

**The Use of Videoconferencing for Lactation Consultation:
A Cross-Sectional Survey of Acceptance among Independent Samples of
Mothers and Infant Fathers/Maternal Partners in the United States**

**A Dissertation Presented for the
Doctor of Philosophy
Degree
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DEDICATION

This dissertation is dedicated to my incredible parents and the best brother in the world, for their endless love, support, and encouragement. Through my father, I learned the true value of hard work and perseverance; my mother showed me that it is important to be kind and to be loyal to my passion; and my brother helped me to remain positive and to enjoy living in each moment. In addition, I would like to dedicate this to my beloved late grandmothers who both believed firmly in the value of education.

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ABSTRACT

Background: Breastfeeding is a health behavior encouraged by Healthy People 2020.

However, an important barrier to breastfeeding is limited access to specialized support if needed.

The use of videoconferencing technology to increase access to the relatively small number of professionals trained to manage breastfeeding issues may ultimately assist with increasing breastfeeding duration and exclusivity rates. Understanding the perceived acceptability of videoconferencing technology among potential users is a critical first step in developing effective interventions.

Objectives: The objectives of this study were 1) to assess the relationship between acceptance of remote lactation consultation using videoconferencing and a) acceptance subscales, b) maternal learning style preferences and c) maternal demographic factors and, 2) to explore the relationship between infant fathers'/maternal partners' demographic factors and their perception of their wives'/partners' acceptance remote lactation consultation using videoconferencing.

Methods: This was a cross-sectional study design using online survey methodology.

Participants included 101 mothers and 80 unrelated infant fathers/maternal partners. Samples were recruited between July 2014 and March 2015, from specific and discrete randomized states. Mothers were English-speaking, ≥ 18 years of age, with an infant of ≤ 4 months of age who had been breast-fed at least once.

Results: Mothers' survey - Factors related to maternal acceptance included 'perceived ease of use' ($r=0.680$, $p<0.001$), 'perceived usefulness/extrinsic motivation' ($r=0.774$, $p<0.001$), and 'intrinsic motivation' ($r=0.689$, $p<0.001$). Learning style preferences and demographics were not significantly related to maternal acceptance. Only 'perceived usefulness/extrinsic motivation' and maternal age predicted acceptance in the regression model (R^2 [square]=0.616, $p<0.001$). Infant fathers'/maternal partners' survey - Factors related to infant fathers'/maternal partners' perception of their wives'/partners' acceptance included 'perceived ease of use' ($r=0.653$, $p<0.001$), 'perceived usefulness/extrinsic motivation' ($r=0.797$, $p<0.001$), and 'intrinsic motivation' ($r=0.756$, $p<0.001$). None of the infant fathers'/maternal partners' demographic factors were significantly different based on their perception of the acceptance of their wives/partners. Only 'perceived usefulness/extrinsic motivation' remained predictive in the regression ($R^2=0.635$, $p<0.001$).

Conclusions: In these samples, mothers' acceptance was slightly positive and infant fathers/maternal partners perceived their wives'/partners' acceptance to be neutral. In both samples, those perceiving videoconferencing to be useful for lactation consultation showed greater acceptance of its use.

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CHAPTER 1 : LITERATURE REVIEW

Breastfeeding Benefits

Benefits for Infants

Breastfeeding, also known as lactation, is a health behavior that provides health benefits to infants¹. It is well-known that the purpose of breast milk is to nourish infants for their development and growth. Some of the benefits of breast milk, relative to the alternative option of infant formula, are that it may lower the risk of childhood overweight or obesity², allergies and asthma^{3, 4} and Sudden Infant Death Syndrome⁵. In addition, studies show that breast milk lowers the risk of infectious diseases^{6, 7} such as gastrointestinal tract infections⁸, respiratory tract infections⁸, otitis media⁹, and necrotizing enterocolitis¹⁰ in infants.

In a population-based prospective cohort study in the Netherlands, Duijts and colleagues assessed the relationship between both breastfeeding exclusivity and duration with gastrointestinal and respiratory tract infections (GTI and RTI)⁸. When infants were between 6 and 12 months of age, questionnaires were used to gather data on breastfeeding behaviors and incidence of infectious diseases in a sample of 4,164 infants⁸. The results indicate that there were significant lower risks of the GTI (aOR:0.65, 95% CI:0.51-0.83, $p<0.01$), upper RTI (aOR:0.50, 95% CI:0.32-0.79, $p<0.01$), and lower RTI (aOR:0.41, 95% CI:0.26-0.64, $p<0.01$) for infants who were exclusively breast-fed until 4 months and partially breast-fed after 4 months in the first 6 months of infant's life, as compared to those who were never breast-fed (reference group)⁸. In addition, they found that those infants who were partially breast-fed until 6 months did not have significant lower risks of GTI and RTI (upper and lower) as compared to infants who were never breast-fed, suggesting the importance of exclusivity⁸. In this study, they also examined the duration of breastfeeding in these same three groups: those breast-fed for 4 months, breast-fed for 4-6 months, or breast-fed for 6 months or longer⁸. The results showed

lower risk of GTI (aOR:0.45, 95% CI:0.30-0.69, $p<0.01$), upper RTI (aOR:0.62, 95% CI:0.49-0.78, $p<0.01$), and lower RTI (aOR:0.61, 95% CI:0.40-0.92, $p<0.05$), among those who were breast-fed 6 months and longer as compared to those who were never breast-fed⁸. However, there was no lowered risk among those breast-fed for 4 months and those breast-fed for 4-6 months in the first 6 months of infant's life as compared to those who never breast-fed (all $p>0.05$)⁸. These findings highlight the importance of the breastfeeding recommendations that have been set in regard to both exclusivity and duration, which is to breastfeed infants for the first six months, and to do so exclusively if possible^{7, 11}.

Breast milk also lowers risk of developing chronic diseases such as diabetes mellitus type 1 and 2 (DM1 and DM2)^{12, 13}, cancer¹⁴, obesity^{15, 16}, and asthma¹⁷. In a population-based case-control study in Germany, Rosenbauer and colleagues examined the relationship between DM1 and potential risk factors, one of which was infant-feeding behavior¹². The participants were children less than 5 years of age, with a mean age of 3.3 years (cases) and 3.0 years (matched controls)¹². Cases were defined as having a diagnosis of DM1. There were 1,871 cases, and 760 matched controls¹². A questionnaire was sent to the parents and a phone interview was conducted if the questionnaire was not complete¹². Data gathered by researchers included breastfeeding duration (< 2 weeks, 2-6 weeks, 7 weeks-4 months, and ≥ 5 months), age when formula/cow's milk was introduced (< 2 weeks, 2-6 weeks, 7 weeks-4 months, and ≥ 5 months), and age when solid food was introduced (≤ 4 months, ≥ 5 months)¹². The results showed that longer breastfeeding duration (≥ 5 months) was associated with a lower risk of DM1 significantly in children less than 5 years of age (aOR:0.71, 95% CI:0.54-0.93, $p=0.012$)¹². Late introduction of formula/cow's milk (aOR:0.80, 95% CI:0.62-1.04, $p=0.092$) was associated with

lower risk of DM1¹². However, breastfeeding exclusivity was not evaluated and therefore it cannot be assumed the late introduction group was exclusive.

Dewey and colleagues compared anthropometric indexes between breast-fed and formula-fed infants to evaluate which group was leaner when infants were 1 year old¹⁵. In the breast-fed group, there were 46 infants who all were breast-fed until 12 months of age or longer¹⁵. However, it is important to note that exclusivity was not reported in this study. In the formula-fed group, there were 41 infants; most were partially breast-fed, and some were not breast-fed at all¹⁵. Anthropometric measurements such as weight, length, and skinfold thickness were measured by trained assistants visiting participants' home¹⁵. Z-scores for weight-for-length, ideal body weight percentage, and body fat percentage were calculated¹⁵. They found that the formula-fed infants had significantly higher mean weight-for-length z-scores as compared to breast-fed infants when infants were between 7-24 months of age ($p < 0.05$, means were not reported)¹⁵. At 12 months, only 7% of breast-fed infants had a weight-for-length measurement that was above the 90th percentile, as compared to 15% of formula-fed infants¹⁵. However, the significance of this difference was not reported. For skinfold thickness index, five sites (triceps, biceps, subscapular, flank, and quadriceps) were measured¹⁵. The overall mean values were higher in formula-fed infants when they were between 9-17 months of age as compared to breast-fed infants¹⁵. Even though this study was done before 2006, when the Centers for Disease Control and Prevention (CDC) revised its growth charts, the absolute difference detected between breast-fed and formula-fed infants would not change. This study contributes to literature indicating that breast-fed infants are leaner than formula-fed infants, which may be linked to lower risk of childhood overweight.

In order to understand what makes breast milk beneficial for infants, Ballard and Morrow described two important components in breast milk: 1) nutritional components and 2) bioactive components¹⁸. In the first few days of life, breast milk is usually yellow in color, thick in consistency, and low in quantity^{18, 19}. This first milk is called colostrum and it strengthens the immune system of infants due to its components such as immunoglobulin (Ig)A, lactoferrin, leukocytes, protein, fat, vitamins, and minerals^{18, 20}. Breast milk becomes mature after 4-6 weeks of life¹⁸. Breast milk contains both macronutrients (e.g. carbohydrate, protein, and fat) and micronutrients (e.g. vitamins A, B1, B2, B6, B12, iodine, among others)¹⁸. Some of the major bioactive components in breast milk are immunoglobulins (e.g. IgA, IgG, IgM), growth factors, and hormones (e.g. leptin, ghrelin, calcitonin, lactoferrin)¹⁸. Though more work needs to be done, these studies show some of the benefits of breastmilk, such lower risk of GTI and RTI, DM1, and infants being leaner than formula fed infants.

Benefit for Mothers

Not only is breastfeeding beneficial for infants, it also has benefits for mothers including lowered risk of breast cancer^{21, 22}, ovarian cancer^{22, 23}, and DM2^{24, 25}. Cancer is the second cause of mortality in the United States (U.S.)²⁶, with breast cancer being the second cause of death in females²⁷. In a Turkoz and colleagues study, retrospective cross-sectional research was conducted with 1,884 participants who had breast cancer²¹. If diagnosed within the last two decades, participants were asked to complete a face-to-face interview to collect detailed information about risk factors such as breastfeeding initiation and duration, smoking status, and oral contraceptive use²¹. The researchers compared hormonal (luminal A and luminal B) and non-hormonal (HER-2 overexpressing and triple negative) breast cancer subtypes²¹. They found

breastfeeding initiation lowered the risk for hormonal breast cancer subtypes (OR:0.74, 95% CI:0.53-1.04, $p=0.04$), compared to non-hormonal subtypes²¹. Based on this finding the authors suggest that breastfeeding may lower the risk of some hormonal breast cancer subtypes and implied that duration may increase this protection²¹. While, the mean duration was reported (12.9 ± 9.9 months), no analysis was reported using this variable²¹. Therefore, this study does support that initiation may lower the risk of development of hormonal breast cancer subtypes but does not support the conclusion of duration. However, breastfeeding duration has been examined in other studies. For example, the Agency for Healthcare Research and Quality (AHRQ), reporting on two meta-analyses evaluating any association between breastfeeding and the risk of breast cancer in mothers, found that those mothers who breast-fed longer than 12 months had a lower breast cancer risk²².

In addition to an association with lower breast cancer risk, breastfeeding has been linked to a lower risk of ovarian cancer. According to the Danforth and colleagues study, researchers used data from the Nurses' Health Study (NHS) and the Nurses' Health Study II (NHS II) to examine the relationship between breastfeeding initiation and duration and the risk of developing ovarian cancer²³. No significant difference in ovarian cancer was found between the 'never breast-fed' (reference group) and 'ever breast-fed' groups (RR:0.86, 95% CI:0.70-1.06, p was not reported)²³. However, the results show that breastfeeding was associated with lower risk of ovarian cancer among those who breast-fed longer than 18 months, as compared to those who never breast-fed (RR:0.66, 95% CI:0.46-0.98, $p=0.02$)²³. In addition, the AHRQ report suggests that the benefits of breastfeeding may only manifest after 12 months²².

In addition to lower risk of breast and ovarian cancer, there are studies that show breastfeeding lowers the risk of developing DM2 in mothers^{24, 25}. For instance, Schwarz and

colleagues found that mothers who breast-fed for 6 months or more (reference group) had lower risk of DM2 as compared to those who had never breast-fed (aOR 1.43; 95% CI, 1.01-2.04)²⁴. In another study by Stuebe and colleagues, data from NHS and NHS II were analyzed to investigate the duration of breastfeeding in relation to DM2 risk²⁵. Their results show longer breastfeeding was associated with a lower risk of developing DM2, among mothers who breast-fed in NHS and NHSII (P<0.05)²⁵. These studies support the importance of exclusivity and duration of breastfeeding for mothers. According to the AHRQ report, longer breastfeeding duration is related to a lower risk of developing DM2 among women who did not experience gestational diabetes mellitus (GDM)²². However, breastfeeding did not appear to protect against later development of DM2 among those experiencing GDM²². Therefore, breastfeeding should not be considered protective among this sub-population.

Benefit for Society

Environmental Benefits

Breast milk is readily available to infants with no need of packaging materials, whereas infant formula involves packaging that includes containers and paper²⁸. Many of these packaging materials from formula will be left in landfills²⁸. According to the United States Breastfeeding Committee (USBC), 550 million cans of formula are deposited in landfills annually²⁹. In addition, in order to manufacture formula, there is utilization of fuel and electricity and transportation from the manufactures to vendors and to households²⁸. These will lead to an annual energy consumption of 110 billion British Thermal Units with the cost of two million dollars in the U.S. alone²⁹.

Economic Benefits

Breastfeeding, as compared to formula feeding, has the potential to transform into significant cost-savings for breastfeeding families and their employers^{28, 29}. According to the USBC, families spend \$2 billion annually in order to purchase breast milk substitutes²⁹.

Breastfeeding has potential benefits for employers as well as, secondary to the higher illness rate seen in formula-fed infants, it has been suggested that parents of breast-fed infants are less likely to miss work due to caring for a sick child²⁹. Specifically, a total of 2,000 work hours could be saved annually, if 1,000 parents chose to initiate breastfeeding instead of formula feeding and this is equivalent to 1 year of employment²⁹.

Breastfeeding also has significant cost-saving for health insurers^{28, 29}. Since breastfeeding may lower the risk of some illnesses, insurers should receive fewer medical claims, resulting in reduced medical costs²⁹. In a recent study by Bartick and Reinhold, authors analyzed direct and indirect costs related to the risk of pediatric diseases and conditions that are higher in formula-fed infants as compared to breast-fed infants³⁰. In addition, they calculated the number of deaths that could potentially have been avoided if an infant was breast-fed³⁰. The authors estimated that if 90% of families in the U.S. were to exclusively breastfeed their infants for 6 months, it would avoid 911 deaths, and could save the nation \$13 billion per year³⁰.

In summary, breastfeeding has benefits for infants, mothers, and society²⁸. Breastfeeding is associated with lower risk of developing some acute and chronic diseases in infants and some chronic diseases among mothers¹. This reduction of illnesses can save money for families and the nation as a whole²⁸⁻³⁰. Therefore, establishing evidence-based breastfeeding recommendations for families and health care providers to follow is important.

Breastfeeding Recommendations and Rates

Due to the significant benefits of breastfeeding, several health professional organizations, such as the American Academy of Pediatrics (AAP) and the World Health Organization (WHO), have established breastfeeding recommendations²⁸. For instance, the AAP recommendation is to breastfeed exclusively for six months and then continue with breastfeeding in combination with complementary foods until the infant is one year old or older, as long as the mother and infant desire to continue⁷. The recommendation from WHO is similar to that of the AAP with the difference of breastfeeding the infant until age two years or older¹¹. The recommendation by the AAP was reaffirmed in 2012, when the updated breastfeeding policy statement was published⁷.

As shown in **Figure 1.1**, breastfeeding rates have been gradually increasing throughout the previous decade³¹. Healthy People consists of science-based national health objectives to improve the public's health across America, and these objectives are updated every 10 years³². Healthy People 2020 has 42 focus areas³³. Maternal, Infant, and Child Health is one of the focus areas and the goal is to “improve the health and well-being of women, infants, children, and families³⁴”. Breastfeeding is under the Infant Care section and breastfeeding target rates for the U.S. are set for the following categories: ‘ever breast-fed’, ‘breastfeeding at 6 months’, ‘breastfeeding at 12 months’, ‘exclusive breastfeeding at 3 months’, and ‘exclusive breastfeeding at 6 months’³⁵.

The Healthy People 2020 target breastfeeding rates are shown in **Table 1.1**. The CDC publishes *The Breastfeeding Report Card* that shows breastfeeding rates for each state and the U.S. overall³⁶. This report card is updated annually³⁶. *The Breastfeeding Report Card* for 2014 has been released by CDC³⁶.

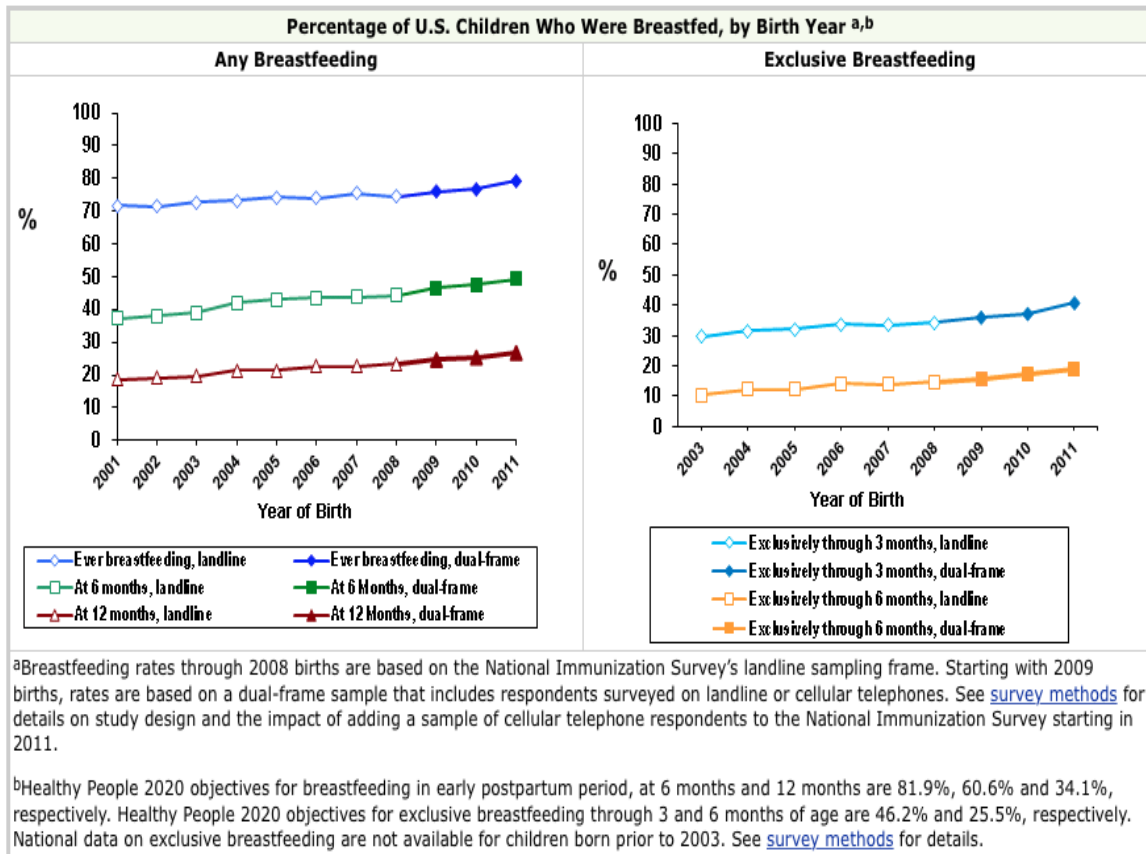


Figure 1.1. Breastfeeding among United States children born 2001-2011, Centers for Disease Control and Prevention National Immunization Survey³¹

[Source: Extracted from: Centers for Disease Control and Prevention. Breastfeeding. Available at: http://www.cdc.gov/breastfeeding/data/nis_data/index.htm]

Table 1.1. A comparison between Healthy People 2020 breastfeeding target rates³⁵ and the United States national 2014 breastfeeding rates³⁶

	Ever BF ^a	BF at 6 mos. ^b	BF at 12 mos.	Exclusive BF at 3 mos.	Exclusive BF at 6 mos.
Healthy People 2020 ³⁵ (Target Rates)	81.9%	60.6%	34.1%	46.2%	25.5%
U.S. National 2014 (Actual Rates) ³⁶	79.2%	49.4%	26.7%	40.7%	18.8%
^a BF = breastfeeding/breast-fed.					
^b mos = months.					

Table 1.1 demonstrates a comparison between Healthy People 2020 breastfeeding target rates and the actual current national breastfeeding rates. In 2014, the U.S. national rate for “ever breast-fed” (also called ‘initiation’) was 79.2%, “breastfeeding at 6 months” was 49.4%, “breastfeeding at 12 months” was 26.7%, “exclusive breastfeeding at 3 months” was 40.7%, and “exclusive breastfeeding at 6 months” was 18.8%,³⁶, as compared to the Healthy People 2020 target rates of 81.9%, 60.6%, 34.1%, 46.2%, and 25.5%, respectively³⁵.

Although the U.S. national initiation rate reached the Healthy People 2010 goal of 75%, duration and exclusivity remain a public health concern³⁷. The national breastfeeding duration rates, at 6 and 12 months, were 43% and 22.4%, respectively; somewhat less than the Healthy People 2010 target rates of 50% and 25%³⁷. The national breastfeeding exclusivity rates, at 3 and 6 months, were 33% and 13.3%, respectively; also less than the Healthy People 2010 target rates of 40% and 17%³⁷. Therefore, though the national initiation objective has been reached, and subsequently increased in Healthy People 2020, effort is still needed in order to increase breastfeeding duration and exclusivity among families (**Table 1.1**).

In 2011, *The Surgeon General’s Call to Action to Support Breastfeeding* was published²⁸. This set of guidelines, designed to support families with their breastfeeding goals²⁸, provides a roadmap designed to increase the breastfeeding rates in the nation. This *Call to Action* highlights the vital roles of people who should be involved with breastfeeding support, such as health professionals, researchers, employers, communities, and stakeholders²⁸. In addition, the *Call to Action* offers strategies that can help increase the breastfeeding rates²⁸.

To summarize, the breastfeeding recommendations developed by both the AAP and WHO²⁸, are meant as guidelines for optimal infant-feeding. In an effort to measure the nation’s progress towards complying with these breastfeeding recommendations, Healthy People revises

breastfeeding objectives, setting new target rates every 10 years^{32,33}. Progress toward these objectives is evaluated using *The Breastfeeding Report Card*, provided by the CDC on an annual basis³⁶. One way to achieve these target rates is to implement the guidelines published in *The Surgeon General's Call to Action to Support Breastfeeding*²⁸.

Breastfeeding Disparities

As with many health behaviors and chronic disease risks³³, disparities exist in breastfeeding practices, in terms of race/ethnicity, income, maternal education, and maternal age²⁸, and many of these factors are interrelated. Data from the National Immunization Survey, covering children born in 2011, shows the breastfeeding initiation rate among non-Hispanic black women (61.6%) was lower than non-Hispanic white women (81.1%) and Hispanic women (83.8%)³⁸. The rate of breastfeeding at 6 months among non-Hispanic black women was 35%, non-Hispanic white women was 52.3%, and Hispanic women was 48.4% which shows a disparity between these groups³⁸. It is important to note that income has an impact within race/ethnicity categories. For example, non-Hispanic black populations with a higher income are more likely to initiate breastfeeding (58%) as compared to their lower income counterparts (37%)³⁹. In regard to education status, mothers who have graduated from college are more likely to breastfeed as compared to mothers with less than a high school degree³⁸. In terms of maternal age, the breastfeeding rates are higher in women 30 years old or older, compared to those under 30³⁸. In order to reduce the breastfeeding disparities, it is essential to recognize the reasons behind each of these disparities and be able to plan and apply strategies to help families across America²⁸.

To conclude, disparities exist in breastfeeding practices. The breastfeeding initiation rate is lower in non-Hispanic blacks as compared to non-Hispanic whites and Hispanics³⁸. In addition, mothers who are less likely to breastfeed include those with: 1) lower income³⁸ 2) less than a high school degree^{28, 38}, and 3) those who are less than 30 years of age³⁸. Therefore, providing additional breastfeeding support to these populations is a potential strategy for decreasing these disparities and positively impacting maternal and infant health.

Breastfeeding Barriers

The benefits of breastfeeding are well-known and the recommendations are well-established²⁸. Despite this, breastfeeding rates are still low in the U.S. The only Healthy People 2010 breastfeeding objective that was met was that of 75% of mothers initiating breastfeeding³⁶. Therefore, target rates for exclusivity and duration were only slightly increased in Healthy People 2020³⁵. There are various breastfeeding barriers that have been identified such as age, education, income, race/ethnicity, and region of residence^{28, 39}. In addition, the accepted social norm of bottle-feeding, embarrassment of breastfeeding in public, lack of breastfeeding support from family members and the community, lack of breastfeeding knowledge, problems with breastfeeding, returning to work/school, and lack of breastfeeding support and education from health care services have also been associated with lack of breastfeeding initiation or early weaning²⁸. Addressing these breastfeeding barriers is essential to increase breastfeeding rates in the U.S. The support of an International Board Certified Lactation Consultant (IBCLC) is included in the *Call to Action* as one way to assist families with their lactation issues²⁸. Therefore, IBCLCs should be a part of the interdisciplinary health care team²⁸ when it comes to the care of mother and infant.

International Board Certified Lactation Consultant

The IBCLC is a credential that can be achieved by completing an extensive supervised clinical experience in breastfeeding consultation⁴⁰. There are three pathways, each of which requires clinical experience and education in the lactation field, that can qualify an individual to complete the credentialing exam offered through the International Board of Lactation Consultant Examiners (IBLCE)⁴⁰⁻⁴². The IBCLC certification must then be renewed every five years, either via continuing education credits or by retaking the exam^{40, 43}. However, reexamination is required every 10 years⁴³. The IBLCE was founded in 1985 and was accredited by the National Commission for Certifying Agencies in 1988⁴⁴.

As of May 2015, there were 27,450 IBCLCs worldwide, in 101 countries⁴⁵. Since 2006, *The Breastfeeding Report Card* has tracked the number of IBCLCs per 1,000 live births in the U.S.³⁶. Per *The 2014 Breastfeeding Report Card*, the number of IBCLCs in the U.S. is 3.5 per 1,000 live births³⁶. This number has gradually increased since 2006, when there were 2.1 IBCLCs per 1,000 live births³⁶. **Figure 1.2** indicates the IBCLCs per 1,000 live births by each state³⁶. This figure illustrates how limited access is to someone holding this credential. In fact, Action Step 11, in *The Surgeon General's Call to Action to Support Breastfeeding*, is to guarantee that IBCLC access is granted to all who may be in need²⁸.

The results showed that only 67.1% initiated breastfeeding in the control group as compared to 82.3% in the intervention group⁴⁶. The intervention group was twice (OR 2.08, 95% CI, the p-value was not reported) as likely to continue with breastfeeding until 6 months as compared to the control group⁴⁶.

To examine how well IBCLCs provided service in a Neonatal Intensive Care Unit (NICU) setting, Gonzalez and colleagues evaluated the IBCLC service implementation plan by conducting what the authors termed a pre-intervention (usual support group) and a post-intervention (IBCLC support group) study design⁴⁷. Therefore, there was no external control group. In this NICU, the early use of mother's own milk was low⁴⁷. The intervention entailed introducing IBCLC support into the NICU⁴⁷. The IBCLCs roles were to support mothers while their infants were in the NICU, to educate and prepare mothers to use their own expressed milk, and to continue with breastfeeding after discharge⁴⁷. For instance, IBCLCs discussed the importance of mother's own milk and assisted with pumping⁴⁷. Because it appears that the standard care did not involve a feeding plan this was a unique feature that was provided by the IBCLC. The development of this feeding plan allowed for an interaction with the mothers, specifically with the pumping for use in a bottle or via a nasogastric tube⁴⁷. To assess any change resulting from IBCLC services, they conducted a retrospective chart review of 175 medical records of infants who were admitted to the NICU prior to implementation of these services. They then repeated the chart review for 175 infants who received IBCLC support⁴⁷. Compared to the pre-intervention standard support group, those mothers receiving support from the IBCLC were significantly more likely to provide their own milk to their infants (31% vs. 47%, standard of care and IBCLC services, respectively. $p=0.002$)⁴⁷. In addition, at hospital discharge, the rate of using own mother's milk was significantly higher (23% to 37%, standard

of care and IBCLC services, respectively. $p=0.004$)⁴⁷. Therefore, though this was not a randomized control trial this evidence is suggestive of a positive impact of the IBCLC on breastfeeding outcomes in the NICU setting.

In summary, the IBCLC credential is the gold standard in lactation support, reflecting extensive education, clinical training, and completion of a credentialing exam^{40, 42, 43}. Moreover, it is recognized globally. The IBCLC credential has been shown to increase lactation success^{46, 47}. Despite the success, and the recognized need for the services of this provider²⁸, it is a relatively new credential and access to the limited number of these practitioners is a challenge⁴⁸. Because of the scarcity of this expertise, it is imperative to evaluate an alternative mechanism for access for mothers who are in need of the services of an IBCLC. Telemedicine is one such mechanism that may assist with increasing access to this care and should be fully explored.

Telemedicine

Definition and Application

The terms telemedicine⁴⁹, telehealth⁴⁹, e-health⁵⁰, or “medicine at a distance”⁵¹ are terms used to describe the transfer of medical information using technology mediums such as phone, e-mail, and/or videoconferencing (VC)⁴⁹. The term telemedicine has been used for over 40 years^{49, 50}. The practice of telemedicine started when hospitals began using emerging technologies to provide remote care to under-reached populations, in order to diagnose, consult, and possibly treat patients who may not otherwise receive care^{49 50}. Currently, telemedicine is being used in places such as physicians’ offices, hospitals, and other organizations that provide health care to people outside of the hospital setting⁴⁹. Telemedicine provides services such as consultation between a primary care provider and a patient or between a primary care provider and a

specialist, and the remote monitoring of patient's health status (e.g. blood glucose, vital sign, heart ECG)⁴⁹. Some of the benefits of telemedicine include: increasing health care access to patients in need; providing quality health care to patients; and decreasing the cost of health care⁴⁹. After research suggested that use of telemedicine resulted in positive outcomes, several medical fields, including dermatology^{50, 52}, psychiatry^{53, 54}, cardiology^{55, 56}, and obstetrics^{57, 58}, have embraced this methodology and use it on a regular basis.

Telemedicine: Early Postpartum and Breastfeeding Support

Telemedicine has been used to provide postpartum support after early discharge from the hospital⁵⁹. Lindberg and colleagues examined the use of VC to provide support to mothers who were discharged from the hospital within 72 hours of delivering a normal and healthy infant⁵⁹. In this Swedish study, parents had access to midwife support 24 hours a day for the first 7 days postpartum⁵⁹. Parents were in control of where to locate the VC equipment in their homes, allowing the ability to control how much to reveal from their home and themselves, and were able to control when the equipment was active and were always the initiators of contact⁵⁹. Quantitative and qualitative methods were used for data collection⁵⁹. Participants completed a questionnaire after each VC contact made to the midwife⁵⁹. Eleven sets of parents participated, and initiated a total of 23 VC calls⁵⁹. Results of questionnaires were reported using descriptive analysis⁵⁹. Major discussion topics, initiated by parents, included concerns about caring for the umbilical cord, questions about neonatal jaundice, and breastfeeding-related questions⁵⁹. For the qualitative component of the study, researchers interviewed parents individually for 20-40 minutes about their experiences with VC⁵⁹. Therefore, a total of 18 interviews were collected (two couples were excluded: one due to technical difficulties and the other had to be re-admitted

to the hospital)⁵⁹. Overall, parents reported having positive experiences with VC, being confident in its use, and were pleased with the advice received from midwives⁵⁹. However, they did not wish for VC to be a replacement for face-to-face (F-to-F) consultation⁵⁹. Rather, parents preferred the availability of both options (VC and F-to-F), allowing them the ability to decide which option to use when needed. The ability for the participants to initiate contact and to decide where the equipment was placed in their homes assisted with the feeling of confidence and privacy control⁵⁹. However, when considering breastfeeding concerns specifically, some parents felt that they needed more hands-on practice, which midwives were unable to provide via VC⁵⁹. In addition, parents felt that access to the midwife, and the presence of the VC equipment, was needed for longer than one week⁵⁹. They reported the expectation that breastfeeding issues would be of concern for longer than just the first week postpartum⁵⁹. Therefore, it is likely that access to these resources should be provided for a longer period of time.

A similar study was conducted among parents of infants hospitalized in the NICU, subsequent to premature birth⁶⁰. Upon discharge from the NICU, parents were able to access nursing staff via VC⁶⁰. Researchers completed in-depth interviews with 10 couples, before and after use of VC⁶⁰. Parents reported feeling more secure in their ability to provide care to their infants, and greater ease with bringing their infants home, knowing that trained, medical support was available at any time⁶⁰. For these parents, it seemed that being able to share verbal and non-verbal information, was a critical component of the communication, with some noting that VC seemed to allow the nursing staff to more easily sense their anxiety and to provide more effective counseling⁶⁰. Parents also noted appreciation for having access to multiple NICU staff at the same time⁶⁰. As with the study among parents of healthy and term infants, parents in this study expressed the desire to have access to a combination of VC and F-to-F care⁶⁰.

Telemedicine for breastfeeding support, via phone, has been well-established⁶¹⁻⁶⁵, and one study has reported the use of email⁶⁶. However, there has been relatively little work exploring the VC application for lactation support^{67, 68}. What has been done suggests parameters that, if acceptably structured, may increase successful application of this technology. Possibly the earliest report of using VC for breastfeeding support was from a case report in Northern Ireland, conducted in the late 1990s⁶⁹. This case reports on the experience of two mothers who volunteered to use VC to receive lactation consultation from a maternity unit⁶⁹. Both mothers had access to the VC equipment for eight weeks, and made between 5-8 contacts with a lactation consultant⁶⁹. Despite reporting poor picture and sound quality, both mothers expressed appreciating the value of this access in times when F-to-F consultation would not be feasible⁶⁹. However, because this was only a case study, completed over a decade ago, not only is generalizability impossible, it is likely that technology has improved dramatically since this time.

Two recent studies, completed in the U.S., have expanded on use of this application for breastfeeding support^{67, 68}. The first, a pilot study by Habibi and colleagues completed in the southeastern U.S.⁶⁷, explored mothers experiences with both F-to-F and VC consultations, and compared diagnoses and treatment plans, by conducting both types of consultation on the same day⁶⁷. These consultations were conducted, sequentially, by two trained IBCLCs⁶⁷, and a final joint-consultation result was shared with the mother in order to ensure all questions were answered and an appropriate management plan was outlined. Due to the small final sample size (n=12)⁶⁷, it was not possible to compare the diagnoses and/or treatment plans between the two consultation types. However, in-depth phone interviews with mothers, conducted between 3-10 days of the breastfeeding consultations, provided rich qualitative data, used for hypothesis generation⁶⁷. Overall, mothers reported having a positive VC experience, were very satisfied

with the VC, and were “somewhat” or “very comfortable” with technology⁶⁷. However, despite the positive experience, they preferred the F-to-F consult⁶⁷. *Maternal characteristics and interaction with technology*, one of the themes arising from the interviews, indicated that education, comfort with technology, and learning style may be important factors influencing the preference of VC over F-to-F and should be explored in future work⁶⁷. Therefore, the authors hypothesized based on mothers’ responses that learning style could have an effect on acceptance of using VC. This hypothesis needs testing in a larger sample. One way to do so is to know the typical learning style that mothers have in order to be receptive to use of VC. Another theme, *accuracy and trust determines acceptability*⁶⁷, reflected the concept that acceptability of VC may be increased if mothers felt that the sound and picture were of good quality, and that the provider was competent, trustworthy, and able to diagnose and provide a treatment plan⁶⁷. The final theme, *conditional acceptance of remote consultation*⁶⁷, illustrates the situation-specific acceptability of VC for breastfeeding support⁶⁷. In other words, though most mothers would prefer a F-to-F consultation, VC would be an acceptable alternative when travel cost, preparing a newborn for travel, or care for older children were prohibitive of an in-person consultation⁶⁷. The theoretical model developed from these themes requires testing in order to better characterize optimal use of this application.

In a similar study, Rojjanasrirat and colleagues assessed the feasibility of VC to facilitate interactions between mother-infant dyads at home and an IBCLC housed in a maternity unit⁶⁸. In addition, they compared LATCH scores (a breastfeeding assessment tool that stands for ‘latch’, ‘audible swallowing’, ‘type of nipple’, ‘comfort’ (maternal comfort), and ‘hold’ (the help that mother needs to position her infant to the breast))⁷⁰ generated by one IBCLC during a VC consultation with those generated by another during an in-person, home consultation⁶⁸. A total

of 10 mother-infant dyads participated in weekly VC sessions for 4 weeks postpartum⁶⁸. The VC sessions lasted between 19-50 minutes⁶⁸. For the first two weeks, there was also a home visit conducted by a different IBCLC than the one who completed the VC session⁶⁸. The purpose of the home and VC sessions was to compare the LATCH scores completed in-person and via VC⁶⁸. Inter-rater reliability between LATCH scores generated by the two different IBCLCs were evaluated for the first two weeks postpartum⁶⁸. A cutoff point of 80% agreement was set to compare the first and second visits between the two IBCLCs⁶⁸. When comparing the first VC LATCH score to the first home visit LATCH score, ‘latch’, ‘comfort’, and ‘help’ fell below 80% agreement between the two types of consult⁶⁸. This lack of agreement likely was due to technological issues described by the sample in their qualitative interviews. Though ‘latch’ and ‘comfort’ were in agreement by the second week ‘help’ (hold) remained below 80% at this measurement⁶⁸. This increased rate of agreement was most likely due to resolving some of the technological issues. Despite the potential issues with the clinical measurement (LATCH) and technology issues experienced by some of the mothers (problems with high-speed internet, firewall issues) all the mothers reported satisfaction with VC, stating that their questions had been sufficiently answered, the technology was easy to use, the sound and picture quality were good, and that they enjoyed not having to travel with their newborn to seek care from an IBCLC⁶⁸. However, as with the findings from Habibi and colleagues, the small sample size (n=10) and homogeneity of this sample (white, college-educated) limit any conclusive ability and support the need for more expansive exploration of this topic in a larger, more diverse sample. As mentioned, lack of family support of breastfeeding, including support from infant fathers/maternal partners (IFMPs), is one of the barriers to lactation²⁸. Moreover, exploring the attitudes of IFMPs may be important in understanding the acceptability of VC for breastfeeding

support as research indicates that, depending on the relationship, IFMPs may have a significant influence on the infant-feeding decision⁷¹⁻⁷³.

Infant Father/Maternal Partner Influence

Research shows that IFMPs can play an important role in the success or failure of breastfeeding efforts^{41, 71-73}. For example, in a randomized controlled trial conducted by Wolfberg and colleagues, expectant fathers were randomly assigned to attend either the standard infant care class (control) or the standard infant care class in addition to a breastfeeding class (intervention)⁷⁴. Breastfeeding initiation, among the partners of the fathers, was assessed postpartum⁷⁴. A total of 59 couples participated in the study⁷⁴. The results showed the breastfeeding initiation was significantly higher in the intervention group (74%), as compared to the control group (41%), ($p=0.02$)⁷⁴. This suggests that educating fathers about breastfeeding can impact breastfeeding initiation. Though some research indicates that fathers are not always considered a meaningful source of advice⁷⁵, other research reports that the fathers' attitude about breastfeeding may be of great importance in making the decision to breastfeed⁷². Given these complex issues, it is important to more fully explore the perceived value of the IFMP's role in the breastfeeding experience. One such factor is their opinion regarding using VC. However, given the high potential for confounding when exploring these relationships between existing couples, paired with the nascent research area, it may be most practical to first survey a free-standing IFMP population (recruited separately), and to do so in an exploratory fashion.

Prior to designing a larger study to explore these factors, and to fine-tune the use of VC for breastfeeding support, it is important to have a basic understanding of the structure of telemedicine itself.

Telemedicine Implementation

Based on an extensive literature review, building on four categories identified by Tanriverdi and Iacono⁷⁶, and by adding the category of Policy and Legislation, Broens and colleagues created a model of inputs likely required to have a successful telemedicine system (Figure 1.3)⁷⁷.

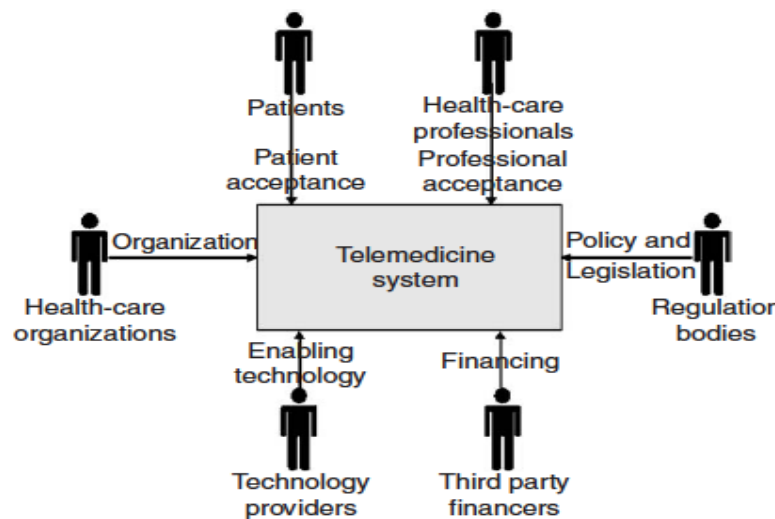


Figure 1.3. Identified determinant categories and their stakeholders in a national, social and cultural context⁷⁷

[Source: Extracted from: Broens et al. Determinants of successful telemedicine implementations: a literature study. *J. Telemed. Telecare*. 2007;13(6):303-309]

In this figure, these researchers emphasize the importance of acceptability of telemedicine among patients and health care professionals. Patient and provider attitudes toward the use of technology can influence their acceptance of telemedicine, and this is critical to consider since they are ultimately the end-users of this technology⁷⁷. If patients and health care providers do not accept the technology, the likelihood of use is low, and including these groups in design of the application early on may increase success⁷⁸. In the case of using VC for breastfeeding

support, assessing both patient and IBCLC acceptance is a necessary component of a well-designed application. For the purpose of this research proposal, the focus will be on expanding the understanding of patient acceptance of VC for breastfeeding support.

To summarize, telemedicine is described as “medicine at a distance⁵¹” that can provide health care to patients remotely by using technology such as e-mail, phone, or VC⁴⁹. In some medical fields such as dermatology and psychiatry, telemedicine has been extensively explored, and has led to its being used on a daily basis. In the area of breastfeeding support, there is limited research into the use of VC for breastfeeding support. Therefore, there is a need to assess patient (mothers’ and IFMPs’) acceptance of VC in order to best increase the use of this application to support breastfeeding and to improve breastfeeding outcomes.

Developing the Research Tool

Use of the Integrated Model for Technology Acceptance

History of Information Technology Acceptance Models

Initially, the Technology Acceptance Model (TAM) was used to assess technology acceptance among employees being introduced to Information Technologies (ITs)⁷⁹. This is important information for organizations or industries to know in order to increase the actual use of technology among their employees⁷⁹. However, over time, the TAM has been adapted by health care researchers in order to assess health care providers’ acceptance of technology⁷⁹, and specifically to assess acceptance of telemedicine⁸⁰⁻⁸². The TAM, developed by Davis and colleagues in the 1980s⁷⁹, is a modification to the Theory of Reasoned Action^{79, 83, 84}. This model posits that “perceived ease of use” and “perceived usefulness” influence “attitudes”, which in turn influence “behavioral intention to use” or “acceptance”, and finally, “behavioral

intention to use/acceptance” is associated with “actual use”⁷⁹. “Perceived ease of use” is also shown to influence “perceived usefulness”, indicating that if technology is considered too difficult to use, the “perceived usefulness” is reduced⁷⁹. Much empirical research of the TAM supports its reliability and validity across different populations and domains^{83, 85}. In the health care domain, the end-users are health care providers and patients. Therefore, the TAM can be used to assess patient desire or perceived need for telemedicine services⁸⁶.

In 1992, Davis and colleagues adapted the Motivational Model (MM) to assess acceptance of the use of computers in the work place⁸⁷. They compared results from two studies of two different computer systems, they conducted with two different groups of Master of Business Administration students⁸⁷. In both studies they found that usefulness (study I: $t_{197}=13.28$, $p<0.001$ and study II: $t_{77}=12.09$, $p<0.001$) and enjoyment (study I: $t_{197}=3.08$, $p<0.01$ and study II: $t_{77}=2.62$, $p<0.05$) were both significantly related to behavioral intention to use⁸⁷. However, usefulness was more strongly related to behavioral intention than was enjoyment⁸⁷. The authors suggested that if a technology is perceived to be highly useful, the relationship between enjoyment and behavioral intention is magnified⁸⁷.

Building on TAM and MM, in 2002, Venkatesh et al. created a model called the Integrated Model (IM) of technology acceptance, and found it to be a better predictor of “behavioral intention” than the TAM or MM model⁸⁸. In 2004, Wilson and Lankton used all three IT acceptance models (TAM, MM, and IM) (**Figure 1.4**) to assess the acceptance of patients who had registered to use “e-health” technology with a health provider⁸⁶.

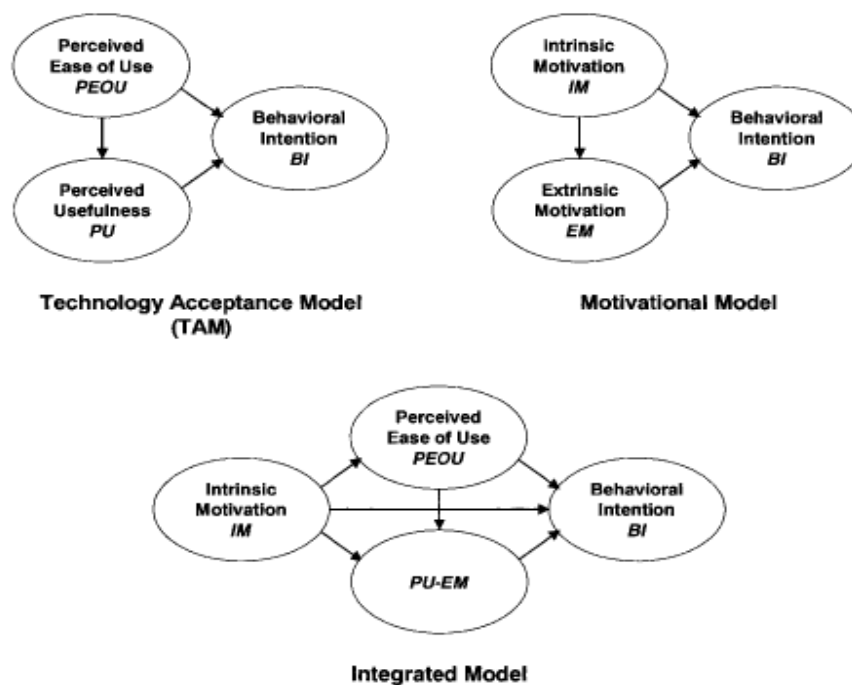


Figure 1.4. Three models of technology acceptance⁸⁶

[Source: Extracted from: Wilson EV, Lankton NK. Modeling patients' acceptance of provider-delivered e-health. *J. Am. Med. Inform. Assoc.* Jul-Aug 2004;11(4):241-248]

They found that all three IT acceptance models predicted behavioral intention in regard to use of e-health among patients⁸⁶. In the lactation field, the “patient” is the breastfeeding family, which includes the mother-infant dyad and potentially the IFMP. Though behavioral intention/acceptance is not always predictive of actual behaviors, as external modifiers (lack of internet, hardware failure, etc.) may impact this pathway, characterizing factors associated with behavioral intention/acceptance may assist with identification of individuals most likely to ultimately use this technology and assist with more efficient use of resources when implementing VC.

Use of the VARK Questionnaire^{©™}

As hypothesized by Habibi and colleagues, learning preference may be a characteristic associated with acceptance of VC⁶⁷. Of the three tools considered for learning preference assessment⁸⁹⁻⁹¹, only one was neither quite lengthy nor prohibitively expensive⁹¹. This tool, known as the VARK Questionnaire^{©™}, where ‘VARK’ is an acronym for Visual, Aural, Read/Write, and Kinesthetic, is a short questionnaire available online, is modestly priced, and has been shown to be reliable and valid in multiple populations^{92, 93}.

The VARK Questionnaire^{©™} consists of 16 questions, each of which has four potential responses (V, A, R, and K)⁹³. However, responses are not mutually exclusive and multiple responses can be chosen⁹¹. The creator of VARK Questionnaire^{©™}, Neil Fleming, explains the rationale for allowing multiple responses, stating “if multimodality is the expectation in life situations, we should allow for it in the structure of the VARK Questionnaire^{©™} and that is why respondents can choose more than one answer to each question⁹¹.” In other words, instead of simply categorizing individuals into one of the four primary learning preferences, this allows for more nuanced characterization of these preferences and potentially increases the understanding of how combinations of learning preferences may impact acceptance of VC for breastfeeding support. It is also possible to categorize individuals into one of the four learning style preferences (V, A, R, and K)^{94, 95}.

The commercial interface for the questionnaire allows for any layperson to complete the questionnaire and purchase a personalized profile report outlining learning strategies for their identified learning processes⁹⁶. For a modest fee, Fleming’s company offers an interface for researchers. They will provide a mini report including categorization into one of the four learning styles preferences or a continuous score for each learning style preference.

In summary, in order to best develop and ultimately implement VC for breastfeeding support, it is important to assess VC acceptance among breastfeeding families, which includes mother-infant dyads, and potentially IFMPs. A tool, consisting of demographic questions, technology acceptance questions, such as those used in the Integrated Model, and VARK learning preferences questions, would allow for evaluating these factors in relation to VC acceptance among mothers, and to explore these relationships among IFMPs.

Conclusion

To conclude, extensive research has shown breastfeeding has benefits for infants, mothers, and society. *The Surgeon General's Call to Action to Support Breastfeeding* provides guidelines that can help increase the breastfeeding rates in the nation and help families to reach their breastfeeding goals. One action step, highlighted by the Surgeon General, is to increase access to IBCLC services. One way to achieve this is to deepen the understanding of acceptance of use of the VC medium among end-users (mothers and IFMPs, in this case). Currently, there is limited research in this area. Before VC can be fully and successfully implemented in the lactation field, it is important to know if there are identifiable characteristics describing those willing to potentially use this technology.

Goal and Objectives of Dissertation Research

Goal : The goal of this dissertation is to explore the characteristics among independent samples of mothers and IFMPs and how these relate to acceptance of remote lactation consultation using VC.

Objective 1: To assess the relationship between acceptance of remote lactation consultation using VC and 1) acceptance subscales, 2) maternal learning style preferences, and 3) maternal demographic factors, among mothers with infants aged 4 months or younger who also report breastfeeding initiation.

Objective 2: To explore the relationship between IFMPs' demographic factors and their perception of their wives'/partners' acceptance of remote lactation consultation using VC, among those IFMPs who report having an infant aged 4 months or younger who is receiving or has ever received breast milk.

Abbreviation List

AAP = American Academy of Pediatrics

AHRQ = Agency for Healthcare Research and Quality

aOR = Adjusted Odds Ratio

BF = Breastfeeding/Breast-fed

CDC = Centers for Disease Control and Prevention

CI = Confidence Interval

DM1 = Diabetes Mellitus Type 1

DM2 = Diabetes Mellitus Type 2

F-to-F = Face-to-Face

GTI = Gastrointestinal Tract Infection

IBCLC = International Board Certified Lactation Consultant

IBLCE = International Board of Lactation Consultant Examiners

IFMP = Infant Father/Maternal Partner

IM = Integrated Model

IT = Information Technology

LATCH = Latch, Audible Swallowing, Type of Nipple, Comfort, and Hold

MM = Motivational Model

MOS = Months

NHS = Nurses' Health Study

NHS II = Nurses' Health Study II

NICU = Neonatal Intensive Care Unit

RTI = Respiratory Tract Infection

TAM = Technology Acceptance Model

U.S. = United States

USBC = United States Breastfeeding Committee

VARC = Visual, Aural, Read/Write, and Kinesthetic

VC = Videoconferencing

WHO = World Health Organization

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**CHAPTER 2 : THE USE OF VIDEOCONFERENCING FOR LACTATION
CONSULTATION: AN ONLINE CROSS-SECTIONAL SURVEY OF
MOTHERS IN THE UNITED STATES**

Abstract

Background: Suboptimal breastfeeding duration and exclusivity rates are a public health concern. Therefore, there is a need for identifying effective tools for use in interventions targeting these behaviors.

Objective: To assess the relationship between acceptance of remote lactation consultation using videoconferencing and 1) acceptance subscales, 2) maternal learning style preferences, and 3) maternal demographic factors.

Design: This was a cross-sectional study using online survey methodology, conducted from July 2014 to January 2015.

Participants/Setting: English-speaking mothers who were at least 18 years of age, with infants aged 4 months or younger, and who reported initiating breastfeeding were eligible to participate. Mothers were recruited from 26 randomly selected states. One hundred and one mothers participated and the response rate was 71%.

Main Outcome Measures: The main outcome was acceptance of use of videoconferencing for lactation consultation.

Statistical Analyses: Analyses completed included independent and one sample t-tests, Pearson and Spearman correlations, and stepwise linear regression.

Results: Acceptance was significantly related to ‘perceived ease of use’ ($r=0.680$, $p<0.001$), ‘perceived usefulness/extrinsic motivation’ ($r=0.774$, $p<0.001$), ‘intrinsic motivation’ ($r=0.689$, $p<0.001$), desire for control of privacy ($r=-0.293$, $p=0.003$), and mother’s perception of maternal partner’s acceptance of videoconferencing for lactation consultation ($r=0.432$, $p<0.001$).

Learning style preferences were not significantly related to acceptance. Only ‘perceived usefulness/extrinsic motivation’ and maternal age remained in the model ($R^2=0.616$, $p<0.001$). Though ‘perceived usefulness/extrinsic motivation’ was positively associated with acceptance, maternal age was inversely related.

Conclusion: This sample of mothers indicated being slightly positively accepting of videoconferencing for lactation consultation, with those perceiving it to be more useful demonstrating greater acceptance than those perceiving it to be less useful.

Keywords: Breastfeeding, Remote Lactation Consultation, Videoconferencing, Technology Acceptance, Mothers

Background

Breastfeeding benefits for infants, mothers, and society are well-known¹.

Though all national breastfeeding rates have improved, the initiation rate has improved more than duration and exclusivity rates²⁻⁴. Therefore, there continues to be a need for research that identifies and targets specific barriers to these behaviors, leading to increased rates of both duration and exclusivity of breastfeeding.

The Surgeon General's Call to Action to Support Breastfeeding, published in 2011, highlights several action steps to increase support for the breastfeeding mother⁵. One action step specifically highlights the services of the International Board Certified Lactation Consultant (IBCLC), as research has shown the positive impact this professional can have on breastfeeding families⁵⁻⁷. However, because this is a relatively new credential and there are limited numbers of IBCLCs in the United States (U.S.)^{2, 8, 9} there is a gap, in both number and physical location, between credentialed professionals and families in need of assistance.

One way to decrease this gap is to increase access by using “medicine at a distance¹⁰”, also known as telemedicine. This includes technologies such as telephone, email, and videoconferencing (VC)¹¹. As VC is the more robust of these tools, it has been the topic of recent research in several health care fields, and is largely considered an acceptable form of care by patients and practitioners alike¹²⁻¹⁴, with those finding it useful, easy, and enjoyable to use being most accepting^{15, 16}. However, the acceptance of VC for lactation support among mothers has been minimally explored¹⁷. It is important to assess this level of acceptance due to possible issues related to exposure of the breast, the minor child, and/or the interior of an individual's home. These, and other issues, may prevent the use of VC for this purpose and warrant carefully-controlled exploration. Therefore, the first step is to assess this acceptance among

breastfeeding mothers. The aim of this study was to evaluate the relationship between acceptance of remote lactation consultation using VC and 1) technology acceptance subscales, 2) maternal learning style preferences, and 3) maternal demographic factors.

Methods

Study Design

This was a cross-sectional study design, using online survey methodology, conducted among a convenience sample of mothers. Mothers were recruited from 27 states, which were selected at random from each of the nine regions of the U.S., in alignment with the U.S. Census Bureau and previous research on breastfeeding outcomes^{18, 19}. This randomization occurred in tandem with a similar survey targeting infant fathers/maternal partners (IFMPs), which recruited concurrently from the remaining states. Recruitment occurred from July 2014 to January 2015, and targeted state breastfeeding coalitions, social media sites, and the corresponding author's research participant database. An array of social media outlets were targeted, including sites such as Craigslist and parenting-oriented Facebook groups. Though breastfeeding groups were targeted, the addition of broader parenting groups allowed for recruitment of those who may have breast-fed only briefly. Finally, in an attempt to target those groups that are underrepresented in both breastfeeding literature and online research literature, specific sites were targeted. For example, Latina and Black breastfeeding/parenting groups were targeted via Facebook. The University of Tennessee, Knoxville Institutional Review Board approved the study protocol prior to implementation, and informed consent was collected electronically.

Eligibility

Mothers were eligible to participate if they were at least 18 years of age; had an infant four months of age or younger who was the result of a singleton birth and had been breast-fed at least once; had access to the internet and a valid email address; were able to communicate in English; and reported residing in one of the 27 randomly selected states:

Alabama, Arizona, Arkansas, California, Colorado, Florida, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Minnesota, Missouri, Montana, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oregon, Rhode Island, South Carolina, The District of Columbia, or West Virginia.

Data Collection

Data were collected using the Qualtrics online survey program. Potentially eligible mothers completed a brief screening survey to assess eligibility. The screening link was provided on the recruitment flyer. If eligible, mothers were asked to provide their name and email address and, subsequently, an email including a unique participant identification number, a copy of the consent form, and a link to the survey (the first page of which included informed consent) was sent. If mothers did not complete the survey within 48 hours, a reminder e-mail was sent. After this, mothers not completing the survey were sent a weekly reminder email until their infant was 15 weeks old or the mother requested to withdraw from the project. The survey consisted of two components that took a total of approximately 25 minutes to complete. Upon completion of the first component (demographics and assessing technology acceptance) mothers were directed to an external website to complete the second component (assessing learning style

preferences). As an incentive for participation, one in 10 mothers completing the entire survey was randomly awarded a \$35 gift card to a national retail store.

Instruments

Component 1

The first component of the survey consisted of three domains: 1) demographic questions, 2) questions assessing acceptance of the use of VC for lactation consultation using statements modified from Wilson and Lankton's work focusing on the Technology Acceptance Model, the Motivational Model, and the Integrated Model²⁰, and 3) additional questions exploring factors potentially related to acceptance that were derived from previous work by the authors and from emerging literature^{17, 21-24}, which it will be referred to as "other factors". The first domain included demographic questions such as maternal and infant age, parity, maternal education, and maternal race/ethnicity. The second domain included four subscales, made up of 11 statements derived from Wilson and Lankton²⁰. Three of the four subscales consisted of three statements, and one consisted of two statements (**Table 2.1**). The first subscale is 'perceived ease of use' and is generally defined as how much an individual believes that technology is easy to use²⁵. In the present study, it is defined as how much a mother believes that using VC for lactation consultation will be effortless and easy. The second subscale is 'perceived usefulness/extrinsic motivation'.

Davis and colleagues define 'perceived usefulness' as "...the extent to which a person believes using the system [technology] will enhance his or her job performance²⁵".

Table 2.1. Subscales, and statements, used to assess acceptability of use of videoconferencing for lactation consultation: original statements from Wilson and Lankton²⁰ and statements modified to assess the use of videoconferencing for lactation consultation

Subscales	Original Statements used by Wilson and Lankton	Modified Statements
Perceived Ease of Use (PEOU)	PEOU1: My interaction with [e-health] will be clear and understandable. PEOU2: [E-health] will be easy to use. PEOU3: I will find it easy to [get e-health to do what I want it to do].	PEOU1: My interaction with [videoconferencing for lactation consultation] will be clear and understandable. PEOU2: [Videoconferencing for lactation consultation] will be easy to use. PEOU3: I will find it easy to [use videoconferencing for lactation consultation].
Perceived Usefulness/Extrinsic Motivation (PUEM)	PUEM1: Using [e-health] will support critical aspects of my [health care]. PUEM2: Using [e-health] will enhance my effectiveness in managing my [health care]. PUEM3: Overall, [e-health] will be useful in managing my [health care].	PUEM1: Using [videoconferencing] will support critical aspects of my [lactation support]. PUEM2: Using [videoconferencing] will enhance my effectiveness in managing my [lactation support]. PUEM3: Overall, [videoconferencing] will be useful in managing my [lactation support].

Table 2.1. Continued.

Subscales	Original Statements used by Wilson and Lankton	Modified Statements
Intrinsic Motivation (IM)	IM1: I will find [e-health] to be enjoyable. IM2: The actual process of using [e-health] will be pleasant. IM3: I will have fun using [e-health].	IM1: I will find [videoconferencing] to be enjoyable [for lactation consultation]. IM2: The actual process of using [videoconferencing for lactation consultation] will be pleasant. IM3: I will have fun using [videoconferencing for lactation consultation].
Behavioral Intention (BI) also known as the ‘acceptance’	BI1: [I intend to use e-health]. BI2: [I predict I will use e-health].	BI1: [If the service were to be available now , I would use videoconferencing for lactation consultation with this baby]. BI2: [If the service were to be available in the future , I would use videoconferencing for lactation consultation].

Extrinsic motivation, or taking an action in order to receive an external rewards, is combined with ‘perceived usefulness’ in the technology acceptance literature^{16, 20}. Therefore, in the present study, this subscale is defined as how useful mothers believe VC will be to their breastfeeding success, ability to follow breastfeeding recommendations, and to do what is best for their infant. Intrinsic motivation generally describes actions taken for an individual’s own gratification or enjoyment. Therefore this third subscale, ‘intrinsic motivation’, is defined in the technology acceptance literature as how enjoyable an individual believes the process of using technology

will be¹⁵. Here it is defined as how enjoyable and gratifying mothers believe the process of using VC for lactation consultation will be. The fourth subscale is ‘behavioral intention (BI)’ also known as ‘acceptance’ and is defined as an individual’s intention or acceptance to use technology²⁵. In the present study, it is defined as mothers’ intention to, or acceptance of, use VC for lactation consultation. After testing statements for content- and face-validity as outlines by Litwin²⁶, modifications included the use of ‘videoconferencing’ instead of ‘e-health,’ and some other minor wording changes (**Table 2.1**). Responses to the statements listed on **Table 2.1** were based on a 7-point Likert Scale, where 1=“strongly disagree” and 7=“strongly agree”. In order to reduce response bias, all statements were randomized in the online survey. The third domain, “other factors”, included questions or statements exploring the mother’s perception of the IFMP’s acceptance of use, how important this perceived acceptance is to the mother, and how important it was for her to be in control of her privacy. These exploratory statements or questions are listed in **Table 2.2**.

Component 2

The second component of the survey consisted of completion of the VARK Questionnaire^{27©™}, which was available via an external link at the end of component 1 of the survey. This questionnaire consists of 16 questions assessing learning style preferences, and was selected due to its brevity, ease of use, and relatively low cost²⁸. Each question includes four potential responses, corresponding with each of the four learning style preferences (‘Visual’, ‘Aural’, ‘Read/Write’, and ‘Kinesthetic’ – or VARK). However, responses are not mutually exclusive, meaning that multiple responses could be chosen²⁹.

Table 2.2. Exploratory questions or statements used to assess mother's perception of infant father's/maternal partner's acceptance of use and her ability to control her privacy

Mother's Perception of Infant Father's/Maternal Partner's Opinion	Response Options
• I believe that the father of my baby/my partner would be accepting of videoconferencing for lactation consultation. • The opinion of the father of my baby/my partner matters to me in my decision to use videoconferencing for lactation consultation.	Ranged from 1 (strongly disagree) to 7 (strongly agree)
Mother's Perception of Importance of Control of Privacy (Home, Self, and Infant)	Response Options
• How important is it to you to be in control of how much of your home is revealed in the background during videoconferencing consultation? • How important is it to you to be in control of how much to reveal of yourself physically? • How important is it to you to be in control of how much you show of your baby on the webcam?	Ranged from 1 (it is not important to me at all) to 7 (it is extremely important to me)

Because mothers could select none of the learning styles, all of the learning styles, or some other variation, mothers could score between 0 and 16 on each of the learning styles. In other words, for V, the mothers could score between 0 and 16. This would be the same for A, R, and K. The questionnaire has been shown to be reliable and valid^{30,31}. Because this questionnaire is proprietary, the authors were provided with the complete data set at the end of the study period.

Statistical Analyses

All data were analyzed using the IBM SPSS (version 22, 2013). SamplePower was used for sample size calculation. A sample size of 100 was needed to yield $\beta=0.8$, $\alpha=0.05$, and to

detect an effect size between 0.27-0.3 (a medium effect). Descriptive analyses were completed first, allowing for data-cleaning and addressing missing data.

Acceptance Variables: Subscales were scored by summing and averaging responses to the subscale statements. This was done for all participants, including those who failed to respond to only one statement. No participants failed to respond to more than one statement. 15 participants did not respond to PEOU3, 8 participants did not respond to PUEM2, and 14 participants did not respond to IM3. All participants responded to both statements in acceptance subscale (**Table 2.1**).

Learning Style Preferences Variables: Based on the responses to each question, each participant had a score for each learning style (Visual, Aural, Read/Write, and Kinesthetic). Therefore, VARK Questionnaire[™] was analyzed as these four separate measures. One participant did not complete the VARK Questionnaire[™]. Of those completing VARK Questionnaire[™], all questions were answered.

Continuous variables were examined for normality. Those variables that were determined not to violate assumptions of normality (Shapiro-Wilk statistic >0.90)³² were analyzed using Pearson correlations. These correlations assessed any associations between the acceptance variable and several continuous independent variables (i.e., subscale scores, learning style preferences, maternal age, importance of control of privacy, and the importance of the IFMP's opinion). Spearman correlation was used to assess the association between acceptance and mother's perception of the IFMP's acceptance of use, since the independent variable was not normally distributed.

Categorical variables including maternal education level, income, race, and maternal relationship with the IFMP were dichotomized in order to increase cell size and allow for valid

statistical testing. In order to evaluate differences in categorical variables in relation to acceptance, independent sample t-tests were completed. Independent variables hypothesized to be predictive of acceptance, and variables found to be significantly related to acceptance in bivariate analyses, were included in the final stepwise regression.

Results

Recruitment/Eligibility

The screening survey was accessed 413 times and completed 331 times (**Figure 2.1**). Of those completing the screening survey, 55% were ineligible to participate. The primary reasons for ineligibility were infants being over 4 month of age (n=140), mothers exiting the screening survey without completing all questions (n=82), and/or mothers not residing in one of the randomly selected states (n=79). These reasons were not mutually exclusive. The reasons for exiting the screening survey early are unknown. Mothers were only considered enrolled if they followed the survey link provided in the email sent to those who were determined to be eligible based on the screening, and if they completed the consent form on the first page of the survey. Of the 148 eligible mothers, 29% never clicked on the link to start the survey. Therefore, 105 mothers completed the survey (response rate of 71%). However, results from four participants were removed from data analysis, as their infants were older than four months upon completion of the survey. Therefore, 101 mothers completed the first component of the survey.

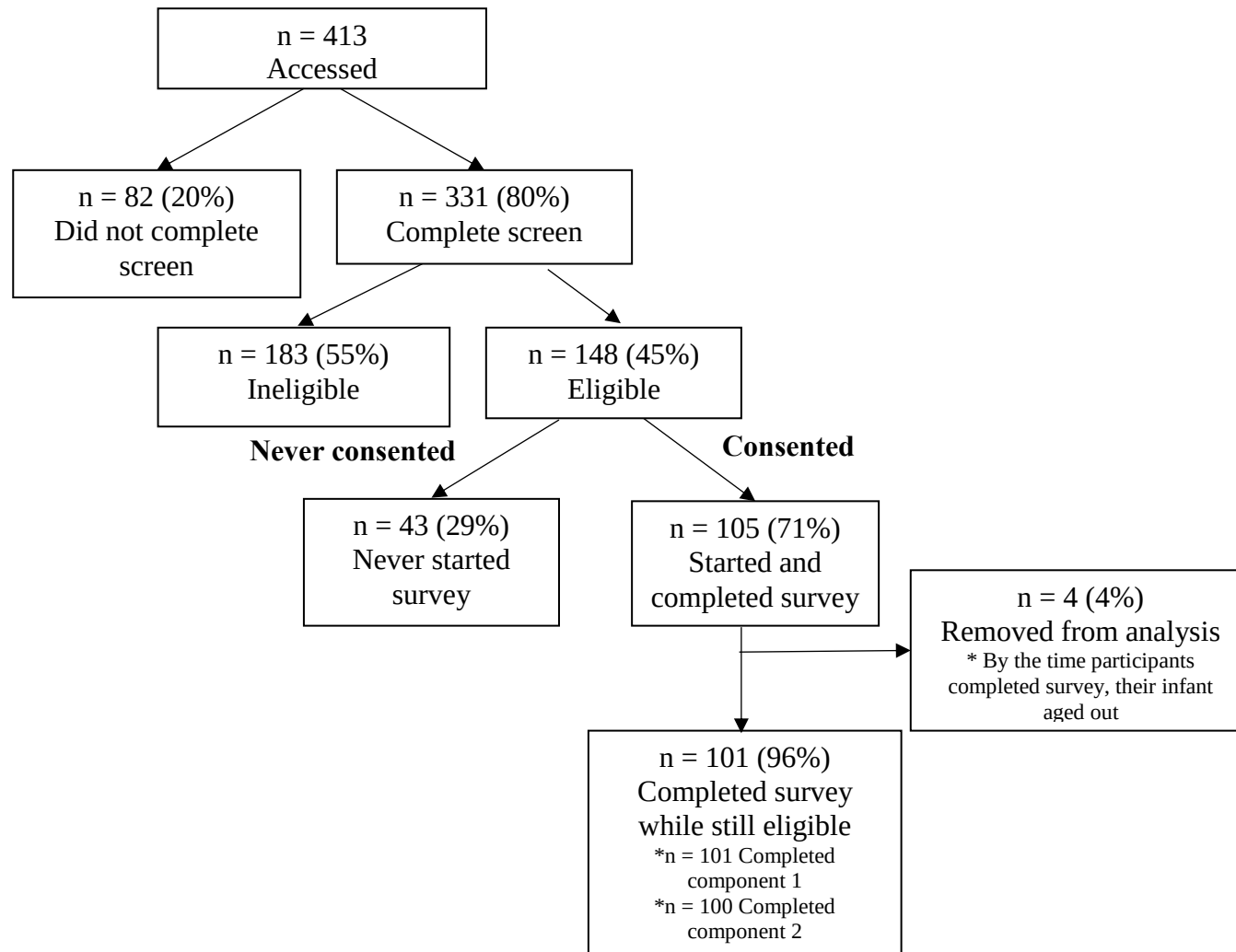


Figure 2.1. Numbers of mothers at each stage of study

However, one mother did not complete the VARK Questionnaire^{©™} (the second component of the survey). Therefore, analyses including these variables were conducted on a sample of 100.

Demographic Characteristics

Demographic characteristics are presented in **Table 2.3**. Mothers were, on average, 30 years old, with infants of approximately 2.4 months of age. The majority of the mothers reported being White (93.2%), non-Hispanic (96%), being married or cohabitating with the IFMP (95%), and having at least a bachelor's degree (64.4%).

Less than a quarter of the mothers (23.8%) were categorized as $\leq 185\%$ of the Federal Poverty Level, secondary to reporting participation in the Special Supplemental Nutrition Program for Women, Infants and Children (WIC)³³ and/or the Supplemental Nutrition Assistance Program (SNAP)³⁴. Slightly more than half of the mothers reported having more than one child (54.5%). Only 3% of the mothers were no longer breastfeeding at the time of survey completion and only 25.7% of mothers reported the use of VC in the week prior to survey.

Acceptance of Videoconferencing for Lactation Consultation

Results of independent sample t-tests are shown in **Table 2.4**. No differences were found in acceptance by maternal education level ($p=0.965$), income ($p=0.383$), parity ($p=0.273$), or use of VC in the week prior to taking the survey ($p=0.707$). Statistical analyses were not completed using race, ethnicity, maternal relationship with the IFMP, and receipt of breast milk at survey completion variables, secondary to their limited variability.

Table 2.3. Demographic characteristics of mothers (n=101)

Variables	
	Mean (SD)
Maternal age, in years	30.1 (4.6)
Infant age, in months	2.4 (1.0)
	Frequency (%)
Maternal race	
White	93.1%
Non-white	7%
Maternal ethnicity	
Hispanic	4%
Non-Hispanic	96%
Maternal relationship with the infant father/maternal partner	
Married or cohabitating	95%
Living apart from infant's father	5%
Maternal education level	
Associate's degree or less	35.6%
Bachelor's degree or higher	64.4%
Income level^a	
≤ 185% Poverty level	23.8%
> 185% Poverty level	76.2%
Parity	
Primiparous	45.5%
Multiparous	54.5%
Infant receiving breast milk at survey completion	
Yes	97%
No	3%
Used videoconferencing in the week prior to survey	
Yes	25.7%
No	74.3%
Percent Participation, by United States Region	
East North Central	31%
East South Central	7.9%
West North Central	6.9%
West South Central	6.9%
Middle Atlantic	7.9%
South Atlantic	19.8%
Mountain	5.9%
New England	2%
Pacific	10.9%
^a ≤ 185% poverty level was defined as participating in either the WIC and/or the SNAP	

Table 2.4. Independent sample t-tests comparing independent variables with acceptance (n=101)

	Acceptance				
	Demographics	Mean (SD)	t	df	P-value
Education level	≤ Associate's degree	4.9 (1.8)	0.044	99	0.965
	> Bachelor's degree	4.9 (1.6)			
Income level	≤ 185% poverty level	4.6 (2.0)	0.876	99	0.383
	> 185% poverty level	5.0 (1.6)			
Parity	Primiparous	5.1 (1.6)	1.103	99	0.273
	Multiparous	4.7 (1.8)			
Used videoconferencing in the week prior to survey	Yes	5.0 (1.6)	0.378	99	0.707
	No	4.9 (1.8)			

Each subscale was tested and found to have a good internal consistency reliability (PEOU: Cronbach's $\alpha=0.842$; PUEM: Cronbach's $\alpha=0.911$, IM: Cronbach's $\alpha=0.856$; and acceptance: Cronbach's $\alpha=0.881$). See **Table 2.5** for means, standard deviations, and Cronbach's alpha scores for each subscale. One sample t-tests indicated that all the subscale means were significantly greater than neutral (4.0) ($p<0.001$) (**Table 2.5**).

Assessment of the importance of the ability to control privacy consisted of three questions focusing on revealing the home (mean=3.8), themselves physically (mean=4.5), or their infant (mean=4.5), via VC. All three variables were significantly negatively correlated with acceptance (data not shown).

Table 2.5. Means, standard deviations, Cronbach's alpha scores, number of statements, and one sample t-test significance for each subscale

Subscales	Mean	SD	Cronbach's α	Number of statements in subscale	p-value
Perceived Ease of Use (PEOU)	5.1	1.3	0.842	3	< 0.001
Perceived Usefulness/Extrinsic Motivation (PUEM)	4.9	1.4	0.911	3	< 0.001
Intrinsic Motivation (IM)	4.8	1.3	0.856	3	< 0.001
Behavioral Intention (BI) also known as 'acceptance'	4.9	1.7	0.881	2	< 0.001

Since all three variables were highly correlated with each other and they were measuring the same outcome, they were averaged as one subscale and termed 'control of privacy'. This subscale demonstrated an excellent internal consistency reliability (Cronbach's $\alpha=0.915$). Though desire for control of privacy was significantly negatively related to acceptance, the relationship was weak ($r=-0.293$, $p=0.003$). Mother's perception of the IFMP's acceptance of VC for lactation consultation (mean=5.8) was moderately positively correlated with acceptance ($r=0.432$, $p<0.001$). A sample mean was calculated for each of the four learning style preferences, and ranged from 4.4 to 6.8 (**Table 2.6**).

The relationships between acceptance and each subscale score, maternal learning style preferences, and other maternal factors are shown in **Table 2.7**. PEOU ($r=0.680$, $p<0.001$), PUEM ($r=0.774$, $p<0.001$), and IM ($r=0.689$, $p<0.001$) were significantly positively related to acceptance and the relationships were strong. Maternal learning style preferences, maternal age, and the mother's perception of the IFMP's opinion about using VC for lactation consultation were not significantly correlated with acceptance.

Table 2.6. Sample means and standard deviations for learning styles among a sample of mothers (n=100)

	Minimum	Maximum	Mean	SD
Verbal	1.0	13.0	4.4	2.8
Aural	1.0	13.0	5.1	2.7
Read/Write	1.0	16.0	6.8	3.3
Kinesthetic	0	13.0	6.1	2.9

Table 2.7. Relationships between subscale scores, maternal learning style preferences, and other maternal factors and acceptance

Independent Variables	Correlation with Acceptance (Pearson)	p-value
Perceived Ease of Use (PEOU) subscale	0.680 ^b	< 0.001
Perceived Usefulness/Extrinsic Motivation (PUEM) subscale	0.774 ^b	< 0.001
Intrinsic Motivation (IM) subscale	0.689 ^b	< 0.001
Visual Learning Style ^a	0.023	0.819
Aural Learning Style ^a	0.097	0.338
Read/Write Learning Style ^a	0.105	0.300
Kinesthetic Learning Style ^a	- 0.148	0.141
Maternal Age	- 0.159	0.113
Control of Privacy subscale (revealing home, self, and infant)	- 0.293 ^b	0.003
The opinion of the infant father /maternal partner regarding the mother's decision to use videoconferencing for lactation consultation matters to mother	- 0.039	0.699
Independent Variables	Correlation with Acceptance (Spearman)	p-value
Mother's perception of father's/partner's acceptance of videoconferencing for lactation consultation	0.432 ^b	< 0.001
^a n=100.		
^b significant at the 0.01 level (2-tailed).		

Finally, stepwise regression was conducted to test which independent variables (maternal demographics, PEOU, PUEM, IM, “other factors”, and/or VARK learning style preferences) might predict acceptance. Maternal demographics that had limited variability (i.e., race, ethnicity, maternal relationship with the IFMP, and infant receiving breast milk at survey completion) were not included in the stepwise regression. **Table 2.8** describes the final model. The two variables remaining in the model were PUEM and maternal age. Together these variables explained ~62% of the variability in acceptance. Though PUEM was positively associated with acceptance, maternal age was inversely related.

Table 2.8. Results of stepwise regression analysis to determine independent variables that predict acceptance

Model	B	SEB	β	p-value
Perceived Usefulness/Extrinsic Motivation (PUEM)	0.945	0.077	0.769	< 0.001
Maternal Age	- 0.050	0.023	- 0.136	0.033
$R^2=0.616, p<0.001$				
Dependent Variable: Behavioral Intention also known as ‘acceptance’				

Discussion

To the authors’ knowledge this study is the first to assess, via survey methodology, the acceptance of use of VC for lactation consultation among a national sample of mothers with young infants. To date, existing research has been largely qualitative in nature and/or has been conducted with relatively small sample sizes^{17, 23}. Results of these previous studies indicated areas in need of further exploration. Thus, this study was designed to address some of these

identified gaps. Specifically, objectives were to assess maternal VC acceptance 1) using modified components of a tool exploring acceptance among patients of a health care provider offering an e-health interface (email, prescription refill, and searchable education data base via a web platform²⁰, 2) using the VARK Questionnaire^{©™} (which assesses learning style preferences)²⁷, and 3) using maternal demographic questions.

According to Davis and colleagues, developers of the Technology Acceptance Model (TAM), those who are accepting of technology are more likely to become ‘users’ of technology³⁵. Briefly, the TAM was originally used to assess technology acceptance among employees being introduced to information technologies (IT)³⁶. Subsequently, Davis and colleagues introduced the Motivational Model (MM) to assess user acceptance of computers in the workplace¹⁵. These are the two most well-known IT acceptance models²⁰. In 2002, Venkatesh et al., introduced the Integrated Model (fusing the TAM and MM) and found this to be more predictive of acceptance than the TAM or MM alone¹⁶. In 2004, Wilson and Lankton used all three models to evaluate acceptance of receipt of e-health among patients who registered to use this technology with a health care provider²⁰. In their study, each of the models were predictive of acceptance²⁰. Using structural equation modeling, previous researchers found a direct, positive relationship between ‘perceived ease of use’ and ‘perceived usefulness/extrinsic motivation’ with acceptance^{16,20}. In the present study, the Integrated Model was used to assess the use of VC for lactation consultation. Though individual correlations were found between acceptance and ‘perceived ease of use’, ‘perceived usefulness/extrinsic motivation’, and ‘intrinsic motivation’, the ‘perceived usefulness/extrinsic motivation’ subscale was the only one to remain in the regression model.

Previous research has found females to be more accepting of technology if they perceived it to be easy to use, whereas males consider usefulness to be the primary motivator for acceptance^{37, 38}. However in the present study, which consisted of only females, ‘perceived usefulness’ was the most important predictor of acceptance and ‘ease of use’ was not a critical variable. This may be explained by the sample, as they reported being comfortable with technology. Results may be different should the study be repeated offline.

It has been theorized that maternal learning style preferences might be related to acceptance of VC for lactation consultation¹⁷. In a recent qualitative study, conducted among 12 mothers who participated in a pilot study to evaluate maternal experiences with lactation consultations conducted via both VC and face-to-face, maternal learning style preferences emerged as a theme¹⁷. Though all mothers reported recognizing the value of VC for lactation consultation, most mothers preferred the face-to-face consultation, with a few stating that this might be explained by their need to be ‘hands-on’ when learning¹⁷. The VARK (‘Visual’, ‘Aural’, ‘Read/Write’, and ‘Kinesthetic’) Questionnaire has been primarily utilized in higher education settings as a way for teachers to tailor their lessons to meets students’ learning needs, specifically pertaining to differences by academic level, major, and gender^{28, 39, 40}. However, the VARK Questionnaire^{©™} has also been used to guide how health education information is presented to patients with different learning style preferences⁴¹⁻⁴³. For instance in one such study, targeting patients with hypertension, those receiving education tailored to their preferred learning style expressed greater satisfaction with the education⁴³. Though it has been hypothesized that those exhibiting greater preference for kinesthetic learning might be more accepting of the use of VC technology for lactation¹⁷, no such relationships were detected in this sample of mothers. However, learning style preferences may have a larger impact on acceptance

among younger mothers, single mothers, and/or mothers from minority populations, and should be explored further.

In a study by Porter and Donthu, it was found that those with less education or those who were older perceived the Internet to be less easy to use than those with more education or who were younger⁴⁴. Despite research indicating that acceptance of technology varies by education level, no such differences were detected in the present sample and, though maternal age explained some of the variability in the final regression model, it was an exceedingly small contribution. It is possible that the lack of, or weak, associations can be explained by the rapidly increasing perfusion of technology into daily activities, that is likely occurring across all education levels⁴⁵. For example, recent research indicates that 74% of all Internet users greater than 18 years of age report using social networking sites⁴⁶ and 64% of American adults report owning a smart phone⁴⁷. Therefore, it is possible that the increasingly ubiquitous nature of technology has eliminated any differences that may have existed just a decade ago and that for a generation that came of age during this time period, acceptance of technology is no longer of great concern. After controlling for modified components of the Integrated Model, maternal learning style preferences, and other maternal characteristics, perceived usefulness of VC for lactation consultation appears to be the most important factor in predicting acceptability of use.

In our study, mothers perceived the IFMP to be accepting of VC for lactation consultation but also reported that the opinion of the IFMP, regarding her decision to use VC for lactation consultation, was not particularly important. It is possible that mothers assumed their partners' opinion would not differ from their own. However, the possibility that in some situations the opinion of the partner may be of little consequence is supported by previous literature exploring infant-feeding decisions⁴⁸. Future work should explore the use of VC with

lactation consultation among IFMPs. The long-term outcome of this study is to ultimately increase breastfeeding duration and exclusivity rates among families in the U.S. by providing remote lactation support using VC for those who have limited access. Before implementing the VC application, it is vital to know if mothers will be accepting of this form of lactation support. Because this study indicated that they are slightly accepting of this application, future work should likely explore factors that increase or decrease this acceptance.

Limitations

There are a couple of notable limitations to this study. First, despite efforts to recruit from a variety of sources, the final sample was representative of white, non-Hispanic mothers who were about 30 years of age. In addition, these mothers appeared to be in a relationship with the father of their infant or their partner. Therefore those at greater risk of early weaning, including younger, single mothers and/or mothers from minority populations, were not well-represented and results are unlikely to be generalizable. However, as access to technology is likely to continue to increase, efforts to reach these populations must continue. Second, exploring acceptance of technology among mothers who were using technology to complete the survey likely biased the results. The survey should be repeated using other methodologies, such as phone interviews or paper surveys. This may increase the variability and generalizability of the findings.

Conclusion

To conclude, this sample of mothers was slightly accepting of VC for lactation consultation but, based on the results of regression, acceptance did not appear to be predicted by

learning style preferences, perceived ease of use, intrinsic motivation, or maternal factors such as parity, education level, or the perceived opinion of the IFMP. Rather, perceived usefulness/extrinsic motivation was the primary predictor of acceptance, and this factor should be explored further. Moreover, future work should target populations that are more diverse and should do so using a variety of survey methodologies. Ultimately, breastfeeding rates may be improved if VC for lactation consultation was used to efficiently increase access to care for mothers at greatest risk of early weaning.

Statement of Potential Conflict of Interest

No potential conflict of interest was reported by the authors.

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Abbreviation List

BI = Behavioral Intention

DF = Degrees of freedom

IBCLC = International Board Certified Lactation Consultant

IFMP = Infant Father/Maternal Partner

IM = Intrinsic Motivation

IT = Information Technology

MM = Motivational Model

PEOU = Perceived Ease of Use

PUEM = Perceived Usefulness/Extrinsic Motivation

SD = Standard Deviation

Sig = Significance

SNAP = Supplemental Nutrition Assistance Program

TAM = Technology Acceptance Model

U.S. = United States

VARC = Visual, Aural, Read/Write, and Kinesthetic

VC = Videoconferencing

WIC = Special Supplemental Nutrition Program for Women, Infants, and Children

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**CHAPTER 3 : THE USE OF VIDEOCONFERENCING FOR LACTATION
CONSULTATION: AN ONLINE CROSS-SECTIONAL SURVEY OF
INFANT FATHERS'/MATERNAL PARTNERS' PERCEPTION OF THEIR
WIVES'/PARTNERS' ACCEPTANCE IN THE UNITED STATES**

Well Established

Suboptimal breastfeeding duration and exclusivity rates are a public health concern in the United States. This is due to breastfeeding barriers that some families encounter. One of these barriers is limited access to an International Board Certified Lactation Consultant.

Newly Expressed

One way to increase families' access to an International Board Certified Lactation Consultant is the use of remote lactation consultation using videoconferencing. This study explores infant fathers'/maternal partners' perception about their wives'/partners' acceptance of the use of this application.

Abstract

Background: Increasing breastfeeding duration and exclusivity rates in the United States are health priorities and objectives from Healthy People 2020. One way to provide breastfeeding support to families who do not have access to an International Board Certified Lactation Consultant is via videoconferencing.

Objective: To explore the relationship between infant fathers'/maternal partners' demographic factors and their perception of their wives'/partners' acceptance of remote lactation consultation using videoconferencing.

Methods: Eighty English-speaking infant fathers/maternal partners who were ≥ 18 years of age, with an infant of ≤ 4 months of age, and who reported their infant was breast-fed at least once

participated in an online survey. These participants were recruited from 22 randomly selected states from July 2014 to March 2015.

Results: Infant fathers'/maternal partners' perception of their wives'/partners' acceptance was significantly related to 'perceived ease of use' ($r=0.653$, $p<0.001$), 'perceived usefulness/extrinsic motivation' ($r=0.797$, $p<0.001$), and 'intrinsic motivation' ($r=0.756$, $p<0.001$). Infant fathers'/maternal partners' demographic factors did not significantly differ by acceptance. Based on stepwise linear regression, 'perceived usefulness/extrinsic motivation' was the only independent variable that predicted acceptance ($R^2=0.635$, $p<0.001$).

Conclusion: This sample of infant fathers/maternal partners perceived that their wives/partners would be neutral in terms of their overall acceptance of using videoconferencing for lactation consultation. Those infant fathers/maternal partners who perceived videoconferencing would be useful to the mother perceived their wives/partners would have a higher level of acceptance.

Keywords: Breastfeeding, Remote Lactation Consultation, Videoconferencing, Technology Acceptance, Infant Fathers/Maternal Partners

Background

Although the benefits of breastfeeding are well-known^{1, 2}, duration and exclusivity rates are still low according to the latest Breastfeeding Report Card published by the Centers for Disease Control and Prevention³. These suboptimal rates can be somewhat explained by barriers that many families encounter such as returning to work or school, lack of breastfeeding education, and/or lack of lactation support from health care providers¹. One of the Action Steps outlined in *The Surgeon General's Call to Action to Support Breastfeeding* is the support of an International Board Certified Lactation Consultant (IBCLC) to assist families with their breastfeeding issues¹. In order to receive the IBCLC credential, one must go through extensive clinical experience to be prepared for helping families with their breastfeeding issues⁴. The impact of the IBCLC professional on breastfeeding success has been assessed^{5, 6}. According to the latest Breastfeeding Report Card, in the United States (U.S.) there are 3.5 IBCLCs per 1,000 live births³. This number shows that families have limited access to an IBCLC, secondary to both the low prevalence and physical location. One way to increase families' access to IBCLCs is the use of remote lactation consultation using videoconferencing (VC), allowing direct communication between this specialized health care provider and mother/infants pairs and families experiencing breastfeeding issues. Remote lactation support can benefit families who are limited by transportation, time, or other such barriers. Increasing access to lactation care may result in cost- and time- savings for families and ultimately increase the breastfeeding rates in the U.S. Therefore, evaluating the perceptions of families, as the end-users of this technology, is essential. Because of the demonstrated influence of infant fathers/maternal partners (IFMPs) on the infant-feeding decision, the aim of this study was to explore any relationships between

IFMPs' demographic factors and their perception of how accepting their wives'/partners' would be to the use of VC for lactation consultation.

Methods

Study Design

This was an exploratory cross-sectional study design, using an online survey methodology among a convenience sample of IFMPs. This sample was recruited from 22 states from 9 regions of the U.S. These regions are outlined by the U.S. Census Bureau and have been used in breastfeeding studies describing regional characteristics^{7,8}. The IFMPs were recruited from these 22 states because a similar study was concurrently conducted among a sample of mothers in a separate group of 27 states, and this reduced the likelihood that participants in these two studies would be related. Recruitment occurred from July 2014 until March 2015, via state breastfeeding coalitions, social media sites (e.g. Craigslist, Facebook), and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). For social media sites, breastfeeding and parenting-oriented groups were targeted. In addition, social media for minority groups were targeted for recruitment since these groups are underrepresented in breastfeeding research related to IFMPs. Prior to implementation, this study was approved by the Institutional Review Board of The University of Tennessee at Knoxville.

Eligibility

The IFMPs were eligible to participate if they were at least 18 years of age; had an infant four months of age or younger who was the result of a singleton birth and had been breast-fed at least once; had access to the internet and a valid email address; were able to communicate in

English; and reported residing in one of the 22 randomly selected states: Connecticut, Delaware, Georgia, Maryland, Massachusetts, Michigan, Mississippi, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, or Wyoming.

Data Collection

Data were collected using the Qualtrics online survey program. For advertisement, a flyer with a brief description of the study and a link to the screening survey was used. Potential participants completed the eligibility screen online and, if eligible, were asked to provide their name and e-mail address. Subsequently, they received an email including an attached consent form and a link to the electronic consent form. Those who consented were immediately directed to the survey. If a participant did not complete the survey within 48 hours of the original e-mail, they received an email reminder to complete the survey. Reminder e-mails were then sent weekly until 1) they completed the survey, 2) their infant turned 15 weeks old, or 3) they requested to be withdrawn from the study. The survey took approximately 15 minutes to complete. As an incentive, IFMPs completing the survey were offered entry into a drawing for a \$25 gift card to a national retail store. This drawing was completed for groups of 10, resulting in eight participants receiving a gift card.

Instrument

The survey consisted of three domains: 1) demographic questions, 2) questions assessing acceptance of the use of VC for lactation consultation using statements modified from Wilson and Lankton⁹, and 3) additional questions exploring factors potentially related to acceptance that

were derived from previous work by the authors and from emerging literature, also referred to “other factors”¹⁰⁻¹⁴. In the first domain, demographic questions such as IFMPs’ and infant ages, race/ethnicity, education, and number of children were asked. The second domain used a tool from Wilson and Lankton, which evaluated e-health acceptance among patients⁹. In the present study, modifications were made from Wilson and Lankton’s work to be applicable to use of VC for lactation consultation. For example, modifications included the use of ‘videoconferencing’ instead of ‘e-health,’ and some other minor wording changes were made after conducting content validity and face validity (**Table 3.1**). In the present study, 11 acceptance statements (four subscales) were used (**Table 3.1**). The subscales were as follows: 1) ‘perceived ease of use’, defined as assessing the easiness of use of the technology¹⁵, 2) ‘perceived usefulness/extrinsic motivation’, defined as assessing the usefulness of the technology to enhance job performance¹⁵, 3) ‘intrinsic motivation’, defined as the process of using technology being fun and enjoyable¹⁶, and 4) ‘behavioral intention/acceptance’, defined as intention to use or accept the technology¹⁵.

The responses to the 11 subscale statements were based on a 7-point Likert Scale, where 1=“strongly disagree” and 7=“strongly agree”. The statements were randomized in the online survey to reduce response bias. Acceptance, in this study, is defined as IFMP’s perception of their wives’/partners acceptance of using VC for lactation consultation.

The third domain included questions or statements exploring the IFMP’s perception of their wife’s/partner’s opinion, and the IFMP’s perception of the importance of control of privacy (revealing home, mother, and infant), their comfort level with their wives/partners receiving a lactation diagnosis remotely, and their perception of their wives’/partners’ willingness to use VC technology to receive lactation consultation in their home or in a nearby health care facility. In **Table 3.2**, statements or questions are listed.

Table 3.1. Subscales, and statements, used to assess acceptability of use of videoconferencing for lactation consultation: original statements from Wilson and Lankton⁹ and statements modified to assess the use of videoconferencing for lactation consultation

Subscales	Original Statements used by Wilson and Lankton	Modified Statements
Perceived Ease of Use (PEOU)	PEOU1: [My] interaction with [e-health] will be clear and understandable. PEOU2: [E-health] will be easy to use. PEOU3: [I] will find it easy to [get e-health to do what I want it to do].	PEOU1: [The mother of my baby's/my partner's] interaction with [videoconferencing for lactation consultation] will be clear and understandable. PEOU1: [Videoconferencing for lactation consultation] will be easy to use. PEOU3: [The mother of my baby/my partner] will find it easy to [use videoconferencing for lactation consultation].
Perceived Usefulness/Extrinsic Motivation (PUEM)	PUEM1: Using [e-health] will support critical aspects of my [health care]. PUEM2: Using [e-health] will enhance my effectiveness in managing [my health care]. PUEM3: Overall, [e-health] will be useful in managing my [health care].	PUEM1: Using [videoconferencing] will support critical aspects of my [baby's/my partner's lactation support]. PUEM2: Using [videoconferencing] will enhance my effectiveness in managing [the mother of my baby's/my partner's lactation support]. PUEM3: Overall, [videoconferencing] will be useful in managing [the mother of my baby's/my partner's lactation support].

Table 3.1. Continued.

Subscales	Original Statements used by Wilson and Lankton	Modified Statements
Intrinsic Motivation (IM)	IM1: [I] will find [e-health] to be enjoyable. IM2: The actual process of using [e-health] will be pleasant. IM3: [I] will have fun using [e-health].	IM1: [The mother of my baby/my partner] will find [videoconferencing] to be enjoyable [for lactation consultation]. IM2: [The mother of my baby/my partner will find] the actual process of using [videoconferencing for lactation consultation] to be pleasant. IM3: [The mother of my baby/my partner] will have fun using [videoconferencing for lactation consultation].
Behavioral Intention (BI) also known as the ‘acceptance’	BI1: [I intend to use e-health]. BI2: [I predict I will use e-health].	BI1: [If the service were to be available now, the mother of my baby/my partner would use videoconferencing for lactation consultation with this baby]. BI2: [If the service were to be available in the future, the mother of my baby/my partner would use videoconferencing for lactation consultation].

Table 3.2. Infant fathers’/maternal partner’s exploratory questions or statements

Infant Father’s/Maternal Partner’s Perception of Importance of Control of Privacy (Revealing Home, Mother, and Infant)	Response Options
• How important is it to you to be in control of how much of your home is revealed in the background during videoconferencing consultation? • How important is it to you that the mother of your baby/your partner is able to control how much she reveals of herself physically? • How important is it to you to be in control of how much of your baby is shown on the webcam?	Ranged from 1 (it is not important to me at all) to 7 (it is extremely important to me)
Infant Father’s/Maternal Partner’s Perception of Mother’s Willingness to Use Videoconferencing from Home or Health Care Facility	Response Options
• If there were no lactation consultants available locally, how willing would the mother of your baby/your partner be to participate in lactation consultation using videoconferencing from your home (if the Internet and a computer were available at home)? • If there were no lactation consultants available locally, and the Internet and a computer were not available at home, how willing would the mother of your baby/your partner be to participate in lactation consultation using videoconferencing from health care facilities where the Internet and a computer were available (e.g. hospitals, doctor’s office)?	Ranged from 1 (not willing at all) to 7 (very willing)

Table 3.2. Continued.

Infant Father's/Maternal Partner's Comfortable Level with Receiving Lactation Diagnosis	Response Options
• How comfortable would you feel with the mother of your baby/your partner receiving breastfeeding diagnosis via videoconferencing?	Ranged from 1 (not comfortable at all) to 7 (extremely comfortable)

Statistical Analyses

Data were analyzed using IBM SPSS (version 22, 2013). Because of the exploratory nature of this work, a sample size calculation was not completed. Rather, it was estimated that a sample size of 100 would allow for regression analyses, with multiple independent variables, to be completed. Descriptive analyses were completed first, allowing for data-cleaning and addressing missing data. All participants answered all survey questions, except for one participant who selected, “prefer not to answer” for the questions pertaining to race and ethnicity. This was considered missing data, thus reducing the sample size to 79 when conducting analyses including these variables. Responses to statements within each subscale were averaged, creating an overall subscale score.

Continuous Variables: Normality testing was completed for all of the continuous independent variables. Pearson correlations were completed for those variables that were determined not to violate assumptions of normality (Shapiro-Wilk statistic >0.90)¹⁷. Pearson correlations assessed any associations between Behavioral Intention (BI), termed ‘acceptance’, and several continuous independent variables (i.e., subscale scores, IFMP’s age, and importance of control of privacy). For those independent variables that were not normally distributed, such as occurred with willingness to use VC (from home or health care facility) and comfort with

receiving breastfeeding diagnosis via VC, their relationship with acceptance was assessed using Spearman correlations.

Categorical Variables: In order to allow for valid statistical testing, some independent variables such as IFMPs' education level, race, and relationship with the infant's mother were dichotomized in order to increase cell size. Independent sample t-tests were conducted to evaluate differences in acceptance between dichotomous categorical variables. Independent variables hypothesized to be predictive of acceptance, and variables found to be significantly related to acceptance in bivariate analyses, were included in the final stepwise regression.

Results

Recruitment/Eligibility

The screening survey was accessed 624 times and completed 418 times (**Figure 3.1**). Of those completing the screen, 290 were ineligible, with the primary reasons being 1) participants exited the screen before completion (n=206), 2) infant was over 4 months of age (n=148), and/or 3) the participant did not reside in one of the randomly selected states (n=131). These reasons were not mutually exclusive. For those participants who exited out early, no reason was provided.

Participants were only considered enrolled if they followed the survey link provided in the email sent to those who were determined to be eligible based on inclusion criteria. Of those 128 participants who were eligible to participate, 91 started the survey and 83 completed it (response rate of 64.8%). Three participants were dropped from analysis, secondary to their infant aging out before completion of the survey. Therefore, analyses were conducted on the final sample size of 80.

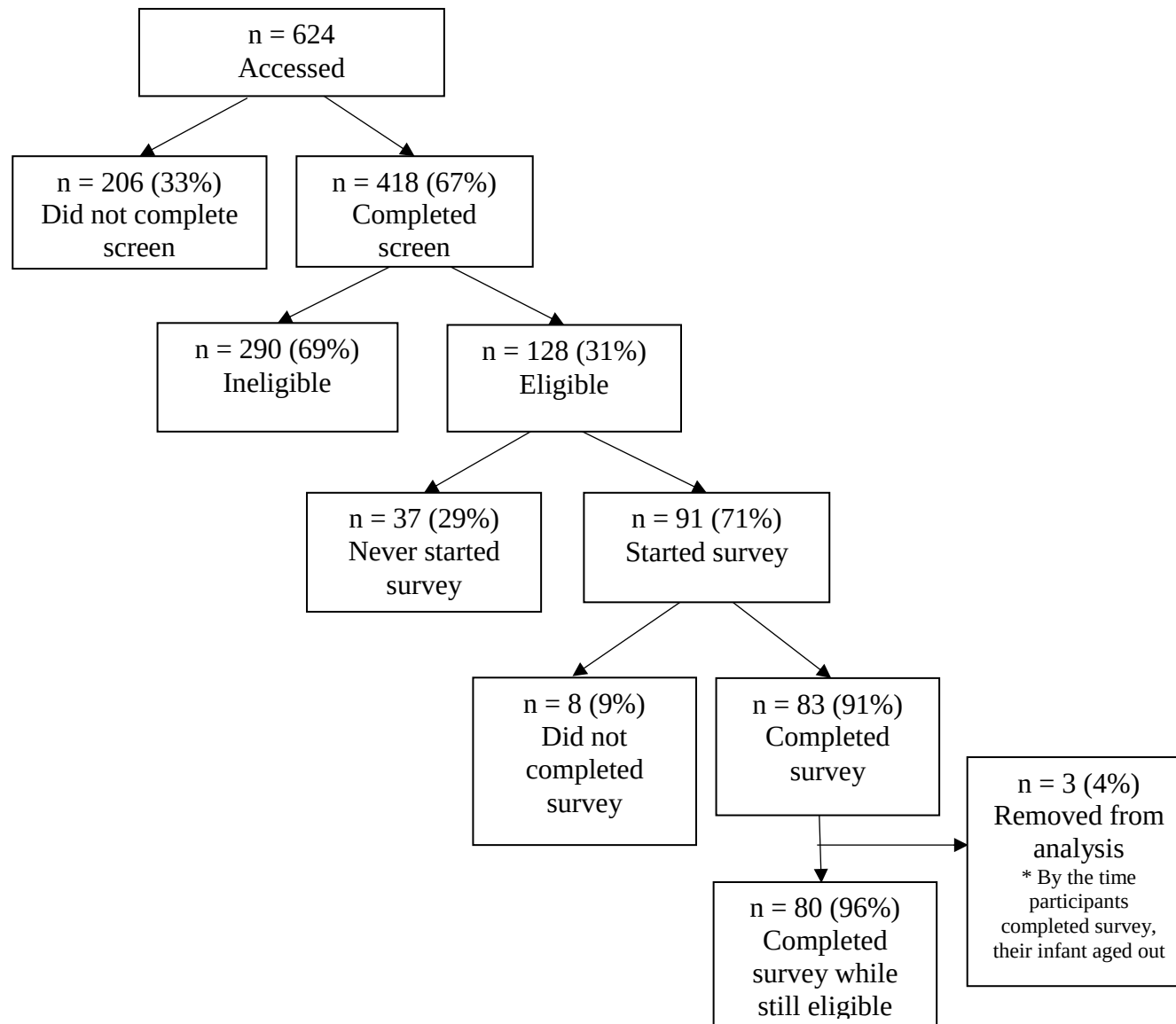


Figure 3.1. Numbers of infant fathers/maternal partners at each stage of study

Demographic Characteristics

The IFMP's demographic characteristics are presented in **Table 3.3**. The IFMPs were, on average, 32 years old, with infants of approximately 2.2 months of age. The majority of participants reported being White (82.3%), non-Hispanic (96.2%), married or cohabitating with the infant's mother (98.8%), and having at least a Bachelor's degree (61.3%).

Less than a quarter of the sample (22.5%) was categorized as $\leq 185\%$ of the Federal Poverty Level, secondary to reporting household participation in WIC¹⁸ and/or the Supplemental Nutrition Assistance Program (SNAP)¹⁹. Slightly more than half of the IFMPs reported having only one child (51.2%), and only 6.3% reported that their infants were no longer receiving breast milk at the time of survey completion. Only 37.5% of IFMPs reported the use of VC in the week prior to survey.

Acceptance of Videoconferencing for Lactation Consultation

Each acceptance subscale was tested and found to have a good internal consistency reliability (PEOU: Cronbach's $\alpha=0.765$; PUEM: Cronbach's $\alpha=0.923$, IM: Cronbach's $\alpha=0.878$; and acceptance: Cronbach's $\alpha=0.942$). See **Table 3.4** for means, standard deviations, and Cronbach's alpha scores for each subscale. One sample t-tests indicated that the means for PEOU ($p<0.001$), PUEM ($p=0.004$), and IM ($p=0.014$) were significantly greater than neutral (4.0) and that the mean for acceptance ($p=0.953$) was not significantly greater than neutral (**Table 3.4**).

Results of independent sample t-tests are shown in **Table 3.5**. No differences were found in acceptance by IFMP education level ($p=0.894$), income level ($p=0.913$), number of children ($p=0.217$), or use of VC in the week prior to taking the survey ($p=0.196$).

Table 3.3. Demographic characteristics of infant fathers/maternal partners (n=80)

Variables	
	Mean (SD)
Infant father/maternal partner age, in years	32.1 (5.4)
Infant age, in months	2.2 (1.0)
	Frequency (%)
Infant father/maternal partner race^a	
White	82.3%
Non-white	17.7%
Infant father/maternal partner ethnicity^a	
Hispanic	3.8%
Non-Hispanic	96.2%
Infant father/maternal partner relationship with the mother	
Married or cohabitating	98.8%
Living apart from infant's mother	1.2%
Infant father/maternal partner education level	
Associate's degree or less	38.8%
Bachelor's degree or higher	61.3%
Income level^b	
≤ 185% Poverty level	22.5%
> 185% Poverty level	77.5%
Number of children	
One child	51.2%
Two or more children	48.8%
Infant receiving breast milk at survey completion	
Yes	93.8%
No	6.3%
Used videoconferencing in the week prior to survey	
Yes	37.5%
No	62.5%
Percent Participation, by United States Region	
East North Central	3.8%
East South Central	37.5%
West North Central	11.3%
West South Central	8.8%
Middle Atlantic	8.8%
South Atlantic	22.5%
Mountain	0%
New England	5%
Pacific	1.3%
^a n = 79.	
^b Defined as household participating in the WIC and/or the SNAP.	

Table 3.4. Means, standard deviations, Cronbach's alpha scores, number of statements, and one sample t-test significance for each subscale

Subscales	Mean	SD	Cronbach's α	Number of statements in subscale	p-value
Perceived Ease of Use (PEOU)	5.1	1.3	0.765	3	< 0.001
Perceived Usefulness/Extrinsic Motivation (PUEM)	4.5	1.5	0.923	3	< 0.004
Intrinsic Motivation (IM)	4.4	1.5	0.878	3	< 0.014
Behavioral Intention (BI) also known as 'acceptance'	4.0	1.9	0.942	2	< 0.953

Table 3.5. Independent sample t-tests results comparing categorical independent variables with acceptance (n=80)

	Acceptance				
	Demographics	Mean (SD)	t	df	p-value
Education level	$\leq$ Associate's degree	4.1 (2.0)	0.134	78	0.894
	$\geq$ Bachelor's degree	4.0 (1.9)			
Income level	$\leq$ 185% poverty level	4.1 (2.1)	- 0.109	78	0.913
	> 185% poverty level	4.0 (1.8)			
Number of children	1	4.3 (1.8)	- 1.245	78	0.217
	2 or more	3.7 (1.9)			
Used videoconferencing in the week prior to survey	Yes	4.4 (2.0)	1.303	78	0.196
	No	3.8 (1.8)			

Relationships between acceptance and each subscale score and IFMP demographic characteristics and “other factors” are shown in **Table 3.6**. PEOU ($r=0.653$, $p<0.001$), PUEM ($r=0.797$, $p<0.001$), and IM ($r=0.756$, $p<0.001$) were significantly positively related to acceptance and the relationships were strong. The IFMPs’ age and importance of the ability to control privacy were not significantly correlated with acceptance.

Table 3.6. Relationships between subscale scores and other infant father/maternal partner factors with acceptance (n=80)

Independent Variables	Correlation with Acceptance (Pearson)	p-value
Perceived Ease of Use (PEOU) subscale	0.653**	< 0.001
Perceived Usefulness/Extrinsic Motivation (PUEM) subscale	0.797**	< 0.001
Intrinsic Motivation (IM) subscale	0.756**	< 0.001
Infant father/maternal partner age	0.032	0.777
Control of privacy subscale (revealing home, mother, and infant)	0.036	0.749
Independent Variables	Correlation with Acceptance (Spearman)	p-value
Infant father’s/maternal partner’s perception of wife’s/partner’s willingness to use videoconferencing subscale (from home or health care facility)	0.579**	< 0.001
Infant father’s/maternal partner’s comfortable level with the wife/partner receiving lactation diagnosis via videoconferencing	0.481**	< 0.001
** Correlation is significant at the 0.01 level (2-tailed).		

Assessment of the importance of the ability to control privacy consisted of three questions focusing on revealing the home (mean=4.4), the wife’s/partner’s body (mean=5.6), or the infant (mean=5.1), during VC. None of these variables were significantly correlated with acceptance (data not shown). However, all three variables were highly correlated with each other and measured importance of control of privacy, so were subsequently treated as a subscale

named 'control of privacy'. This subscale was tested for reliability and the Cronbach's α of 0.812 demonstrated good internal consistency reliability.

Assessment of the IFMP's perception of the wife's/partner's willingness to use VC for lactation consultation consisted of two questions focusing on use from the home (mean=5.6) or from a nearby health care facility (mean=4.9). Both variables were significantly correlated with acceptance and with each other (data not shown). Therefore, responses to the two questions were averaged together, creating the subscale 'willingness to use' (Cronbach's α =0.828).

IFMPs' perception of wives'/partners' willingness to use VC for lactation consultation (from home or a health care facility) was significantly, strongly positively correlated with acceptance ($r=0.579$, $p<0.001$). The IFMPs' comfort level with the wife/partner receiving a lactation diagnosis via VC (mean=4.8) was significantly, moderately positively correlated with acceptance ($r=0.481$, $p<0.001$).

In order to predict which independent variables (i.e. acceptance subscales, IFMPs' demographics, and "other factors") would predict acceptance, stepwise linear regression was completed. A total of 11 variables were entered into the regression (**Table 3.7**). The final model indicated that only PUEM remained as a significant predictor of acceptance (overall model: $R^2=0.710$, $p<0.001$). PUEM explained 63.5% of the variability in acceptance.

Table 3.7. Results of stepwise regression analysis to determine independent variables that predict acceptance

Model	B	SEB	β	p-value
Perceived Usefulness/Extrinsic Motivation (PUEM)	1.022	0.088	0.797	< 0.001
$R^2=0.635, p<0.001$				
Dependent Variable: Behavioral Intention also known as 'acceptance'				

Discussion

Breastfeeding support, from multiple sources, is considered to be an important factor in most successful breastfeeding experiences, and IFMPs are viewed as among one of the most critical sources for this support¹. However, despite research indicating that mothers often value their partner's opinion when making decisions about infant-feeding, maternal partners generally express deference to the mother's decision in this domain²⁰⁻²⁵. Therefore, it is important to explore the use of VC for lactation support among IFMPs, but to do so in the context of how accepting they believe their wives/partners will be to its application. This study is novel as, to authors' knowledge, it is the first to explore the perception IFMPs have of their wives'/partners' acceptance of using VC for lactation consultation.

In the present study the Integrated Model of technology acceptance²⁶ was used to explore the IFMPs' perception of their wives'/partners' acceptance. The Integrated Model, along with two other models (Technology Acceptance Model and Motivational Model), was used by Wilson and Lankton to assess e-health acceptance among patients who registered to use e-health provided by a health care provider⁹. They found that that all three models predicted acceptance⁹. However, because the Integrated Model has been shown in other studies to predict acceptance better than either the Technology Acceptance Model or the Motivational Model²⁶, it was

preferentially selected to predict IFMPs' perception of their wives/partners acceptance. However, the statements used by Wilson and Lankton were modified in way as to be related to the context of VC for lactation support. In the current study, 'perceived usefulness/extrinsic motivation' was the only variable that predicted acceptance in the regression model. This revealed that if an IFMP perceives the VC to be useful to his wife/partner to manage her breastfeeding issues, he also believes his wife/partner will be accepting of VC. Those IFMPs who believe their wives/partners will be accepting of VC also perceive it to be useful for managing breastfeeding issues. No demographic factors appeared to be related to IFMPs' perceptions of their wives'/partners' level of acceptance. Demographic factors were evaluated in relation to acceptance as it has been shown in previous research that those with higher education were more accepting and those who were older were less accepting²⁷.

Overall, IFMPs perceived their wives/partners would be largely ambivalent to the use of this technology. However, as their belief that the technology would be easy to use, useful, and fulfilling increased, their perception of their wives'/partners' acceptance also increased. It is possible that fathers who consider this technology to be of greater value would also be more confident in their ability to support their partner in the use of this technology, thus increasing their perception that their wives would be more accepting. Conversely, those who believe their wives/partners to be more accepting may be more willing to troubleshoot any technical or mechanical glitches one might experience with this application compared to those who believe their wives/partners to be less accepting. Ultimately, after controlling for multiple factors, IFMPs perceiving VC to be useful to mothers was the only predictor of acceptance.

Based on limited existing literature exploring applications of VC, IFMPs were asked about privacy control²⁸, likelihood of use of this application in another location (for example, in

the case of rural areas with limited internet access), and their confidence in a lactation diagnosis received online¹⁰. Based on research exploring the experiences of nine Swedish couples using VC for postpartum support which indicated issues with security²⁸, IFMPs were asked about the importance of the ability of the wife/partner to control privacy (revealing home, mother, and infant) while using VC for lactation consultation. In this sample of U.S. IFMPs, concern with privacy control, in this context, was slightly above average and was not significantly related to their perception of their wives/partners acceptance²⁸.

Access to lactation consultation for those in underserved communities, such as in rural areas, is an Action Step outlined in the Surgeon General's Call to Action to Support Breastfeeding¹. As such, IFMPs were asked how willing they believed their wives'/partners' would be to accessing VC, either from their home or from a health care facility providing this service, if a lactation consultant was not available locally. It was found that this variable was significantly related to IFMPs' perception of their wives' acceptance. Therefore, future work should likely explore the use of this technology among rural and/or underserved communities.

Finally, earlier research has indicated that trust of the provider may influence patient comfort level with a diagnosis received via VC¹⁰. Therefore, IFMPs were asked about their comfort level with their wife/partner receiving a lactation diagnosis via VC. Though IFMPs that were more comfortable with receiving a lactation diagnosis via VC also reported perceiving their wives/partners to be more accepting of the use of VC, overall it appeared that the fathers were ambivalent about this mode of diagnosis. Future work should likely explore reasons for the relatively neutral feelings expressed by IFMPs about their wife's/partner's perception. The ultimate goal of this study is to increase breastfeeding duration and exclusivity rates among families in the U.S. using remote lactation consultation via VC. Therefore, exploring what can

be done to make this experience more accepting is important before actually implementing the VC.

Limitations

There are several limitations to this study. First, most participants in this sample were White, non-Hispanic, and had earned a bachelor's degree or higher, despite the efforts made to target minority groups through social media and WIC. Therefore, the results may not be generalizable to other populations. Second, almost all infants were receiving breast milk at the time of survey completion. Therefore, these results likely do not reflect the perceptions of those who may have experienced breastfeeding barriers that lead to early weaning. Third, this study was conducted online and required use of technology. Therefore, technology acceptance levels in this sample are likely to be somewhat biased. Future work, conducting a similar survey using paper or by conducting phone interviews may increase variability.

Conclusion

This sample of IFMPs believed that their wives/partners would be relatively neutral with regard to the overall acceptance of use of VC for lactation support. There were no differences found between IFMPs' demographic characteristics and their perceptions of their wives'/partners' acceptance of VC. Though there were significant relationships detected between IFMPs' perceptions of their wives' acceptance and perceived ease of use, intrinsic motivation, and perceived usefulness/extrinsic motivation, only perceived usefulness/extrinsic motivation remained significant in the final regression model. This relationship should likely be

explored further, as it is possible that fathers who value this technology may be better able to support their wives/partners to participate in remote lactation consultation.

Future work should also explore these concepts in a more diverse population. Remote lactation consultation, via VC, may allow families to have increased access to the IBCLC professional, thus increasing the likelihood of engaging in optimal breastfeeding behaviors.

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Declaration of Conflict Interests

The authors disclosed no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Abbreviation List

BI = Behavioral Intention

DF = Degrees of freedom

IBCLC = International Board Certified Lactation Consultant

IFMP = Infant Father/Maternal Partner

IM = Intrinsic Motivation

PEOU = Perceived Ease of Use

PUEM = Perceived Usefulness/Extrinsic Motivation

SD = Standard Deviation

Sig = Significance

SNAP = Supplemental Nutrition Assistance Program

U.S. = United States

VC = Videoconferencing

WIC = Special Supplemental Nutrition Program for Women, Infants, and Children

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CHAPTER 4 : CONCLUSION AND FUTURE RESEARCH DIRECTIONS

Conclusion

This study, among two independent samples of mothers and fathers/maternal partners (IFMPs) in the U.S., provided information on mothers' perception and IFMPs' perception of their wives/partners acceptance of use of videoconferencing (VC) for lactation consultation. The results revealed that, overall, mothers appeared to be slightly positive in their acceptance of the use of VC for remote lactation consultation. However, the separate sample of IFMPs perceived that their wives/partners would be relatively neutral toward use of this technology. These findings may be different when evaluating acceptance among a sample that is more diverse. In both samples, perceived usefulness/extrinsic motivation was the primary predictor of acceptance. Those mothers who perceived VC to be useful for lactation consultation reported higher acceptance, which is in contrast to earlier work showing women's acceptance linked primarily to ease of use. This may indicate that they need to find the application useful more than whether or not it is easy to use. Those IFMPs who perceived VC useful also perceived their wives/partners would have higher acceptance. Again, this was of greater importance than ease of use, indicating that, for those who see the value in its application, ease of use is not initially perceived as a reason to not be accepting. Future work should likely explore the experiences of individuals who have used this technology when experiencing breastfeeding barriers, in order to assess their opinions and experiences regarding both ease of use and usefulness. In addition, exploring the concepts related to acceptance, among diverse populations, may provide different results and future avenues for research targeting removal of breastfeeding barriers.

Future Research Directions

Based on these results, there are a few future directions for research that may be worth evaluating:

1. Assessing the acceptance of VC for lactation support among more diverse groups such as minority populations, those with an education level below a bachelor's degree, younger mothers, and/or single mothers, is essential, as these populations are more likely to wean early and to need support from a lactation expert. Therefore, this line of research may lead to effective interventions targeting populations experiencing barriers to lactation support.
2. Assessing the acceptance of VC for lactation support among those who have already weaned or are having breastfeeding issues is also important, as their perception of acceptance may be different than the population that it was evaluated in this study (majority were currently breastfeeding).
3. Assessing the acceptance of VC for lactation support using different methodology, other than an online survey, such as paper survey or phone interviews is likely an important avenue of research. This will allow for evaluation of acceptance among those who may be less comfortable with use of technology.
4. Assessing the acceptance of VC for lactation consultation among International Board Certified Lactation Consultants, as they are also the end-user of this technology. This will allow for evaluation of how comfortable and accepting they are to providing lactation education and diagnosis via VC.

VITA

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