dentist might have more knowledge on the relationship between breastfeeding and oral development than a physician. However, this type of analysis would not have been accurate for this study based on the participation rate of N=12.

Conclusion:

Lactation care providers are often times one of the first professionals to provide oral health information to the mother/child pair. While there are resources available for LCPs to

enhance their knowledge on the relationship between breastfeeding and oral development it is unsure how much of that information they are taught during their initial training to earn their credential(s). Lactation care providers report discussing this relationship with their patients often and feel comfortable providing this information. This level of comfort could explain why lactation care providers refer to dental professionals less than 50% of the time. Although, lactation care providers perceive breastfeeding to positively influence the infant's oral development. This study supports the need for an inter-professional collaboration between dental professionals and lactation care providers. In doing so, the mother/child pair will be more informed on oral development which could lead to a decrease in oral disease/complications and an increase in oral health prevention.

Chapter V: Article for Submission

Journal of Dental Hygiene

Title: Oral Development and Breastfeeding: An Assessment of the Lactation Care Provider
Approach

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Keywords: Oral Development, Breastfeeding, Lactation Care Providers

ABSTRACT

Purpose: The purpose of this study was to assess lactation care provider's perception, attitude and behavior on the relationship between breastfeeding and oral development; including oral malocclusion, breathing patterns, tethered oral tissues and dental caries.

Methods: A multiple-choice survey was disseminated to members of The United States Lactation Consultant Association. Descriptive analysis was used to evaluate each question.

Results: A total of 12 members participated in the survey, 11 International Board Certified Lactation Consultants (IBCLCs) and 1 Non-IBCLC. Lactation care providers have resources available which describe the relationship between breastfeeding and oral development. However, it was unclear when they receive this training. Lactation care providers discuss this relationship with their patients more than 50% of the time and state they feel comfortable in doing so. This level of comfort could describe why lactation care providers refer to dental professionals less than 50% of the time.

Conclusion: Lactation care providers are often the first professionals to provide oral health information to the mother/child pair. While there are resources available to LCPs on the relationship between oral development and breastfeeding it is unclear how they receive their training. However, lactation care providers report discussing this relationship with their patients during their interactions and feel comfortable providing this information. Lactation care providers also report they do not refer to dental professionals on a regular basis even though they perceive breastfeeding to positively influence oral development. This study

supports the need for an interprofessional collaboration between dental professionals and lactation care providers.

Introduction:

Lactation care providers are professionals who specialize in human lactation and the clinical management of breastfeeding. They often provide support to breastfeeding mothers and their babies and provide educational training to medical personnel. They prevent, recognize, and solve breastfeeding difficulties as well as advocate, conduct research, provide leadership and professional development for the lactation community. Lactation care providers work in a variety of settings including hospitals, clinics, private medical practices, community health departments, federally qualified health centers, home health agencies, and private practices.

Lactation care providers use evidence-based practice behind their teachings, even though human lactation, or breastfeeding, is natural. Lactation care providers use the science of breastfeeding to assist the mother with latching and the physical act itself. They provide information on the benefits for both the mother and the infant; typically focusing on physical, mental and social health.

In respect to the mother's health, breastfeeding can help release hormones, such as prolactin and oxytocin, which help the mother bond with the infant as well as aid with postpartum recovery. Studies have also shown that women who breastfeed tend to experience decreased rates of breast and ovarian cancer later in life as well as reduce the risk for developing type 2 diabetes, rheumatoid arthritis and cardiovascular disease¹. Breastfeeding also provides the convenience of feeding an infant with minimal cost and supplies.²

As far as infant health is concerned, the most common information provided revolves around the infant's physical health. The physical benefits of breastfeeding an infant include ideal nutrition, the transfer of antibodies, the prevention of SIDS, and the reduced risk for allergies, asthma, and other medical conditions.

Breastfeeding influences the infant's oral development in many ways. Studies have shown breastfeeding influences oral development by impacting the formation of the dental arch, dentition, occlusion, and facial profile. It also plays a role in palate formation which is believed to contribute to the infant's breathing patterns.³ Breastfeeding also strengthens the sucking and swallowing mechanisms and can lead to early detection for tongue and lip ties; also helping with articulation during speech development. Lastly, breastfeeding influences the oral microbiome which is a contributor to caries formation.

With so many beneficial aspects of breastfeeding on oral development, it raises the questions:

Q1. Do lactation care providers receive training on the relationship between breastfeeding and oral development while earning their credentials?

Q2. Do lactation care providers present their patients with information on the relationship between breastfeeding and the infant's oral development?

Q3. How comfortable do lactation care providers feel discussing this relationship with their patients?

Which pose the hypotheses:

H1. Lactation care providers do not receive training on the relationship between breastfeeding and oral development while earning their credentials.

H2. Lactation care providers do not present their patients with information on the relationship between breastfeeding and the infant's oral development.

H3. Lactation care providers do not feel comfortable discussing this relationship with their patients.

Dental hygienists are healthcare professionals who specialize in prevention and work in private and public settings to meet the oral health needs of patients. This is achieved by conducting various assessments of the head and neck region, performing specific procedures within their scope of practice, and providing oral health education.

Since, the oral cavity is the main area dental hygienists work in and treat, it is important to understand what can influence oral development. During dental hygiene school, the student is required to take courses which cover dental anatomy and anatomy of the head and neck. However, these courses don't cover the relationship between breastfeeding and oral development. With that being said, it becomes the dental hygienist's responsibility to learn this relationship on their own, as patients may ask them for advice. Often times, patients feel comfortable asking their dental hygienist for advice since they develop a trusting relationship with them.

A dental hygienist should also feel comfortable referring out to a lactation care provider when the conversation extends past their knowledge. Being able to collaborate with and refer to other healthcare providers is essential to provide the patient with comprehensive

care. Therefore, knowing who lactation care providers are and what services they offer can be beneficial for patients.

An interprofessional relationship between lactation care providers and dental hygienists may prove to be beneficial for the infant. Often times, the mothers who are receiving their pre- and post- natal care through public health settings, such as federally qualified health centers, are interacting with lactation care providers for their breastfeeding support. Lactation care providers may be the first to recognize a developmental problem, such as tethered oral tissues, since this will present as a challenge when the infant tries to latch. When the infant transitions to eating solids, the child becomes at risk for developing dental caries without proper home care. The child and mother pair are then in need of oral health education. Having family involved in the child's oral health early on could lead to a decrease in oral disease(s) and an increase in preventive measures. In the long run, the infant will be healthier from this relationship which is the goal of both healthcare professions.

Methods and Materials:

This, descriptive, study assessed lactation care provider's perception, attitude, and behavior on the relationship between breastfeeding and the oral development; including oral malocclusion, breathing patterns, tethered oral tissues, and dental caries. Previous studies have focused on the benefits of breastfeeding, the positive effect of lactation care provider involvement, and the effects of breastfeeding on oral malocclusion, breathing patterns, tethered oral tissues and dental caries.

The survey was sent to a convenience sample of lactation care providers who are members of The United States Lactation Consultant Association® (USLCA®). USLCA® membership is open to all who support and promote breastfeeding or aspire to learn more and connect with colleagues, including lactation care providers, students and advocates. Members may join at any time and do not need to be an International Board Certified Lactation Consultant, IBCLC® to be a member but can be.³⁹ The survey was distributed with the approval and permission from The Board of Directors of USLCA®.

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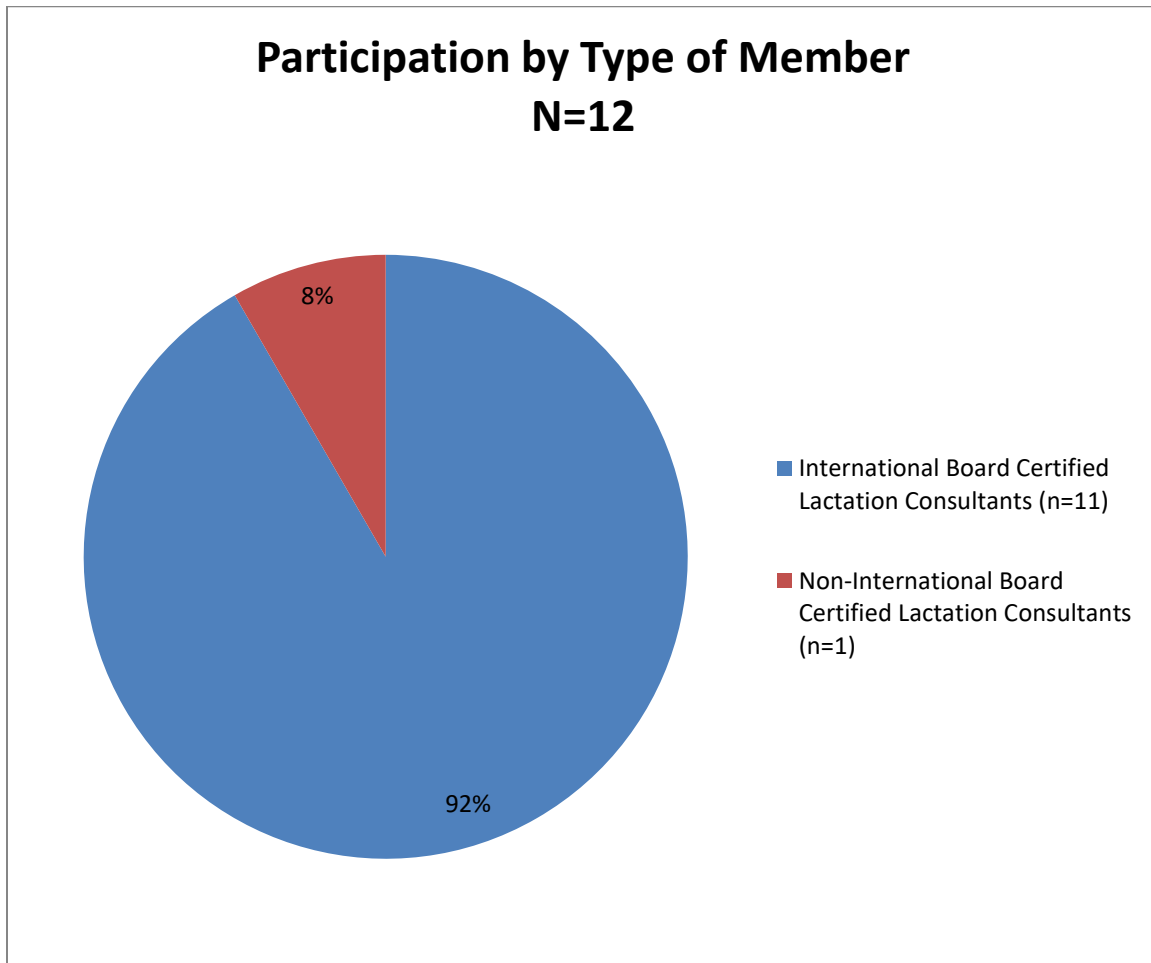


Figure 3. Individual response rate by type of member

Of the 12 participants, 41% (n=5) had been a Lactation Care Provider (LCP) for 0-5 years, 17% (n=2) had been a LCP for 6-10 years, 25% (n=3) had been a LCP for 11-20 years and 17% (n=2) had been a LCP for 20+ years. All the participants reported working in private practice as well as a hospital or public health setting. And 83% (n=10) reported working in the Western region of The United States.

The first set of questions asked the participants to reflect on the initial training they received while earning their credentials to become a LCP. They were asked to respond to the following statements using a Likert Scale.

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(n=1) Strongly Disagree to receiving training. For the Non-IBCLC group, 100% (n=1) Somewhat Agree to receiving training.

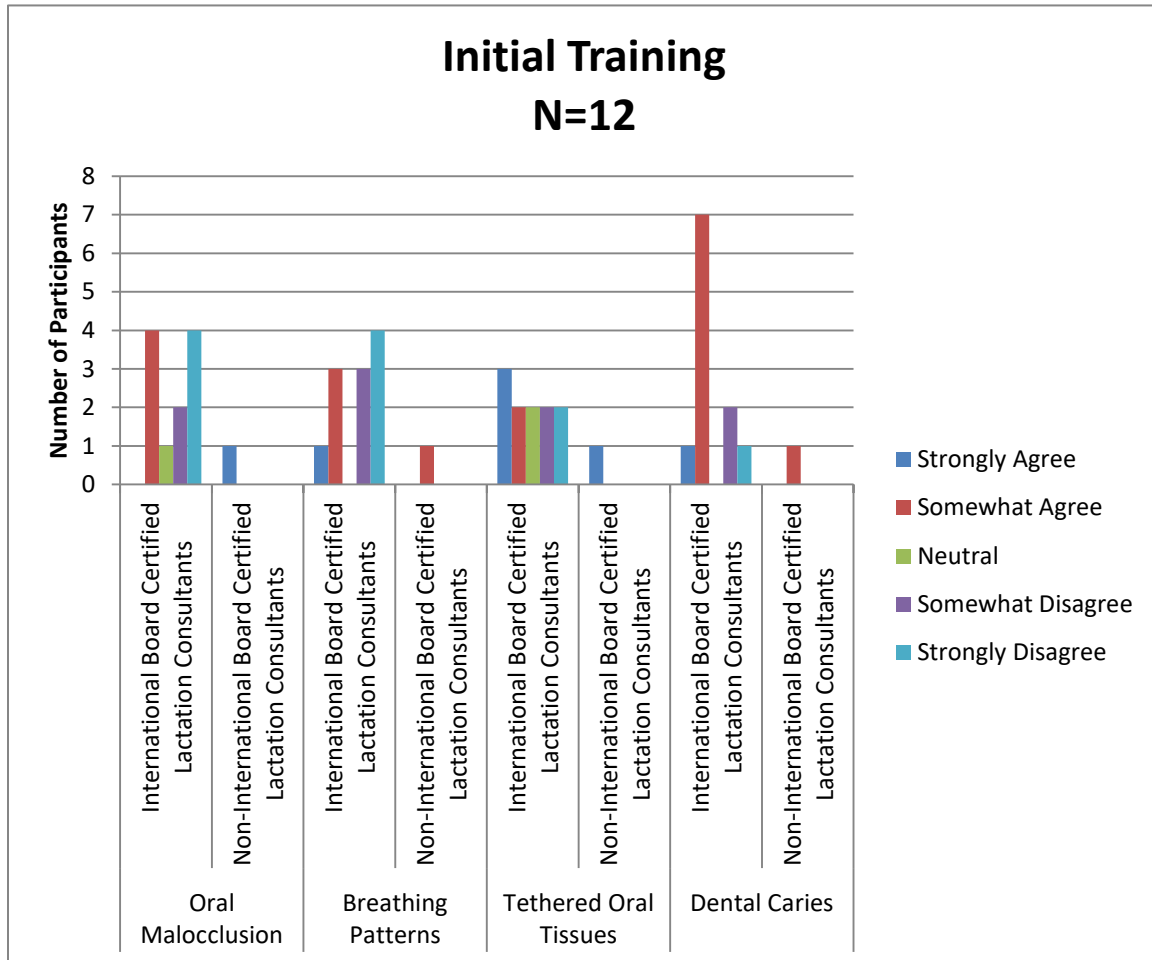


Figure 4. Initial training received on the relationship between breastfeeding and OM, BP, TOTs, and DC

The next set of questions asked the participants to reflect on their current level of knowledge on the relationship between breastfeeding and oral development, taking the following into consideration:

- *oral malocclusion (OM)*
- *breathing patterns (BP)*
- *tethered oral tissues (TOTs)*
- *dental caries (DC)*

Again, they were asked to respond to the following statements using a Likert Scale and the data were further divided into two response groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 5. For Oral Malocclusion, in the IBCLC group, 55% (n=6) Strongly Agree they are knowledgeable, 18% (n=4) Somewhat Agree, and 9% (n=1) Strongly Disagrees to being knowledgeable. For the Non-IBCLC group, 100% (n=1) Somewhat Agrees to being knowledgeable. For Breathing Patterns, in the IBCLC group, 64% (n=7) Strongly Agree they are knowledgeable, 18% (n=2) Somewhat Agree, 9% (n=1) Somewhat Disagrees, and 9% (n=1) Strongly Disagrees to being knowledgeable. For the Non-IBCLC group, 100% (n=1) is neutral to being knowledgeable. For Tethered Oral Tissues, in the IBCLC group, 91% (n=10) Strongly Agree they are knowledgeable and 9% (n=1) is Neutral. For the Non-IBCLC group, 100% (n=1) Somewhat Agrees to being knowledgeable. For Dental Caries, in the IBCLC group, 55% (n=6) Strongly Agree they are knowledgeable and 45% (n=5) Somewhat Agree to being knowledgeable. For the Non-IBCLC group, 100% (n=1) Somewhat Agrees to being knowledgeable.

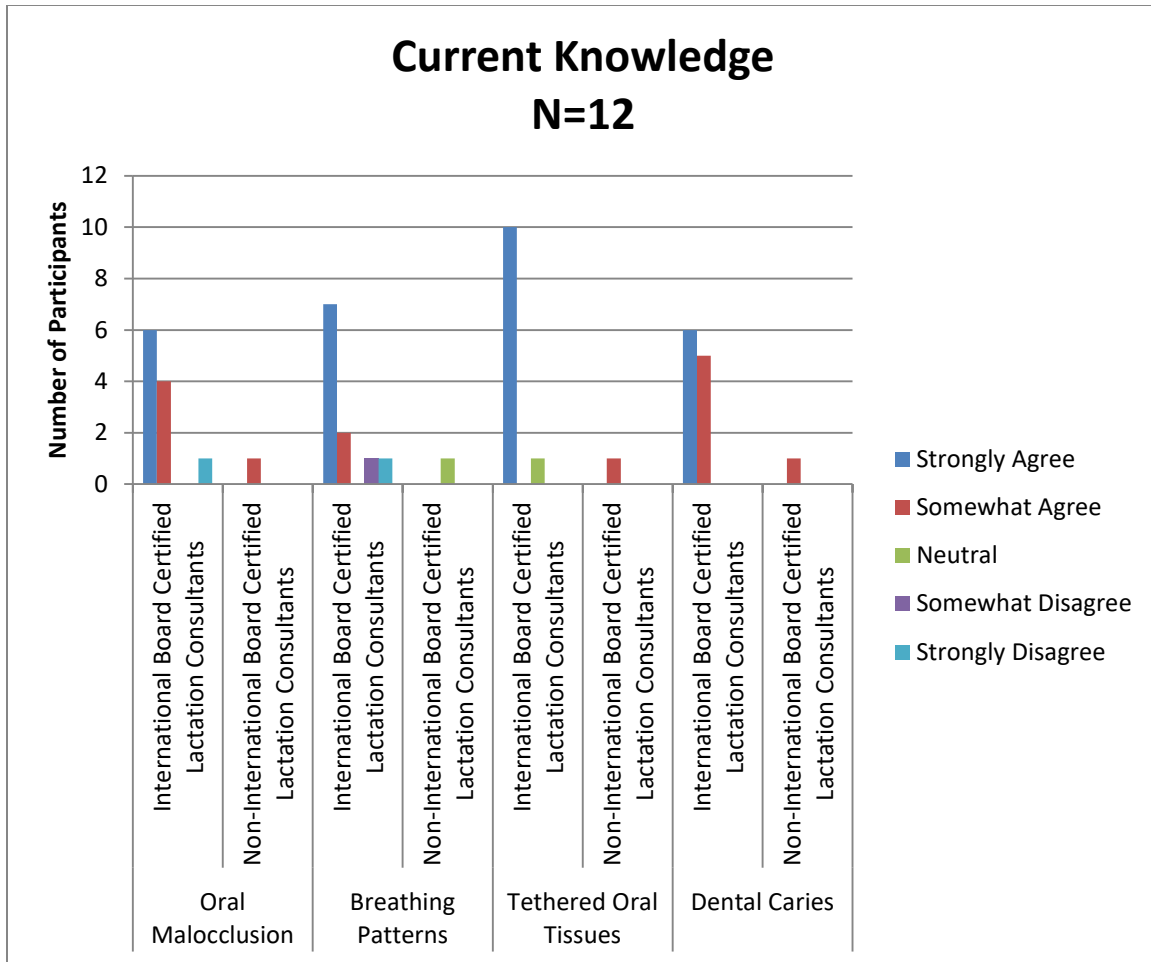


Figure 5. Current level of knowledge on the relationship between breastfeeding and OM, BP, TOTs, and DC

A follow up question asking the participants if they had taken additional training and/or courses on the following relationships was asked:

- *Breastfeeding and Oral Malocclusion*
- *Breastfeeding and Breathing Patterns*
- *Breastfeeding and Tethered Oral Tissues*

- *Breastfeeding and Dental Caries*

The participants responded by selecting *Yes* or *No* and the responses were further divided into two groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 6. For the IBCLC group, 73% (n=8) had taken additional training and/or courses in Oral Malocclusion, 55% (n=6) had taken in Breathing Patterns, 100% (n=11) had taken in Tethered Oral Tissues, and 55% (n=6) had taken in Dental Caries. For the Non-IBCLC group, 100% (n=1) did not take additional training and/or courses in any of the relationships asked.

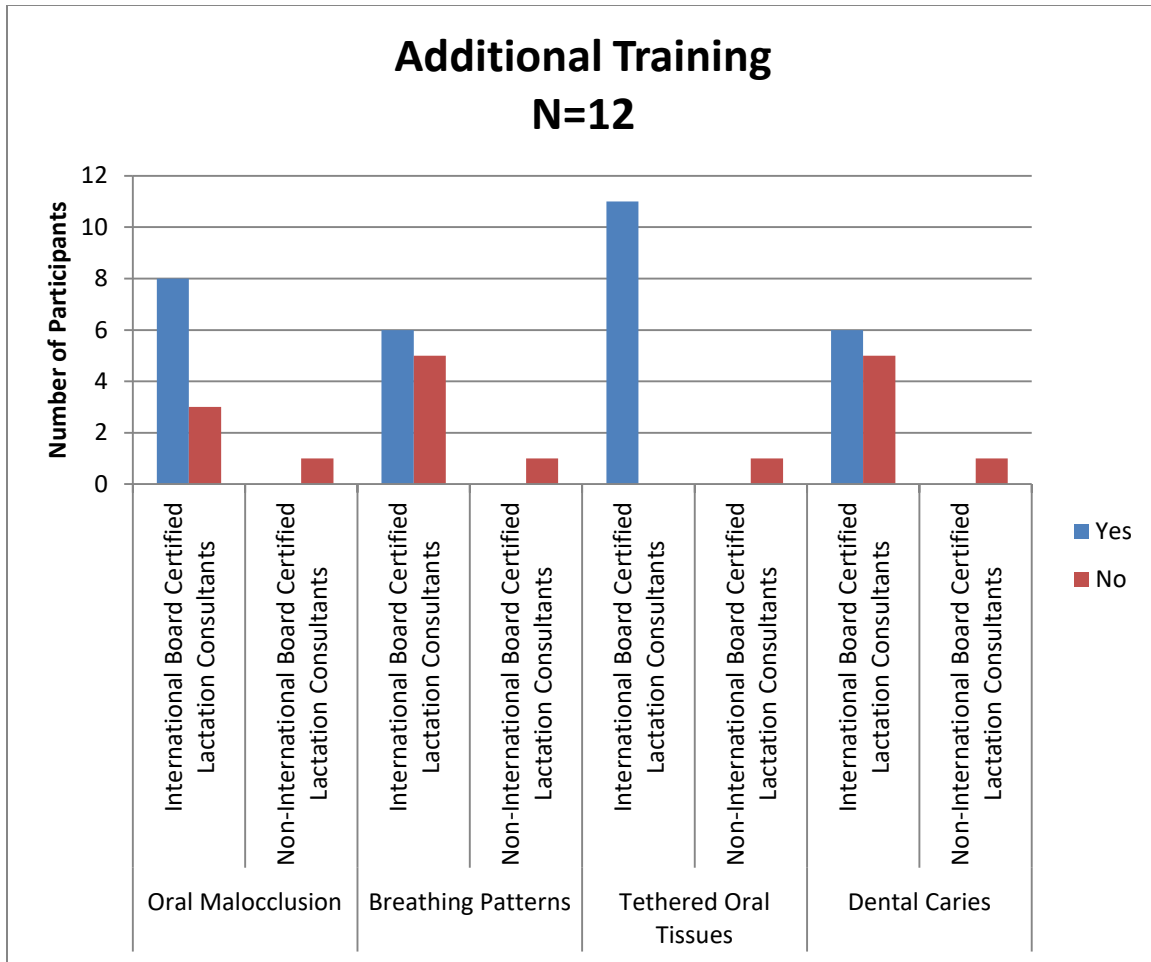


Figure 6. Additional Training taken on the relationship between breastfeeding and OM, BP, TOTs, and DC

Then the participants were asked about their current level of comfort in discussing the relationship between breastfeeding and oral development, taking the following into consideration:

- *oral malocclusion (OM)*
- *breathing patterns (BP)*

- *tethered oral tissues (TOTs)*
- *dental caries (DC)*

Again, they were asked to respond to the following statements using a Likert Scale and the data were further divided into two response groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 7. For Oral Malocclusion, in the IBCLC group, 27% (n=3) Strongly Agreed to being comfortable discussing, 55% (n=6) Somewhat Agreed, 9% (n=1) was Neutral, and 9% (n=1) Strongly Disagreed. For the Non-IBCLC group, 100% (n=1) Somewhat Agreed to being comfortable discussing. For Breathing Patterns, in the IBCLC group, 55% (n=6) Strongly Agree to being comfortable discussing, 27% (n=3) Somewhat Agreed, 9% (n=1) was Neutral, and 9% (n=1) Strongly Disagreed. For the Non-IBCLC group, 100% (n=1) was Neutral in comfortability. For Tethered Oral Tissues, in the IBCLC group, 91% (n=10) Strongly Agreed to being comfortable discussing and 9% (n=1) Somewhat Agreed. For the Non-IBCLC group, 100% (n=1) Somewhat Agreed to being comfortable discussing. For Dental Caries, in the IBCLC group, 45% (n=5) Strongly Agreed to being comfortable discussing, 45% (n=5) Somewhat Agreed, and 9% (n=1) was Neutral. For the Non-IBCLC group, 100% (n=1) was Neutral in comfortability.

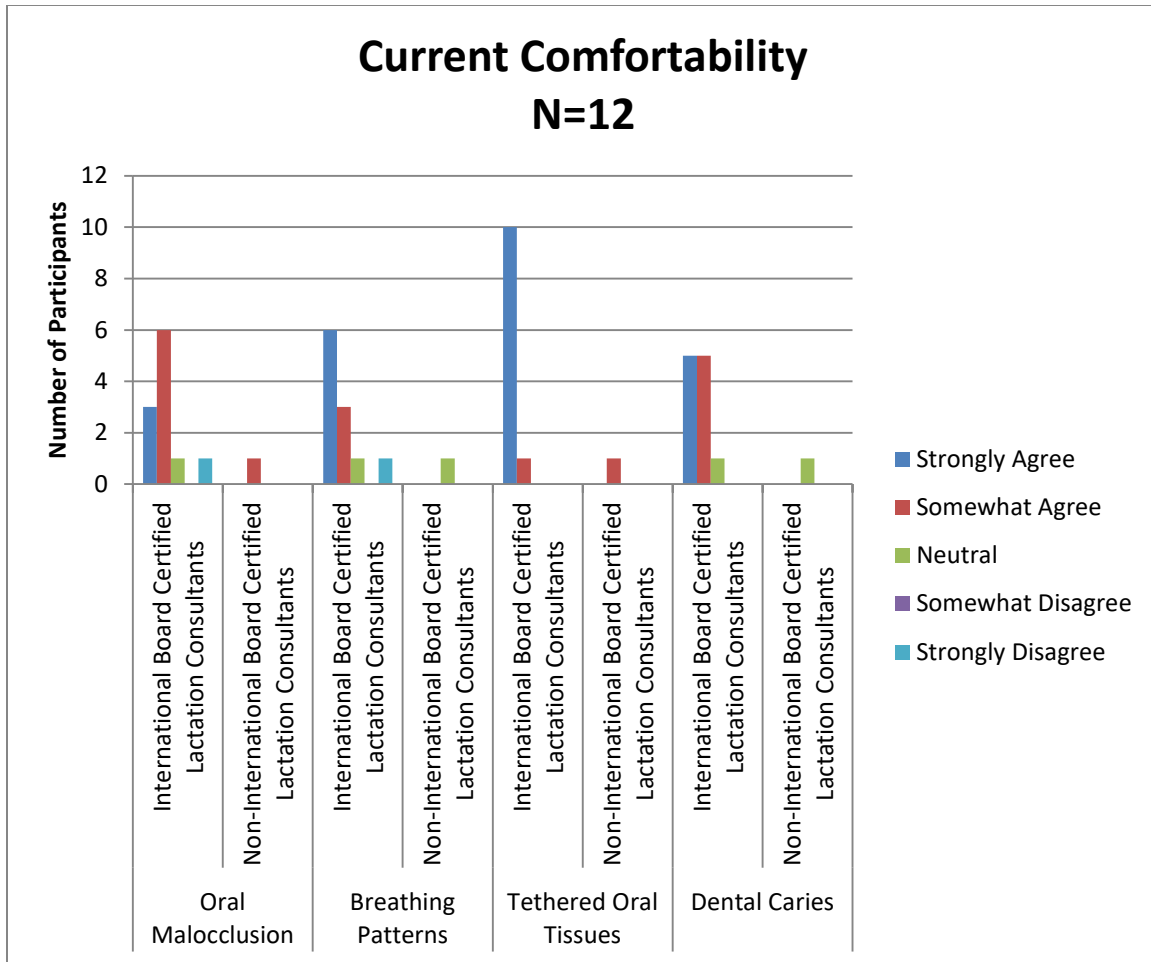


Figure 7. Current level of comfort in discussing the relationship between breastfeeding and OM, BP, TOTs, and DC

The participants were then asked to reflect on the interactions they had with their patients and give an average percentage of how often they discuss the relationship between breastfeeding and oral development. Data was further divided into two response groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 8. In the IBCLC group, 9% (n=1) stated they discuss the relationship 0-25% of the time, 18%

(n=2) discuss the relationship 26-50% of the time, 55% (n=6) discuss the relationship 51-75% of the time, and 18% (n=2) discuss the relationship 76-100% of the time. In the Non-IBCLC group, 100% (n=1) discuss the relationship 0-25% of the time.

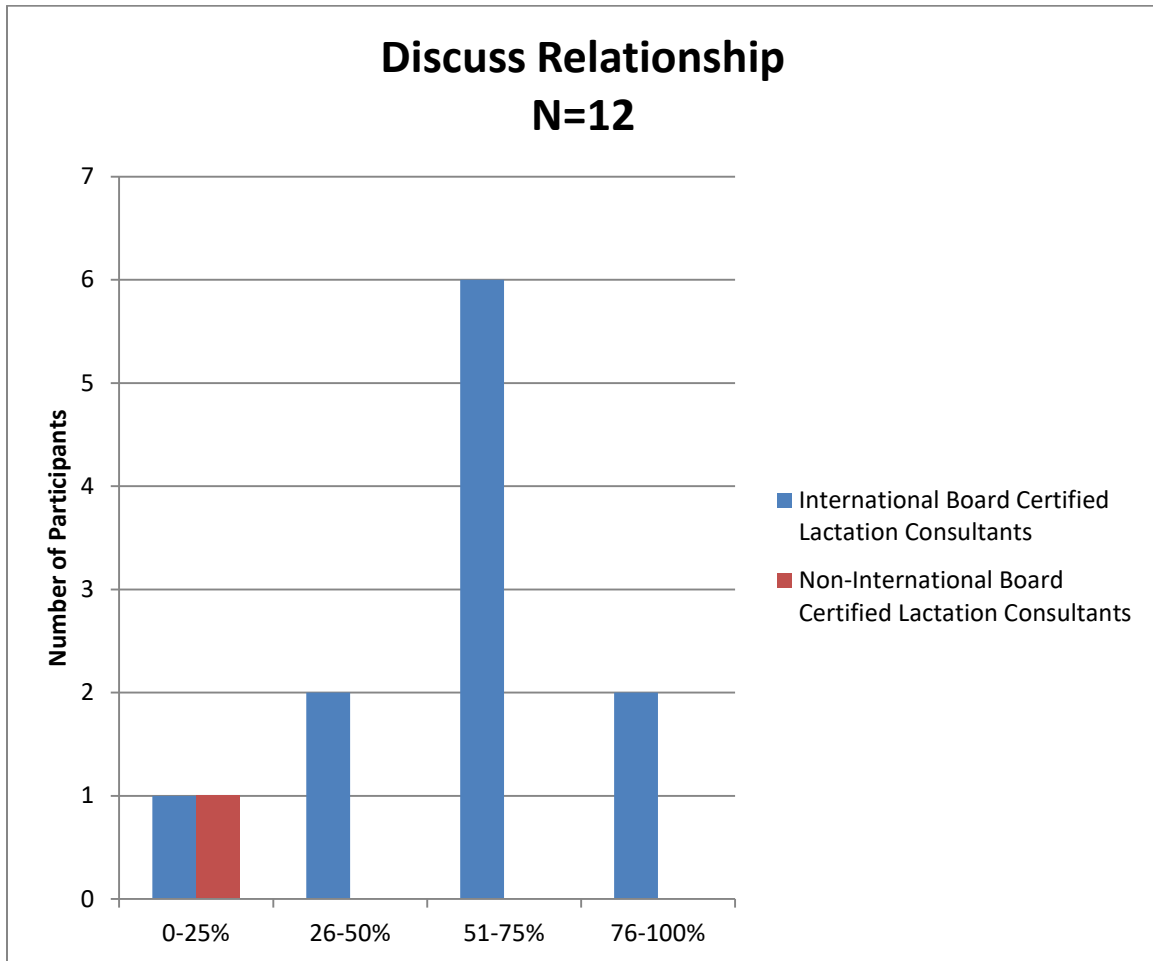


Figure 8. Frequency of LCPs discussing the relationship between breastfeeding and oral development during patient interactions

As a follow up question, the participants were asked to reflect on the interactions with their patients and how often they refer their patient to dental professionals when they have an oral health concern. Again, the data was divided into two response groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 9. In the IBCLC group, 55% (n=6) refer out 0-25% of the time, 18% (n=2) refer out 26-50% of the time, 9% (n=1) refer out 51-75% of the time, and 18% (n=2) refer out 76-100% of the time. In the Non-IBCLC group, 100% (n=1) refer out 76-100% of the time.

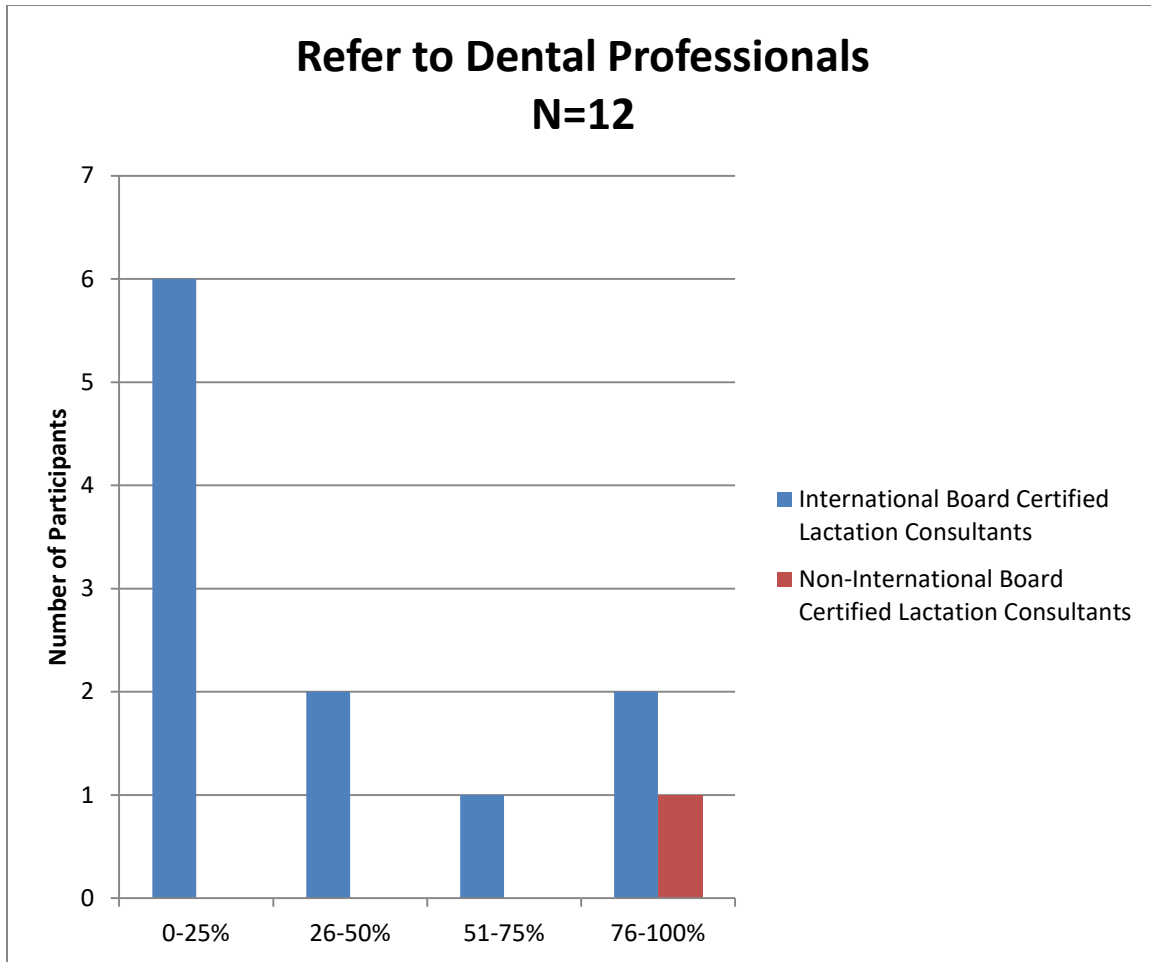


Figure 9. Frequency of LCPs referring out to dental professionals during patient interaction when there is an oral health concern

Lastly, the participant was asked to what extent they perceive breastfeeding to influence the infant’s oral development based on their training and experience. The data were further divided into two response groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 10. For the IBCLC group, 82% (n=9) responded “To a

great extent” and 18% (n=2) responded “To a moderate extent.” For the Non-IBCLC group, 100% (n=1) responded “To a great extent.”

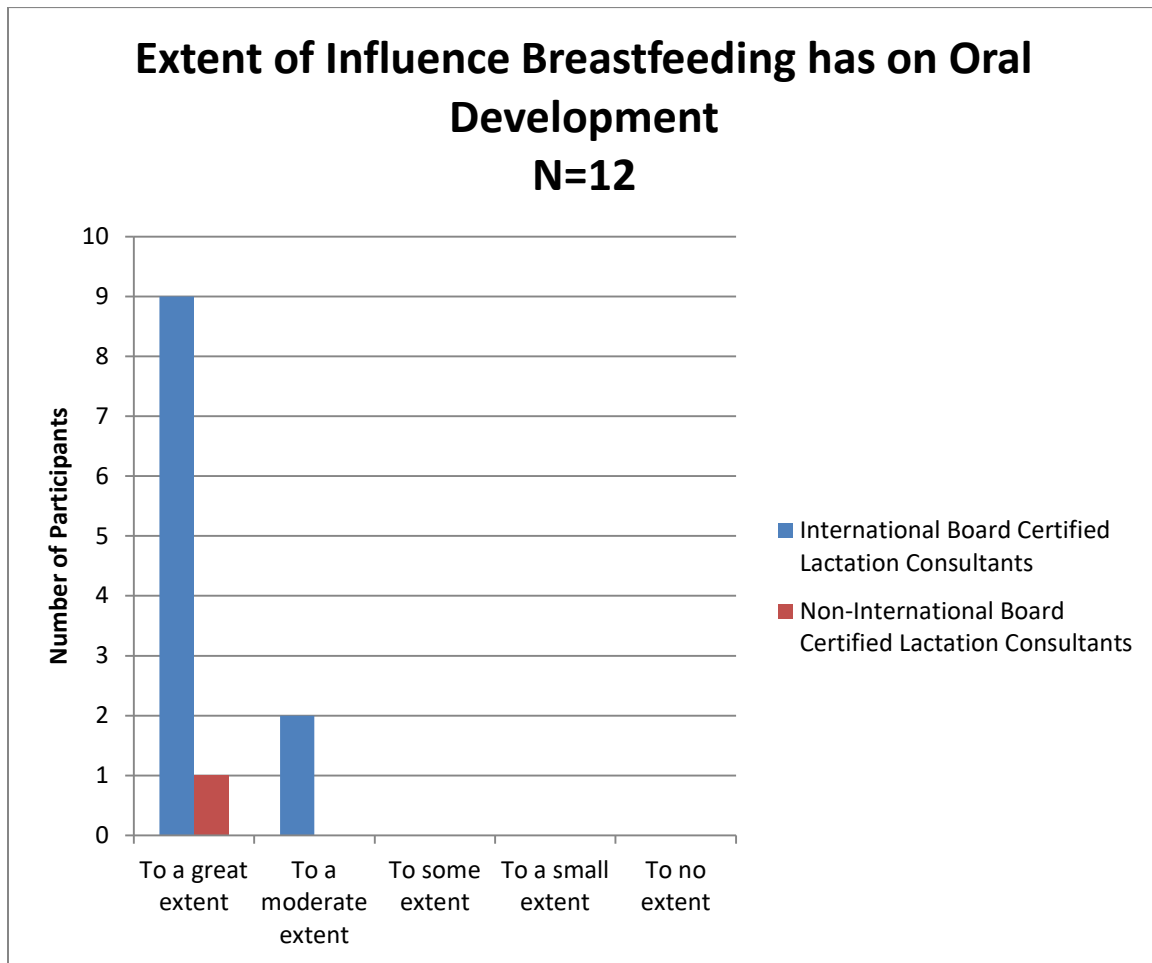


Figure 10. The extent LCPs perceive breastfeeding to influence oral development

A follow up question was asked of the participants to describe what kind of influence they perceive breastfeeding to have on the infant’s oral development. The data were further

divided into two response groups: those who were IBCLCs and those who were Non-IBCLCs. This is illustrated in Figure 11. Both the IBCLC group and the Non-IBCLC group had a 100% response rate of breastfeeding having a positive influence on the infant's oral development.

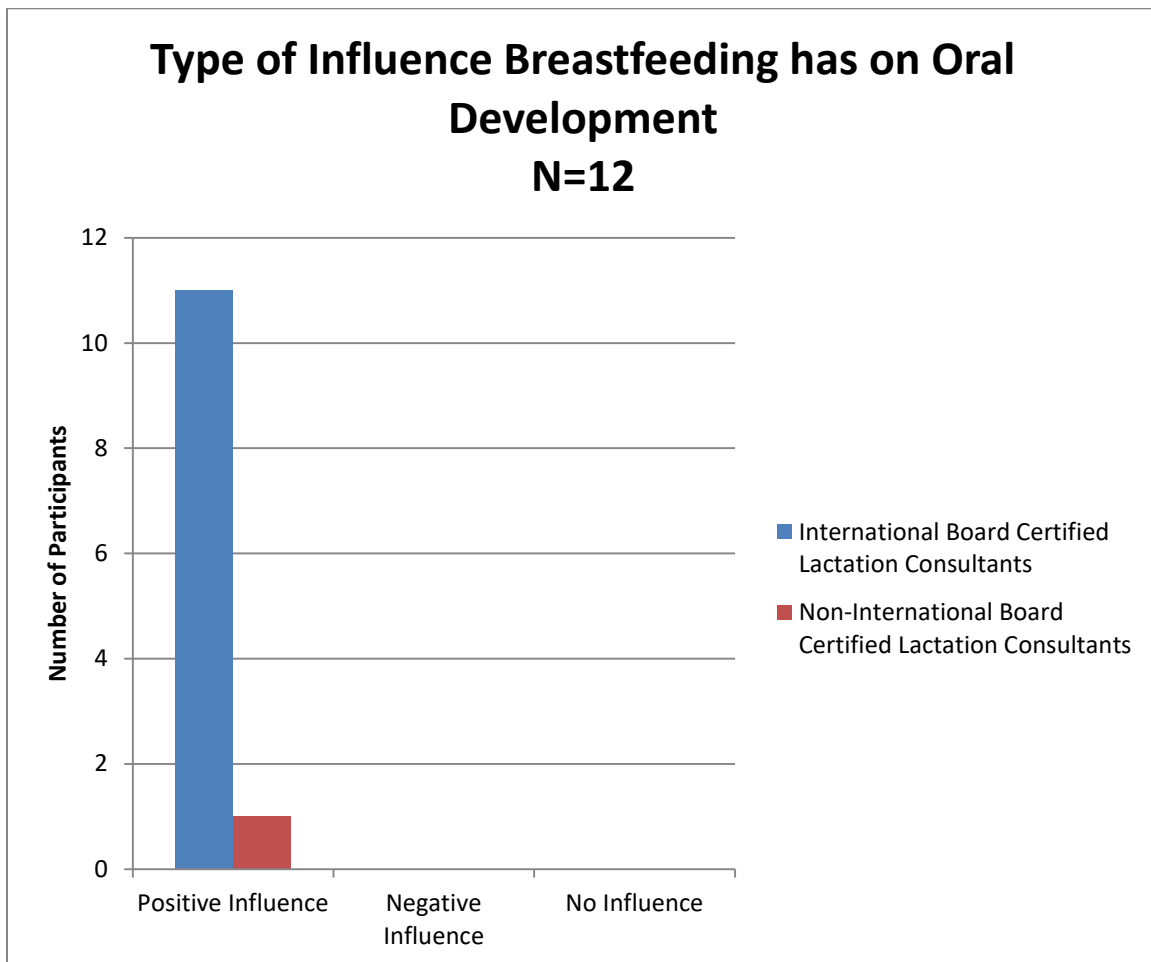


Figure 11. LCPs perception of influence breastfeeding has on the infant's oral development

Discussion:

In terms of participants, there was about an equal response rate from the “years practicing” options and all participants worked in similar settings. The responses received on the “what region do you serve question” was interesting. 83% (n=10) said they served the Western region of The United States. This raises the questions, 1) Are there more LCPs in the Western region than other regions of The United States? Or 2) Do LCPs in the West value research more than other regions of The United States? Another demographic question which rose further questioning was “which type of member are you.” With 92% (n=11) of participants being IBCLCs it raises the questions 1) Do IBCLCs value research more than Non-IBCLCs? And 2) Can this be contributed to the requirement of being a healthcare professional or taking health science classes prior to being eligible to test for IBCLC certification?

In attempt to answer research question one “Do lactation care providers receive training on the relationship between breastfeeding and oral development while earning their credentials?” with the hypothesis of (H1) Lactation care providers do not receive training on the relationship between breastfeeding and oral development while earning their credentials cannot be accepted or rejected. With the response rate being small, statistical comparisons were unable to be conducted. Descriptive statistics of the sample population however suggest that at least half of the responses report receiving training on the relationship between breastfeeding and oral development while earning their credentials.

Had this research question been worded differently, leaving out the “while earning their credentials” part the results could have been different. For example, if this question just asked if LCPs receive training on the relationship the results would have been different. The questions asking about “Current Knowledge” (Figure 5) and “Additional Training” (Figure 6) illustrate that LCPs do have resources to train them on the relationship between breastfeeding and oral development. While they may or may not receive training on this relationship during their initial training to earn their credentials, they may take additional training and/or courses to learn more about this.

Research question two, “Do lactation care providers present their patients with information on the relationship between breastfeeding and the infant’s oral development?” had the hypothesis of H2. Lactation care providers do not present their patients with information on the relationship between breastfeeding and the infant’s oral development would be rejected using descriptive statistics. Based upon the responses, 66% (n=8) of the participants report discussing the relationship between breastfeeding and the infant’s oral development with their patients more than 50% of the time. The follow up question asking about “how often do you refer to dental professionals” showed that 66% (n=8) of the participants refer less than 50% of the time. This shows an inverse relationship of LCPs discussing the relationship with patients and how often they refer to dental professionals.

Lastly, research question three “How comfortable to lactation care providers feel discussing this relationship with their patients?” had the hypothesis of H3. Lactation care providers do not feel comfortable discussing this relationship with their patients which would be rejected utilizing descriptive statistics. Overall, all four factors evaluated determine

lactation care providers agree that they feel comfortable discussing the relationship between breastfeeding and oral development with their patients.

Conclusion:

Lactation care providers are often times one of the first professionals to provide oral health information to the mother/child pair. While there are resources available for LCPs to enhance their knowledge on the relationship between breastfeeding and oral development it is unsure how much of that information they are taught during their initial training to earn their credential(s). Lactation care providers who responded report discussing this relationship with their patients often and feel comfortable providing this information. This level of comfort could explain why lactation care providers refer to dental professionals less than 50% of the time. Although, lactation care providers perceive breastfeeding to positively influence the infant's oral development. This study supports the need for an inter-professional collaboration between dental professionals and lactation care providers. In doing so, the mother/child pair will be more informed on oral development which could lead to a decrease in oral disease/complications and an increase in oral health prevention.

Appendix A: HRPO Approval Letter



Human Research Protections Program

September 3, 2019

Christine Nathe
University of New Mexico
MSC09 5020
Albuquerque, NM 87131
(505) 272-8147
Fax: (505) 272-5584
CNathe@salud.unm.edu

Dear Christine Nathe:

On 9/3/2019, the HRRC reviewed the following submission:

Type of Review: Initial Study
Title of Study: Oral Development and Breastfeeding: An Assessment of the Lactation Care Provider Approach
Investigator: Christine Nathe
Study ID: 19-412
Submission ID: 19-412
IND, IDE, or HDE: None

Submission Summary: Initial Study

Documents Approved:

- RGatlin_Consent
- RGatlin_HRP583_Template
- RGatlin_RecruitmentLetter
- RGatlin_Survey

Review Category: EXEMPTION: Categories (2)(i) Tests, surveys, interviews, or observation (non-identifiable)

Determinations/Waivers: Provisions for Consent are adequate.
HIPAA Authorization Addendum Not Applicable.

Submission Approval Date: 9/3/2019
Approval End Date: None
Effective Date: 9/3/2019

The HRRC approved the study from 9/3/2019 to inclusive. If modifications were required to secure approval, the effective date will be later than the approval date. The "Effective Date" 9/3/2019 is the date the HRRC approved your modifications and, in all cases, represents the date study activities may begin.

Because it has been granted exemption, this research is not subject to continuing review.



Please use the consent documents that were approved by the HRRC. The approved consents are available for your retrieval in the "Documents" tab of the parent study.

If the study meets the definition of an NIH Clinical Trial, the study must be registered in the ClinicalTrials.gov database. Additionally, the approved consent document(s) must be uploaded to the ClinicalTrials.gov database.

This determination applies only to the activities described in this submission and does not apply should you make any changes to these documents. If changes are being considered these must be submitted for review in a study modification to the HRRC for a determination prior to implementation. If there are questions about whether HRRC review is needed, contact the HRPO before implementing changes without approval. A change in the research may disqualify this research from the current review category. You can create a modification by clicking Create Modification / CR within the study.

If your submission indicates you will translate materials post-approval of English materials, you may not recruit or enroll participants in another language, until all translated materials are reviewed and approved.

In conducting this study, you are required to follow the Investigator Manual (HRP-103), which can be found by navigating to the IRB Library.

Sincerely,

Thomas F. Byrd, MD
HRRC Executive Chair

Appendix B: Recruitment Letter

Hello,

You have been selected to participate in a research survey, Oral Development and Breastfeeding: An Assessment of the Lactation Care Provider Approach. It aims to evaluate lactation care provider's perception, attitude, and behavior on the relationship between breastfeeding and the oral development; including oral malocclusion, breathing patterns, tethered oral tissues, and dental caries. The survey should take approximately 5-10 minutes to complete.

Click on the following link to participate:

<https://ctsctrials.health.unm.edu/redcap/surveys/?s=3A4CKF8EDL>

If you have any questions, please don't hesitate to email Robin Gatlin at RobinG@salud.unm.edu or if you have questions regarding your legal rights as a research subject, you may call the UNMHSC Office of Human Research Protections at (505) 272-1129.

Your participation is greatly appreciated.

Christine Nathe, RDH, MS, Principal Investigator

Robin Gatlin, RDH, BS, MS Candidate

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Appendix C: Informed Consent

University of New Mexico Health Sciences Center

Informed Consent Cover Letter for Anonymous Surveys

STUDY TITLE

Oral Development and Breastfeeding: An Assessment of the Lactation Care Provider Approach

Mrs. Christine Nathe from the Department of Dental Hygiene, is conducting a research study. The purpose of the study is to assess lactation care provider's perception, attitude, and behavior on the relationship between breastfeeding and the oral development; including oral malocclusion, breathing patterns, tethered oral tissues, and dental caries. You are being asked to participate in this study because you are a member of The United States Lactation Consultant Association.

Your participation will involve completing a survey. The survey should take about 5-10 minutes to complete. Your involvement in the study is voluntary, and you may choose not to participate. There are no names or identifying information associated with this survey. The survey includes questions such as "Considering your current level of comfort in discussing the relationship between breastfeeding and oral development, please rate the following statement". You can refuse to answer any of the questions at any time. There are no known risks in this study, but some individuals may experience discomfort when answering questions. All data will be kept for 1 year in a locked file in Mrs. Christine Nathe's office and then destroyed.

The findings from this project will provide information on lactation care provider's training, patient interaction and comfort in discussing the relationship between breastfeeding and oral development. If published, results will be presented in summary form only.

If you have any questions about this research project, please feel free to call Robin Gatlin at (505) 917-9832. If you have questions regarding your legal rights as a research subject, you may call the UNMHSC Office of Human Research Protections at (505) 272-1129.

By clicking "OK", you will be agreeing to participate in the above described research study.

Thank you for your consideration.

Sincerely,

Christine Nathe, RDH, MS
Professor

HRRC#19-412
Version Date August 22, 2019

HRPO #:

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Version:

Appendix D: Survey

1. Are you a member of The United States Lactation Consultant Association (USLCA)?
 - a. Yes
 - b. No
 - If yes, proceed to next question
 - If no, “Thank you for your participation” message
2. What type of member best describes you?
 - a. Consultant (International Board Certified Lactation Consultant)
 - b. Counselor/Educator (i.e. Certified Lactation Counselor, Certified Breastfeeding Educator, etc.)
 - c. Peer (i.e. La Leche League, WIC Peer Counselor, etc.)
 - d. Supporter of breastfeeding (but no certifications)
 - If answer a-c, proceed to next question
 - If answer d, “Thank you for your participation” message
3. What type of credentials do you hold? (Check all that apply)
 - a. International Board Certified Lactation Consultant (IBCLC)
 - b. Certified Lactation Specialist Course (CLSC)
 - c. Certified Breastfeeding Specialist
 - d. Lactation Educator Counselor
 - e. Breastfeeding Counselor (BFC)
 - f. Breastfeeding Educator Certification (BEC)
 - g. Certified Lactation Counselor (CLC)
 - h. Advanced Lactation Consultant (ALC)
 - i. Advanced Nurse Lactation Consultant (ANLC)
 - j. WIC Peer Counselor
 - k. Certified Lactation Educator (CLE)
 - l. La Leche League Leader (volunteer)
 - m. Baby Café Breastfeeding Counselor (BCBC)
 - If choose a, complete this question:
 1. Which Pathway did you take to become certified?
 - a. Pathway 1: Recognized Health Professionals and Recognized Breastfeeding Support Counselors
 - b. Pathway 2: Accredited Lactation Programs
 - c. Pathway 3: Mentorship with an IBCLC
 - If chose a, answer this question:
 1. What type of recognized health professional are you?
 - a. Dentist
 - b. Dietician
 - c. Midwife
 - d. Nurse
 - e. Occupational Therapist
 - f. Pharmacist

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- g. Physical Therapist
- h. Physiotherapist
- i. Physician
- j. Medical Doctor
- k. Speech Pathologist
- l. Speech Therapist
- m. Other

- If chose m. other, answer “fill in the blank”

- If chose b or c, proceed to the next question

- If chose b-m, proceed to next question

4. How many years have you been practicing as a lactation care provider?
 - a. 0-5 years
 - b. 6-10 years
 - c. 11-20 years
 - d. 20+ years
5. Which of the following best describes your practice setting? (Check all that apply)
 - a. Private
 - b. Public
 - c. Educator
 - d. Hospital
 - e. Other
 - If chose e. other, answer “fill in the blank”
6. What region(s) of the United States do you serve? (Check all that apply)
 - a. Northeast
 - b. Southeast
 - c. Midwest
 - d. Southwest
 - e. West
7. Considering your INITIAL TRAINING in becoming a lactation care provider, please rate the following statement: I received TRAINING on the relationship between BREASTFEEDING and ORAL MALOCCLUSION.
 - a. Strongly Agree
 - b. Somewhat Agree
 - c. Neutral
 - d. Somewhat Disagree
 - e. Strongly Disagree
8. Considering your INITIAL TRAINING in becoming a lactation care provider, please rate the following statement: I received TRAINING on the relationship between BREASTFEEDING and BREATHING PATTERNS.
 - a. Strongly Agree

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- b. Somewhat Agree
 - c. Neutral
 - d. Somewhat Disagree
 - e. Strongly Disagree
9. Considering your INITIAL TRAINING in becoming a lactation care provider, please rate the following statement: I received TRAINING on the relationship between BREASTFEEDING and TETHERED ORAL TISSUES (TOTs).
- a. Strongly Agree
 - b. Somewhat Agree
 - c. Neutral
 - d. Somewhat Disagree
 - e. Strongly Disagree
10. Considering your INITIAL TRAINING in becoming a lactation care provider, please rate the following statement: I received TRAINING on the relationship between BREASTFEEDING and DENTAL CARIES.
- a. Strongly Agree
 - b. Somewhat Agree
 - c. Neutral
 - d. Somewhat Disagree
 - e. Strongly Disagree
11. Considering your CURRENT level of KNOWLEDGE on the relationship between breastfeeding and oral development, please rate the following statement: I am KNOWLEDGABLE on the relationship between BREASTFEEDING and ORAL MALOCCLUSION.
- a. Strongly Agree
 - b. Somewhat Agree
 - c. Neutral
 - d. Somewhat Disagree
 - e. Strongly Disagree
12. Considering your CURRENT level of KNOWLEDGE on the relationship between breastfeeding and oral development, please rate the following statement: I am KNOWLEDGABLE on the relationship between BREASTFEEDING and BREATHING PATTERNS.
- a. Strongly Agree
 - b. Somewhat Agree
 - c. Neutral
 - d. Somewhat Disagree
 - e. Strongly Disagree
13. Considering your CURRENT level of KNOWLEDGE on the relationship between breastfeeding and oral development, please rate the following statement: I am KNOWLEDGABLE on the relationship between BREASTFEEDING and TETHERED ORAL TISSUES (TOTs).
- a. Strongly Agree
 - b. Somewhat Agree
 - c. Neutral

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- d. Somewhat Disagree
 - e. Strongly Disagree
14. Considering your CURRENT level of KNOWLEDGE on the relationship between breastfeeding and oral development, please rate the following statement: I am KNOWLEDGABLE on the relationship between BREASTFEEDING and DENTAL CARIES.
- a. Strongly Agree
 - b. Somewhat Agree
 - c. Neutral
 - d. Somewhat Disagree
 - e. Strongly Disagree
15. Since earning your credentials, have you taken additional training and/or courses, including Continuing Education, on the relationship between BREASTFEEDING and ORAL MALOCCLUSION?
- a. Yes
 - b. No
16. Since earning your credentials, have you taken additional training and/or courses, including Continuing Education, on the relationship between BREASTFEEDING and BREATHING PATTERNS?
- a. Yes
 - b. No
17. Since earning your credentials, have you taken additional training and/or courses, including Continuing Education, on the relationship between BREASTFEEDING and TETHERED ORAL TISSUES (TOTs)?
- a. Yes
 - b. No
18. Since earning your credentials, have you taken additional training and/or courses, including Continuing Education, on the relationship between BREASTFEEDING and DENTAL CARIES?
- a. Yes
 - b. No
19. Considering your CURRENT level of COMFORT in discussing the relationship between breastfeeding and oral development, please rate the following statement: I am COMFORTABLE discussing the relationship between BREASTFEEDING and ORAL MALOCCLUSION with my patients.
- a. Strongly Agree
 - b. Somewhat Agree
 - c. Neutral
 - d. Somewhat Disagree
 - e. Strongly Disagree
20. Considering your CURRENT level of COMFORT in discussing the relationship between breastfeeding and oral development, please rate the following statement: I am COMFORTABLE discussing the relationship between BREASTFEEDING and BREATHING PATTERNS with my patients.
- a. Strongly Agree

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- b. Somewhat Agree
 - c. Neutral
 - d. Somewhat Disagree
 - e. Strongly Disagree
21. Considering your CURRENT level of COMFORT in discussing the relationship between breastfeeding and oral development, please rate the following statement: I am COMFORTABLE discussing the relationship between BREASTFEEDING and TETHERED ORAL TISSUES (TOTs) with my patients.
- a. Strongly Agree
 - b. Somewhat Agree
 - c. Neutral
 - d. Somewhat Disagree
 - e. Strongly Disagree
22. Considering your CURRENT level of COMFORT in discussing the relationship between breastfeeding and oral development, please rate the following statement: I am COMFORTABLE discussing the relationship between BREASTFEEDING and DENTAL CARIES with my patients.
- a. Strongly Agree
 - b. Somewhat Agree
 - c. Neutral
 - d. Somewhat Disagree
 - e. Strongly Disagree
23. Looking back at your interactions with your patients, how often do you find yourself discussing the relationship between breastfeeding and the oral development with your patients?
- a. 0-25% of the time
 - b. 26-50% of the time
 - c. 51-75% of the time
 - d. 76-100% of the time
24. Looking back at your interactions with your patients, how often do you find yourself referring your patients to dental professionals when they have an oral health concern?
- a. 0-25% of the time
 - b. 26-50% of the time
 - c. 51-75% of the time
 - d. 76-100% of the time
25. Based upon your training and experience, to what extent do you perceive breastfeeding to have an influence on the infant's oral development?
- a. To a great extent
 - b. To a moderate extent
 - c. To some extent
 - d. To a small extent
 - e. To no extent
- If chose a-d, answer the following question:

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1. What kind of influence do you perceive breastfeeding to have on the infant's oral development?

- a. Positive influence
- b. Negative influence
- c. No influence

- If chose e, "Thank you for your participation" message

Thank you for your participation in this survey! Your responses are truly of value. The results of this research will be made in summary form and available to the public at a later date.

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