THE EFFECT OF RESTRICTED PARENTAL MOVEMENT DURING THE COVID-19 PANDEMIC ON THE UTILIZATION OF PASTEURIZED DONOR BREASTMILK IN THE NICU: A QUALITY IMPROVEMENT PROJECT

By

Cayenne Sirois, B.S

A Project Submitted in Partial Fulfillment of the Requirements

for the Degree of

MASTER OF SCIENCE

in

Dietetics and Nutrition

University of Alaska Anchorage

August 2021

APPROVED:

Carrie King, Ph.D., Committee Chair
Amanda Walch, Ph.D., Committee Member
Jane Noonan N.N.P-B.C, Committee Member
LeeAnne Carrothers, Ph.D., Director
School of Allied Health
Kendra Sticka, Ph.D., Associate Dean of Clinical Health Sciences
College of Health

Abstract

The COVID-19 pandemic presented as a major health crisis that caused shutdowns and restricted access to healthcare facilities globally. Not only did this have an immeasurable impact on adult critical care units, but also on neonatal intensive care units (NICUs). One impact of COVID-19 was restricted access and movement to Providence Alaska Medical Center's (PAMC's) NICU, affecting both families and designated caregivers. This movement restriction caused families to choose whether to stay at the bedside or leave the NICU without the ability to re-enter for an undefined or restricted period of time. The purpose of this retrospective chart review was to evaluate how restricted access affected donor breast milk (DBM) usage in the NICU for infants <35 weeks according to their respective feeding protocols. DBM was used as a surrogate marker for mothers own milk (MOM) as this is routinely supplemented when MOM is unavailable. Yearly averages of DBM (in mLs) per infant in their respective feeding protocol from 2019-2020 were collected and sorted according to episode (monthly for 2019 data versus monthly or restricted access period for 2020). A survey was provided to NICU staff to obtain qualitative data on barriers and facilitators to MOM during COVID-19. An ANOVA test was planned to interpret results for average DBM usage per infant in their respective feeding protocol and descriptive statistics and trends in the qualitative data were reported from the NICU staff survey. Incomplete data collection occurred due to unforeseeable issues with the electronic healthcare record (EHR) report. The staff survey provided a small sample size of data (n = 10) for perceived barriers to utilizing MOM (restricted access, stress, and childcare concerns) and facilitators (more time in the NICU and more access to lactation) during COVID-19. Considering the inability to interpret average DBM mLs per infant accurately, this study demonstrates a need for a more consistent and accurate EHR report to carry out the methods for this study. Overall, this study provides strong methodology to conduct and analyze DBM as a surrogate marker for MOM during the COVID-19 pandemic for future studies at PAMC or other NICUs.

Table of Contents

List of Appendices

Page

Preface/Acknowledgments

Thank you to my wonderful project committee: Carrie King, Amanda Walch, and Jane Noonan for all your support, guidance, and encouragement throughout this project. Carrie, thank you for being willing to take questions from me multiple times throughout the week, or even within the same day. Your guidance and patience is immensely appreciated and helped ease me through this process as smoothly as it possibly could have been. Amanda, thank you for all your thoughtful ideas and promptly providing me with feedback that always enhanced and added to the quality of this research. Your willingness to be a part of and help with this study is very appreciated. Jane, your dedication in helping me see this project through, orienting me to the various hurdles and unforeseen concerns I had, helped me tremendously. Your problem-solving skills and immense knowledge of NICU was a valuable asset to this work that I cannot thank you enough for. I am so thankful to all of you as both my mentors and inspirations. Thank you to all the University of Alaska Anchorage staff, including Dr. Parker, who helped me with the statistical analysis portion of this study. Thank you to Providence Alaska Medical Center's NICU staff for participating in the survey portion of this study. Also, thank you to Providence Alaska Medical Center for allowing me to use this facility to conduct this retrospective chart review in completion of my Master of Science degree.

Introduction

COVID-19 is a major health crisis that has spread worldwide since December of 2019. The virus originated in Wuhan, China with an identified cluster of pneumonia cases throughout the Hubei Province.[1] The virus since has spread world-wide via rapid transmission through human droplets (from the nasal passage via sneezing, coughing, breathing, etc.).[1] COVID-19 is within the same coronavirus family as SARS and MERS, which have both caused epidemics from animal-to-human transmission within the past two decades.[1] However, COVID-19 has proven to be more infectious and became classified as a pandemic in March of 2020.[2] Due to the healthcare burden and fast transmission rate, COVID-19 caused severe restrictions in the neonatal intensive care unit (NICU) at Providence Alaska Medical Center (PAMC), requiring minimal movement out of the unit. This in turn caused unforeseen challenges for mothers in the NICU with their preterm infants, as movement restrictions created additional stress and burdens to the already challenging adjustments to the NICU. It is unknown how the unprecedented movement restrictions impacted mothers' own milk (MOM) supply in the NICU during the COVID-19 pandemic when compared to years prior.

Premature or term infants have improved outcomes when they are able to receive MOM versus donor breast milk (DBM). MOM overall reduces short-term and long-term morbidity, likelihood of enteral feeding intolerance, nosocomial infection, necrotizing enterocolitis (NEC), chronic lung disease (CLD), retinopathy of prematurity (ROP), re-hospitalization after discharge, and reduction of developmental and neurocognitive delay.[3] DBM is typically regarded as the best alternative when MOM is unavailable. While evidence remains clear that DBM reduces risks of morbidity and mortality as compared to infant formula, pooled DBM is notoriously low in protein and lipid content when compared to MOM due to Holder pasteurization methods.[4] The

result of interchangeably using DBM and MOM in premature infants is an increased risk for postnatal growth restrictions.[5] Therefore, significant efforts to encourage and deliver resources for mothers to provide milk is exponentially important for nutritional outcomes that are monitored at discharge such ass weight, length, and head circumference.

Further, DBM is consistently used in infants born <35 weeks gestational age at PAMC's NICU. Trending DBM usage in this population is an important metric to monitor as a decrease implies an increase in MOM production (considering DBM is routinely used in this population in the absence of MOM). Quality improvement projects focused on ways to increase MOM supply, using a surrogate marker of decreased DBM use, are routinely implemented in PAMC's NICU as this topic is essential to the overall health and nutritional outcomes of preterm infants. Considering the unique logistical challenges that COVID-19 presented to PAMC's NICU, there was a unique opportunity to analyze whether current restrictions decreased the amount of DBM used in the NICU and represented a surrogate marker of an increase in the amount of MOM. Further, MOM production has been shown to increase with optimal nursing or pumping frequency of every 2–3 hours per day.[6] Consequently, previous COVID-19 restrictions provided an opportune time to measure whether current virus protocols decreased DBM usage, implying a subsequent increase in MOM supply.

Literature Review

Since the start of the COVID-19 pandemic and the subsequent rapid changes to the healthcare landscape, the NICU has faced a multifactorial cascade of hurdles to continued care of the preterm infant and neonates at an already increased risk of morbidity and mortality. With these hurdles, a major focus has been maintaining appropriate nutrition parameters while ensuring safety and decreased risk of transmission of COVID-19 to the NICU's vulnerable

population. An integral part of a neonate's stay in the NICU is availability of MOM or DBM. Though MOM is unquestionably superior for neonatal nutrition, COVID-19 instilled an uncertainty in the possibility of contracting COVID-19 via pathogenic COVID-19 RNA passing through breastmilk. The purpose of this section is to provide the most contemporary data on the various multifactorial concerns that COVID-19 has presented to the NICU population. Considering global attention to COVID-19 in March of 2020, preliminary research exists that correlates trends between COVID-19 and pregnancy, prevalence of preterm births during the COVID-19 pandemic, and COVID-19's impact on the NICU. Search terms used for this section include "pregnancy and COVID-19," "pregnancy outcomes and COVID-19," "breastmilk and COVID-19," "vertical transmission COVID-19," "COVID-19 and preterm birth rates," "COVID-19 and breastfeeding guidelines," "COVID-19 and breastmilk," and "COVID-19 and donor milk." Databases used to research this topic were Pubmed, Google Scholar, and Cochrane Library for information published from 2020 to present.

In discussing COVID-19 and NICU related topics, the first area to explore is pregnancy and the subsequent risks this virus presents to neonates. At the beginning of the pandemic, a major concern was whether COVID-19 could be transferred from the placenta to the fetus prior to or directly after delivery, or through breastmilk or immediate skin-to-skin contact after an infant is born to a COVID-19 positive mother (known as vertical transmission).[7] Literature shows a small risk for vertical transmission via a systematic review of 936 infants with COVID-19 positive mothers during pregnancy.[8] In this review, it was found that with RT-PCR testing (most common test used for COVID-19 diagnosis) 3.2% of the time mothers passed COVID-19 to the fetus within the third trimester.[8] For transplacental transmission, viral RNA and protein were found within the placenta, but also within amniotic fluid and neonatal blood samples at

time of birth.[8] In conclusion, this study suggests that COVID-19 follows suit with other viruses in pregnancy; with an increased gestational age of the fetus (typically within the third trimester) there's an increased rate of vertical transmission.[8] However, vertical transmission appears to be relatively uncommon in COVID-19. A gap in the review is the possible impact of transmission of COVID-19 to the fetus and long-term outcomes on the neonate. Side effects of severe COVID-19 cases (including hypertension, cardiovascular disease, hypercoagulation, local thrombus formation, etc.) are a concerning health outcome to monitor for in COVID-19 positive pregnant mothers and infants.[8] Additionally, in these pregnant mothers with COVID-19, adverse maternal and neonatal outcomes should be considered in terms of how this affects potential preterm birth risk and growth restriction.[8] Understanding this is key to preventing any nutrition deficiencies associated with preterm birth and growth restrictions.

Considering this study focuses on preterm infants (born <35 weeks gestational age) and how lockdown measures affected DBM usage, literature was reviewed in regards to the trend of prematurity globally during the COVID-19 pandemic. Though it appears relatively unclear whether COVD-19 definitively causes an increased risk for preterm delivery at birth, there appears to be an affected trend of prematurity rates globally due to the COVID-19 pandemic and subsequent shutdown. A study completed in Denmark looked at rates of prematurity at birth from March 12th to April 14th of 2020 and compared them to that same time period in 2015-2019.[9] This date range was chosen in this study considering as of March 12th, Denmark began a strict lockdown.[9] Childcare facilities, schools, and universities were closed, non-essential public workers were sent home, private sector employees were encouraged to work remotely, gatherings for over 10 individuals were prohibited, and travel was restricted.[9] This study concluded that there was a significantly lower amount of extremely premature infants in

Denmark during the COVID-19 lockdown period when compared to years prior.[9]This study theorized that due to home confinement, increased focus on hygiene and strict physical distancing may have potentially reduced systemic inflammation rates associated with preterm delivery of pregnant mothers.[9] However, these results are not necessarily causal and further studies should be conducted globally to determine if this appears to be a consistent trend related to COVID-19 restrictions.[9]

A study conducted in Melbourne, Australia also noted a significant decrease in the rate of prematurity during the COVID-19 lockdown period from July to September of 2020 when compared to July to September of 2019.[10] Lockdown procedures for Melbourne included limited outings to essential personnel, medical care, one-hour per day of exercise, or shopping for necessities within five kilometers of home.[10] Gatherings of people greater than two were banned, mask wearing was required and a curfew of 8 p.m. was imposed.[10] Considering Melbourne's strict lockdown criteria, lifestyle changes such as reduced work, increased hygiene, social distancing and a decrease in exposure to pathogenic organisms, less exposure to air pollution, and other potential risk-factors to preterm births are suspected to have contributed to the reduced prematurity trend during the COVID-19 lockdown period.[10] Overall, it is currently unknown whether the reduction in prematurity is definitively related to reduction in preterm births or if other confounding factors have a potential influence. Contrary to the Danish and Melbourne study, Arnaez, et. al. suggests an inconsistency found in gestational ages prematurity was reduced in during lockdown measures.[11] This study further concluded no link was found between prematurity and lockdown measures.[11] Further studies are needed to verify prematurity trends during restrictive measures, as conflicting research exists. Additionally, if prematurity is reduced by lockdown measures, another explorable study is how to feasibly continue reducing premature

birth rates without extremely restrictive national guidelines. Additionally, another topic of exploration is how to continue the cultural shift of increased hygiene practices and pregnant mothers distancing themselves from others to prevent transmission of pathogens.

Another major concern at the beginning of the pandemic was transmission of COVID-19 through MOM. Considering there are many bioactive components of breastmilk that provide immunity to neonates such as immunoglobulins, lactoferrin, lysosomes, and cytokines (integral in engulfing harmful microorganisms, targeting microbacteria, and providing both protection and regulation of the immune system), the need for MOM is immeasurable in neonates. In a review of existing literature, 18 women who were COVID-19 positive resulted in only one sample of MOM that had COVID-19 RNA detected initially, with a follow-up sample testing negative.[12] This study suggested that this sample of MOM likely did not contain COVID-19 RNA capable of replication, rendering the virus unable to cause infection to a neonate.[12] Therefore, continuation of providing MOM has been uniformly accepted during COVID.[12] However, recommendations for delivery of MOM from COVID-19 positive mothers has varied throughout the pandemic. Various regulatory bodies have suggested separation of COVID-19 mothers from neonates after birth to prevent transmission. The Center for Disease Control and Prevention (CDC) and American Academy of Pediatrics (AAP) are among those that recommend temporary separation and a six foot social distancing maintenance at home, though expression of MOM is still recommended with hygiene that is appropriate for infection prevention (cleanliness of breastmilk pumps, hand washing, etc.).[12] The International Confederation of Midwives (ICM) in agreeance with the United Nations Children's Emergency Fund (UNICEF), the Academy of Breastfeeding Medicine (ABM), and the Royal College of Obstetricians and Gynecologists (RCOG) agree that breastfeeding maintenance and skin-to-skin contact (with general infection

control prevent, i.e. masks, proper hygiene, etc.) remains important in COVID-19 symptomatic mothers.[12] Mothers who are too ill to breastfeed are recommended to continue expressing MOM.[12] Lubbe, et. al., agrees with the later protocols, suggesting the benefit of breastmilk outweighs the risk of infection.[12] Continued breastfeeding and zero-separation protocols for best practice are encouraged.[12]

Currently, few studies exist reporting the effect of COVID-19 on DBM throughout the pandemic. At the beginning of COVID-19, rigorous guidelines in Wuhan, China negatively affected the ability of DBM donors to provide milk to banks due to strict lockdown guidelines and diminished access to DBM sites (typically in hospitals).[13] Inevitably, this provided concern for countries with rapidly increasing COVID-19 rates and need for a consistent supply of DBM for the NICU population.[13] However, articles previously published concerning DBM availability are now considered out-of-date as they were published prior to determining whether transmission of COVID-19 via breastmilk was possible.

Overall, rapid changes have occurred in the current knowledge of COVID-19 in pregnancy, the rate of preterm births affected by COVID-19 infections, transmission of COVID-19 via breastmilk, and how COVID-19 has affected DBM. With the current newness of studying COVID-19, it is difficult to find contemporary articles with updated information, as new information can occur in an extremely finite period of time. In reviewing literature, data from early to mid-2020 can prove to be outdated based on current global knowledge produced by expedited research. Currently, theorized effects of stress on MOM supply, restrictions of the NICU and effect on MOM production, and use of DBM throughout the pandemic have been a gap in contemporary NICU COVID-19 literature. The aim of this study was to provide insight into PAMC's response, effect and fluctuations in DBM use as a surrogate marker to measure

MOM during the COVID-19 pandemic and what quality improvement recommendations can be reasonably generated from this unique window of time in the NICU.

Research Question

Due to restricted access of the Newborn Intensive Care Unit (NICU) during the Coronavirus Disease 2019 (COVID-19) pandemic, were any changes noted in the use of pasteurized donor breast milk (DBM)?

Hypothesis

There will be no difference between DBM use in January to December of 2020 compared to January to December of 2019 due to the movement restrictions at PAMC put in place because of the COVID-19 pandemic.

Goal and Objectives

Goal: To understand the relationship between the unit movement restrictions due to COVID-19 and DBM use.

Objective #1: Compare the overall average of DBM usage (mLs per infant) from January to December of 2019 and January to December of 2020.

Objective #2: Analyze differences in DBM usage based on COVID-19 movement restrictions in PAMC's NICU (average mLs per infant).

Objective #3: Conduct a survey for NICU staff involved in direct patient care to measure perceived barriers and facilitators of MOM production in the NICU during COVID-19 times compared to non-COVID-19 times.

Objective #4: Identify barriers or facilitators to lactation associated with restrictive measures in the NICU during COVID-19 times compared to non-COVID-19 times.

Methods

According to the 2019 audit for infant's receiving their MOM prior to COVID-19, approximately 51% of infants had MOM available in PAMC's NICU at discharge.[14] At PAMC, DBM is offered to infants up to 35 weeks gestational age and for a maximum three to seven days when an infant is born >35 weeks. If MOM is unavailable, use of DBM is strongly recommended for infants born <32 weeks gestational age. Current DBM is supplied from a milk bank for verified 20 Cal/oz, 22 Cal/oz, and 24 Cal/oz concentration. In this study, infant data was separated into three separate groups based on current feeding protocols. Though PAMC has four total feeding protocols, data was only used for infants in the first three protocols as DBM is routinely used in infants <35 weeks. In infants >35 weeks, formula can be used as a supplement to MOM, therefore, data from PAMC's fourth protocol did not capture DBM or subsequent MOM supply accurately. The classification for sorting infants into the four separate feeding protocols can be seen in Appendix A. The methods for the data collection in this study were developed by the principal investigator. There was not prior established methodology to follow. The following methods were developed to carry out the data collection process:

Step 1: An Excel file template was developed prior to the data collection process in order to organize data according to the study criteria. Within this created Excel file, two separate Excel sheets were made to separate 2019 (pre-COVID-19) data from 2020 (COVID-19) data. Column headers for each sheet included protocol number, deidentified patient code, gestational age at birth, birth weight, service date of DBM charge, mL of DBM (per service date), and total mL of DBM per infant per episode. Service dates represent the date and amount of DBM used on one specific day only. Episodes were used to describe the different time references that average mLs per infant were collected. Episodes are described by months (for 2019 data) or month versus

restricted movement period (for 2020 data- see Appendix B for restriction details). The following headers were repeated for each feeding protocol #1-3.

Step 2: Next, data was pulled from an EHR report owned by NICU management (not by the principal investigator) that collected all DBM service dates for all patients from January 2019 to December of 2020.

Step 3: Once the EHR report was run, it was converted into a separate Excel file on a HIPPA compliant PAMC encrypted computer to protect patient information and prevent data breaches.

Step 4: Patients that did not meet inclusion criteria (ex: any infant >35 weeks) were deleted from the Excel file. Any infant with missing gestational age at birth or birth weight were verified according to retrospective chart reviews to see if inclusion criteria were met. If they were not met, that patient was excluded. Additionally, any extraneous data related to coding and billing were deleted from the Excel file, as these often caused duplicate service dates for patients throughout the entirety of the report.

Step 5: Remaining data was organized according to lowest gestational age at birth. Data was then manually sorted into the Excel file template created for this study. Infants were sorted according to their feeding protocol, coded in order to de-identify information, and verified to ensure information was sorted into the appropriate episode according to the DBM service date.

Step 6: Once all infants were sorted within their respective feeding protocol (based on gestational age at birth or birth weight), year of service date (2019 versus 2020), and episode (based on service date of DBM charge), the sum of each infants DBM usage per episode and protocol were programmed into Excel. At the end of each episode, an equation was programmed into Excel that found the average mL per infant for each episode. This equation calculated the

total mL of DBM per infant per episode divided by the total number of infants within that episode. For each feeding protocol number (1-3) for 2019 and 2020, a yearly average was calculated via an Excel equation. This equation added each episode's DBM mL average and divided by the total number of episodes for 2019 and 2020 data respectively.

Step 7: A brief survey was provided via email to NICU staff involved in direct patient care during the pandemic. The survey (Appendix C and D) measured perceived barriers and facilitators for production of MOM in the NICU during the COVID-19 pandemic compared to non-COVID-19 times. The aim of this survey was to incorporate the human perspective of how clinical staff perceived barriers and facilitators to reach breastfeeding, pumping, and production goals during the pandemic. Overall, the purpose of this survey was to provide staff observations that helped interpret changes in DBM usage during the COVID-19 movement restriction.

Strict COVID-19 restrictions were implemented as of March 27, 2020 in the NICU due to growing concern for viral transmission. For a full timeline of the evolution of the COVID-19 restrictions, see Appendix B. A notable effect of the COVID-19 restrictions in the NICU was the parent/support person's inability to leave the NICU. Mandatory re-entry passes were implemented for families to gain access back into the NICU. Initially, parents were only allowed to leave for medical appointments, therefore, family members needing to leave for other reasons (i.e. work, child care, etc.) were denied re-entry. These restrictions created a phenomenon in which mothers were most frequently at the bedside for the duration of the quarantine, while fathers and other caretakers left for work and additional childcare, depending on each family's situation. Mothers primarily remained at the bedside until April 17, 2020, when 24-hour passes were granted for non-medical appointments. Overall, restrictions were in greatest effect from

March 27 until April 17, 2020. However, parental restrictions, including day passes (versus 24 hour passes) and parent only access to the NICU, continued through the remainder of 2020.

Analysis

The data measured was average DBM use per infant (in mLs) in each respective protocol from January to December of 2020. In January to December of 2019 episodes represent monthly DBM averages per infant in their respective protocol. In 2020 data was collected to compare average DBM use per infant (in mLs) in each respective protocol between three distinct changes to restrictive measures (i.e., pre-COVID-19 restrictions from January to March 27, 2020 to most restrictive from March 28 to April 17, 2020 and less restrictive from April 18 to December 31, 2020) or monthly averages if not within a restricted time period (similar to 2019 data collection). Yearly averages were then calculated from monthly episodes (for 2019 data) or COVID-19 restrictions and/or monthly averages (for 2020 data) to ensure similarity in the data sets. Averages were used uniformly across the 2019 versus 2020 data set to ensure consistency and accurate results between the two data sets. Plans for this data was to use a two-way ANOVA to compare the different time intervals, with the three different independent factors representing the three feeding protocols. Statistical significance would have been evaluated using a p-value of <0.05 with a post-hoc analysis to determine whether the findings were significant. For the survey completed by the NICU staff, descriptive statistics were completed for the Likert scale responses and the open-ended question qualitative data was reviewed for trends within the responses. Review and approval was obtained from Providence St. Joseph's Health System and University of Alaska Anchorage institutional review board (IRB) prior to implementing this study.

Results

The PAMC NICU feeding protocol demographics for the timeframe of this study show 94 patients in protocol #1 with an average of 1349 mLs of DBM used in 2019 versus 97 infants with an average of 928 mLs of DBM used in 2020 (Appendices E and F). For Protocol #2, 101 patients for 2019 with an average of 1014 mLs of DBM versus 2020 with 101 infants collected with an average of 1085 mLs. For protocol #3, 103 patients in 2019 were collected with an average of 782 mLs versus 2020 with 112 infants and an average of 854 mLs. Protocol #1 in 2020 was the only protocol that showed less DBM use yearly when compared to 2019. The validity of all of the demographics data is in question due to significant issues identified with the EHR report (discussed further in the Strengths and Limitations section).

A two-way ANOVA was not completed for this study due to concern for validity and reliability of the data. Considering this, any inferences made through statistical analysis would be inherently incorrect due to incomplete data, and subsequent analysis was not carried out.

The survey (n = 10) provided some insight into staff interpretation of lactation during the COVID-19 pandemic. The frequency of responses (Appendix G) shows that majority of staff did not feel mothers were more willing to pump during the COVID-19 pandemic when compared to 2019 (60%, n = 6), mothers did not have more access to lactation support during the pandemic (90%, n = 9), and that barriers did change during the COVID-19 pandemic (50%, n = 5). The last question (lactation barriers changed during the COVID-19 pandemic) was the only question to generate “strongly agree” responses (30%, n = 3).

Staff provided perspective about how lactation support for families was perceived through the pandemic (Appendix H). A common trend in responses for question four (NICU staff perception of barriers to lactation during the COVID-19 pandemic) included visitation

restrictions causing more hindrance (i.e. forcing mothers to stay in or out of NICU) and adding stress (increase personal protective equipment (PPE) use), causing stress for childcare within families, and missing family or friend support. For these reasons, NICU staff attributed movement restrictions as barriers to lactation or challenges that made producing MOM more difficult. Additionally, this survey brought interesting results on the psychosocial aspect of NICU visitation restrictions. One participant responded: "*initial restrictions in the hospital did not allow mothers to leave the hospital or risk not being let back in, this coupled with PPE made several mothers withdrawn and reclusive*." Another survey response suggested visitation restrictions "*added stress outside of NICU experience*," speaking to the NICU staff-perceived toll that visitation restrictions took on mothers and their MOM supply during the COVID-19 pandemic when compared to 2019.

NICU staff perceptions of perceived facilitators for MOM during COVID-19 showed that some of the perceived barriers were also considered facilitators to NICU staff. Having mothers at the bedside and having a greater chance to meet with lactation consultants was perceived to help MOM supply. One staff member stated: "*for some parents having to be at the bedside more, or not at all, they made the choice to stay at the bedside.*" This comment by NICU staff shows that given the choice to either be in the NICU all the time or to lose access to the NICU for an undefined period of time, some mothers chose to stay in the NICU at all times, creating a facilitator to MOM production. Though this specific question asked for facilitators to MOM, survey responses implied that staff perceived there to be benefits to MOM production during COVID-19, however, the emotional and physical toll that the COVID-19 movement restrictions took on mothers in the NICU were not considered sustainable for the long-term well-being of mothers and families.

Discussion

There is not a set of uniform feeding protocols that are used across NICUs internationally. Therefore, it varies between how many feeding protocol pathways are used, how MOM or DBM are fortified, whether protocols are driven by gestational age and/or birth weight, or if trophic feedings are used. Generally, guidelines are provided for how quickly to advance enteral feedings with a general rule that infants <1200 grams at birth should not have large bolus feeding advancements to prevent complications.[15] Additionally, feedings should not be advanced greater than 20 mLs/kg daily to prevent any adverse effects an instability to the infant.[15] Based on these guidelines, many NICUs will incorporate these standards differently and may have different populations and protocol advancements, if feeding protocols are utilized at all. Considering these feeding protocols may differ from PAMC's, NICUs interested in this study should adjust parameters accordingly to fit feeding protocols relevant to their population. Additionally, not all NICUs globally have access to DBM and a preterm infant formula is used as an alternative, making this a factor to consider as well.

COVID-19 presented a challenge to breastfeeding and lactation globally. In the United Kingdom a survey was sent out to 1,219 mothers breastfeeding during the COVID-19 pandemic. About 41.8% of these mothers perceived that their breastfeeding was supported during the COVID-19 pandemic, while 27% struggled to get lactation support and stopped breastfeeding prematurely.[16] Though the nature of these survey questions were different from this study, a commonality can be seen that mothers (in the United Kingdom study) and staff perception (at PAMCs NICU) highlight the increased barriers that the COVID-19 pandemic created in providing MOM. This resulted in some mothers (in the UK) stopping breastfeeding before they

were ready. In the survey sent out to staff, a NICU staff member commented on this trend and that the stress, fear, anxiety, and lack of support affected mothers ability to produce MOM.

Additionally, another study (n = 29) interviewed mothers during March to June of 2020 and analyzed their perceived support and experience breastfeeding during the pandemic. Within this study, mothers felt they were able to breastfeed, but the support received was negatively impacted by the pandemic.[16] Mothers felt increased stress and isolation while trying to provide MOM, which resonates with the survey provided for this study where one PAMC NICU staff member felt that some mothers became withdrawn and reclusive during the pandemic.[16] Continued access to lactation support is integral to prevent any confusion in the NICU related to breastfeeding during the pandemic, enhancing MOM supply, and providing feeding support to families.[17] The need for this additional support of mothers during the pandemic is vital and shown in the survey question two, as most staff perceived that mothers did not have additional access to lactation support during the pandemic. In comparing these global studies on perceived lactation barriers and facilities to this study conducted in PAMCs NICU, results appear consistent that the pandemic was perceived to increase barriers to lactation for mothers and greater support is needed to better facilitate lactation support.

Strengths and Limitations

Unexpected data quality issues arose from the data collection process which caused significant concern for the validity of the results. Of these data discrepancies, some were able to be remedied while others caused significant flaws that caused an unknown amount of missing data. Firstly, the repetitive billing and reimbursement dates were not clearly defined in the report settings initially. All DBM mLs were originally included, regardless of service date. After further investigation and minor adjustments to the report setting found by trial and error, it was found

that these repetitive service dates were related solely to billing and reimbursement. Duplicate service dates did not reflect any additional DBM mLs that each infant received. After this was realized, duplicates were deleted from the data set and data was adjusted accordingly in Excel.

Further, errors within the data occurred during the manual sorting process to each respective feeding protocol. When sorting the DBM mLs, it was noticed that some infants had a consistent string of DBM service dates within an episode period, with the exception of one day missing. After this was noted in a few patients, a chart review of 15 patients was conducted to verify whether dates were missing due to a report error or for an explained reason. After further investigation into charts, no consistency was found as to why certain dates would not be generated within the report (i.e documentation differences, held enteral feedings, etc.). Of these 15 patients, nearly half had missing service dates of DBM. Consequently, it is undetermined how often missing data was occurring throughout the entirety of the 608 samples throughout all the episodes from 2019-2020 (see Appendix E and F). Finding all the missing variables would have required an extensive chart review of every patient over the two year period by the principal investigator, which was not feasible and would have increased the likelihood of data collection error. Therefore, a major limitation of this study is the data gaps from the EHR report.

Further, without monthly mLs per infant provided in the report, the data set required extensive manual sorting and equation programming via Excel. Sorting included exclusion criteria, specific protocol, episode (monthly vs. restricted COVID-19 time period); programming included manual sums of mLs of DBM used per patient in order to program averages to find average mLs per patient for each episode. The method for data collection, sorting, and programming increased the risk for human error had the data been analyzed. This further enhances the need for a stronger data collection EHR report for DBM usage per patient.

Additionally, with the uniqueness of studying lactation during COVID-19, one the major limitation of this study is repeatability. As restrictive lockdowns were key to controlling the spread of COVID-19, these movement restrictions would be difficult to recreate for the purpose of a research study. Further, it is undetermined whether mothers in the NICU are on average producing greater or less than usual MOM supply due to external factors (i.e. stress, fear, less familial support, lack of diverse food sources, etc.)[18-20]. Another limitation is whether the control group would have represented a typical average in a 1-year time period that can be considered "normal DBM" use or if that time interval was higher or lower than average for unknown reasons.

Considering this report is owned by a PAMC NICU management, settings could not be fully adjusted by the principal investigator without ownership of the report. Further, limited access exists for the principal investigator to create a private EHR report for NICU services involving direct patient data. Many attempts were made to explore why information was not being pulled correctly into the data set, but these attempts were inevitably unsuccessful. A significant breakdown within the data analysis process was detected after realizing data was being inconsistently pulled into the report, with no available remedy for the report settings, and an inability to create a new EHR report. When the error in the EHR report is corrected, this study could provide vital information to PAMC and future quality improvement recommendations. Although the research question was not able to be answered by this project, the methodology provides PAMC the framework for conducting this study in the future to see if COVID-19 had an impact on DBM usage as a surrogate marker for MOM. Strengths of this study are the ability to generate quality improvement recommendations to remove barriers and enhance support of

increased MOM production in the NICU by analyzing manageable restrictive measures and how these measures can be applied to PAMC's NICU to improve nutritional outcomes for neonates.

Conclusion

In order to answer the research question for this study, the development of a reliable and valid EHR report to provide average mLs of DBM per specific date range for infants within their respective protocol is needed. An EHR report providing this information would significantly reduce the potential for human error when completing manual data collection.

Overall, survey results showed no clear barriers or facilitators to lactation, though write-in responses (question four and five) provided valuable insight on staff perception of lactation support during the pandemic. From data collection, protocol #1 for 2020 was the only feeding protocol with a lower yearly average of DBM use when compared to 2019.

Additional opportunities for expansion of this data include analysis of the 3-month period of restriction during COVID-19 compared to multiple year averages as the control versus 2019 only. Averaging several "typical" years as the control would ensure a more reliable baseline for DBM averages per infant in their respective feeding protocol each year.

Though this study took place in unprecedented times, the relevance of how restrictive measures affect the ability to provide MOM to preterm infants is extremely valuable. The strength of this study lies within the methodology, laying the groundwork for how to compare DBM averages per infant during the COVID-19 pandemic to years prior. With access to a more reliable EHR report for DBM averages, this study provides the background, methods, data collection, and data analysis processes needed to carry out this study in the future at PAMC or for other NICUs interested in this study.

Although the analysis of DBM averages was not able to be completed and cannot provide clinical recommendations, the merit of using DBM usage as a quality improvement marker during COVID-19 can provide vital discussions and recommendations to guide NICU protocol. Further studies of other NICUs using DBM (or with direct ways to study MOM usage) are encouraged to see trends in MOM production during COVID-19. With further investigation, data can provide a better understanding of MOM trends during the pandemic. Additionally, studying the psychosocial aspect of how restrictive measures possibly affected MOM production by direct discussion with families to provide more personal insight would be highly valuable.

Dietetics and Nutrition Practice Implications

This study provides viable groundwork into how restrictive measures influence the availability of MOM in the NICU, using DBM as a surrogate marker. This has implications for dietetics and neonatal nutrition to generate reasonable quality improvement recommendations that will create wider availability of MOM for premature infants. Considering MOM is integral to neonatal health, the need for greater access and facilitation of lactation recommendations is an ongoing quality improvement measure in PAMC's NICU that continues to be adjusted, tracked, and measured. Overall, this study impacted PAMC's NICU by demonstrating the need for a reliable EHR report to find DBM usage per infant within a given time period. The relevance and usefulness of this study remains clear with methodology presented for future use to evaluate how COVID-19 movements restrictions affected DBM use as a surrogate for MOM.

Glossary

1. Chronic Lung Disease or Bronchopulmonary dysplasia (BPD): Infants born with respiratory distress syndrome typically need additional help with breathing for long periods of time, which in premature infants can lead to inflammation and scarring within the lungs known as BPD.[21]
2. Enteral Nutrition: Any type of feed that utilizes the gastrointestinal tract.[22]
3. Epidemic: A sudden increase in the number of cases of a particular disease for what is normally expected in the population of an area.[23]
4. Holder Pasteurization: Heating milk to 145 degrees Fahrenheit or (62.5 degrees Celsius) for 30 minutes and then allowing to cool back to room temperature to destroy bacteria and microorganisms.[24]
5. MERS: Middle Eastern Respiratory Syndrome (MERS) is a respiratory virus with gastrointestinal features that causes infection that may lead to pneumonia. In severe cases organ failure and death are noted.[25]
6. Morbidity: Having a disease or noted symptoms of a disease; a measure of the amount of disease in a given population.[26]
7. Necrotizing Enterocolitis: A serious and sometime fatal condition in which cells that line the bowel wall become injured.[27]
8. Nosocomial: Meaning originated or acquired in a hospital.[28]
9. Pandemic: Affecting a large population of individuals, where a particular disease has spread through several countries and/or continents.[23]
10. Parenteral Nutrition: Nutrients and calories are infused into a patient's vein when unable to feed enterally.[22]

11. Pneumonia: An inflammatory infection affecting the air sacs in one or both lungs noted with accumulation of fluid or pus which results in coughing with phlegm or pus, fever, chills, and difficulty breathing.[23]
12. Retinopathy of Prematurity (ROP): A disease in which blood vessels within the eye swell and overgrow within the light-sensitive layer of nerves in the retina (located at the back of the eye).[27]
13. SARS: Severe Acute Respiratory Syndrome (SARS) is a respiratory virus known to be fatal that began in China in November 2002. Within the coronavirus family.[30]

References

1. Gorbalenya AE, Baker SC, Baric RS, de Groot RJ, Drosten C, Gulyaeva AA, et. al. The species severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nat Microbiol*. 2020; 5(4): 536-544. doi: 10.1038/s41564-020-0695-z
2. The Mayo Clinic. Coronavirus disease 2019 (COVID-19). https://www.mayoclinic.org/diseases-conditions/coronavirus/symptoms-causes/syc-20479963. Updated August 7th, 2020. Accessed August 16th, 2020.
3. Meier, PP, Engstrom JL, Patel AL, Jegier BJ, Bruns NE. Improving the use of human milk during and after the NICU stay. *Clin Perinatol.* 2010 Mar; 37(1): 217-245. doi: 10.1016/j.clp.2010.01.013.
4. Piemontese P, Mallardi D, Liotto N, Tabasso C, Menis C, Perrone M, et al. Macronutrient content of pooled donor human milk before and after Holder pasteurization. *BMC Pediatrics.* 2019; 19(58). https://doi.org/10.1186/s12887-019-1427-5
5. Brownell E, Matson A, Smith K, Moore J, Esposito P, Lussier M, et al. Dose-response relationship between donor human milk, mother's own milk, preterm formula, and neonatal growth outcomes. *Journal of Pediatric Gastroenterology and Nutrition.* 2018; 67(1): 90-96. doi: 0.1097/MPG.0000000000001959.
6. The Mayo Clinic. Infant and toddler health. https://www.mayoclinic.org/healthy-lifestyle/infant-and-toddler-health/in-depth/breastfeeding/art-20048312. Updated April 3rd, 2020. Accessed August 24th, 2020.

7. Medical Definition of Vertical transmission. RxList. https://www.rxlist.com/vertical_transmission/definition.ht. Accessed June 7th, 2021.
8. Kotlyar AM, Grechukhina O, Chen A, et. al. Vertical transmission of coronavirus disease 2019: a systematic review and meta-analysis. *American Journal of Obstetrics & Gynecology*. 2021;224(1):35-53.e3. doi:10.1016/j.ajog.2020.07.049
9. Hedermann G, Hedley PL, Bækvad-Hansen M, et al. Danish premature birth rates during the COVID-19 lockdown. *Arch Dis Child Fetal Neonatal Ed*. 2021;106(1):93-95. doi:10.1136/archdischild-2020-319990
10. Matheson A, McGannon CJ, Malhotra A, et. al. Prematurity rates during the coronavirus disease 2019 (COVID-19) pandemic lockdown in Melbourne, Australia. *Obstet Gynecol*. 2021;137(3):405-407. doi:10.1097/AOG.0000000000004236.
11. Arnaez J, Ochoa-Sangrador C, Caserío S, et al. Lack of changes in preterm delivery and stillbirths during COVID-19 lockdown in a European region. *Eur J Pediatr*. 2021;180(6):1997-2002. doi:10.1007/s00431-021-03984-6
12. Lubbe W, Botha E, Niela-Vilen H, Reimers P. Breastfeeding during the COVID-19 pandemic – a literature review for clinical practice. *Int Breastfeed J*. 2020;15(1):82. doi:10.1186/s13006-020-00319-3
13. Marinelli KA. International perspectives concerning donor milk banking during the SARS-CoV-2 (COVID-19) pandemic. *J Hum Lact*. 2020;36(3):492-497. doi:10.1177/0890334420917661
14. Noonan, J. Total Premie Nutrition: March 2020 Update. Lecture presented at Providence Alaska Medical Center: March 27th, 2020; Anchorage, AK.

15. Ziegler E, Carlson S. Enteral feedings. University of Iowa Stead Family Children's Hospital. Published August 30th, 2012. Accessed June 25, 2021. https://uichildrens.org/health-library/enteral-feedings
16. Brown A, Shenker N. Experiences of breastfeeding during COVID-19: Lessons for future practical and emotional support. *Maternal & Child Nutrition*. 2021;17(1):e13088. doi:10.1111/mcn.13088
17. Snyder K, Worlton G. Social Support During COVID-19: Perspectives of Breastfeeding Mothers. *Breastfeeding Medicine*. 2021;16(1):39-45. doi:10.1089/bfm.2020.0200
18. Ziomkiewicz A, Babiszewska M, Apanasewicz A, et al. Psychosocial stress and cortisol stress reactivity predict breast milk composition. *Scientific Reports*. 2021;11(1):11576. doi:10.1038/s41598-021-90980-3.
19. *Effect of dietary protein value on lactation*. CRC Press; 2018. doi:10.1201/9781351069434-13
20. Moirasgenti M, Doulougeri K, Panagopoulou E, Theodoridis T. Psychological stress reduces the immunological benefits of breast milk. *Stress and Health*. 2019;35(5):681-685. doi:https://doi.org/10.1002/smi.2903
21. Greenspan JS. Bronchopulmonary dysplasia. KidsHealth website. https://kidshealth.org/en/parents/bpd.html#:~:text=Babies%20who%20are%20born%20very,and%20need%20intensive%20medical%20care. Published October 2014. Accessed September 2nd, 2020.
22. Kirby DF, Parisian K. Overview: what do enteral and parenteral nutrition refer to. American College of Gastroenterology. https://gi.org/topics/enteral-and-parenteral-nutrition/. Published September 2011. Accessed September 2nd, 2020.

23. Lesson 1: Introduction to Epidemiology. Center for Disease Control and Prevention. https://www.cdc.gov/csels/dsepd/ss1978/lesson1/section11.html. Published May 18th, 2020. Accessed September 2nd, 2020.
24. Petherick A. Holder pasteurization holds up well against most germs. Internal Milk Genomics Consortium Website. https://milkgenomics.org/article/holder-pasteurization-holds-well-germs/#:~:text=There%20is%20nothing%20particularly%20surprising,back%20down%20to%20room%20temperature. Published July 2017. Accessed September 2nd, 2020.
25. Steckelberg, JM. What is MERS-CoV, and what should I do? Mayo Clinic website. https://www.mayoclinic.org/diseases-conditions/sars/expert-answers/what-is-mers-cov/faq-20094747. Published October 25th, 2018. Accessed September 2nd, 2020.
26. 13. Morbidity. National Cancer Institute. https://www.cancer.gov/publications/dictionaries/cancer-terms/def/morbidity. Accessed September 2nd, 2020.
27. Premature birth. Mayo Clinic website. https://www.mayoclinic.org/diseases-conditions/premature-birth/symptoms-causes/syc-20376730. Published December 21st, 2017. Accessed September 2nd, 2020.
28. Shiel WC. Medical definition of nosocomial. https://www.medicinenet.com/script/main/art.asp?articlekey=4590. Accessed September 2nd, 2020.
29. Pneumonia. Mayo Clinic website. https://www.mayoclinic.org/diseases-conditions/pneumonia/symptoms-causes/syc-20354204. Published June 13th, 2020. Accessed September 2nd, 2020.

30. Severe acute respiratory syndrome (SARS). Mayo Clinic website. https://www.mayoclinic.org/diseases-conditions/sars/symptoms-causes/syc-20351765. Published September 24th, 2019. Accessed September 2nd, 2020.

Appendix A

Feeding Protocols for PAMC NICU

Table 1. Feeding Protocols for PAMC NICU

Protocol	Gestational Age at Birth (weeks)	Weight at Birth
#1	<30; and/or	<1250 grams
#2	30 1/7 - 32 6/7; and/or	<1500 grams
#3	33 1/7 – 34 6/7	>1500 grams
#4 (Not used for study)	>35 weeks	>1500 grams

Appendix B

Spring 2020 COVID-19 PAMC NICU Movement Restriction

Table 2. COVID-19 Restriction Timeline in PAMC's NICU

Date	Household Members Allowed	Restriction Changes
March 27, 2020	Parents/Support person only	Initiation of standards. Parents not allowed to "re-enter" facility without pass. Encouraged to stay in NICU. Only allowed to leave the NICU for the cafeteria, appointments and briefly for scenery change. Parent in-and-out log used. No caregivers besides parents allowed in the unit. Foster parents can only enter after the facility after biological parents have left.
March 31, 2020	Parents/Support person only	Re-entry pass in effect. Parents denied entry without pass. Parent in-and-out log used, but under revision.
April 1, 2020	Parents/Support person only	Parent log revised to include the exact amount of time parents spent off unit.

April 17, 2020	Parents/Support person only	One parent/support person allowed a re-entry pass in a 24-hour period. Not limited to medical appointments only. Time limit not restricted or recorded. May take several days to return, but attestation signed verifying community masking will be observed.
August 14, 2020	Parent/Support person only	A twin infant admitted to the NICU discharged separately from their sibling may re-enter the facility with mom (previously a discharged twin had to stay in the NICU. If they left with mom they would not be allowed to re-enter, even if mom had a pass).

Appendix C

NICU Staff Recruitment Email

Hello Everyone,

To fulfill part of the requirements for the M.S. in Dietetics and Nutrition program at the University of Alaska Anchorage, I'm conducting a NICU centered study that will look at how donor breast milk usage was affected by the COVID-19 pandemic. My goal is to use donor breast milk as a surrogate marker for mothers' breast milk in infants <35 weeks to see if there were any changes during our various movement restrictions in the NICU during COVID.

I am interested in what you think were barriers and/or facilitators for mothers to pump and provide breast milk during COVID. Your perspectives are very important and I hope to get as many responses as possible! If you are interested in being a part of my study, please fill out this survey by **June 9th** Your participation in this survey is optional and voluntary.

The link to my qualtrics survey is below. Once you click-on this link it will direct you to the survey. There is a brief statement asking for consent to be a part of my study and then the survey questions will follow. I'm distributing this survey to NICU staff involved in direct patient care during the COVID-19 pandemic. I will be collecting survey responses through qualtrics to maintain confidentiality. Please do not include any personal identifiers in your responses to maintain your confidentiality. You are free to skip any questions you would not like to answer. This survey has been reviewed by the University of Alaska Anchorage and Providence St. Joseph Health Institutional Review Boards.

Link: http://uaa.co1.qualtrics.com/jfe/form/SV_3C9tH7mB5E4Yv1I

Thank you all in advance! Feel free to email me if you have any further questions.

Respectfully,

Cayenne Sirois, RD LD
Providence Alaska Medical Center
(907) 212-5877

Appendix D

NICU Staff Online Survey

The purpose of this study is to view the unique perspective of PAMC's NICU staff on the lactation experience of mothers during the COVID-19 pandemic. Please consider any facilitators or barriers to lactation that you can recall during various points of the pandemic (from more restrictive times to least). For your confidentiality, this survey will not ask identifiable information. Risks of participating in this study are confidentiality if identifying data is included in your responses. Please do not include any personal identifiers in your responses to mitigate that risk and maintain your confidentiality. By answering yes below, you are certifying that you are 18 years of age or older, and that you voluntarily agree to participate in this study and understand that you are free to withdraw your consent and discontinue participation at any given time. You are free to skip any questions you would not like to answer. This survey has been reviewed by the University of Alaska Anchorage and Providence St. Joseph Health Institutional Review Boards.

Likert Scale: Strongly Agree, Agree, Disagree, Strongly Disagree

- I feel mothers were more willing to engage in pumping or breastfeeding during the COVID-19 pandemic compared to 2019 prior to movement restrictions.
- I feel mothers had more access to lactation support during the COVID-19 pandemic compared to 2019.
- The lactation barriers mothers typically face in the NICU changed due to the COVID-19 pandemic.

- Fill in the blank: What were barriers to lactation during the COVID-19 pandemic?

  _____

  _____

- Fill in the blank: What were facilitators to lactation during the COVID-19 pandemic?

  _____

  _____

Comments

Appendix E

Data Demographics 2019

Table 3. Number of participants from each episode and respective feeding protocol in 2019. Additionally, average mLs per infant within each episode and respective protocol in 2019 (rounded to the nearest mL).

Episode: 2019	Protocol #1	Average mLs DBM	Protocol #2	Average mLs DBM	Protocol #3	Average mLs DBM
January	12	1911	7	887	16	1095
February	8	2043	5	881	6	1912
March	4	1418	8	1180	4	752
April	6	900	5	135	7	767
May	6	1240	11	1103	6	1007
June	5	826	5	838	5	297
July	10	729	8	1522	7	378
August	10	1515	9	529	12	302
September	8	938	12	841	6	831
October	6	1131	9	1361	10	735
November	7	1319	11	2095	5	663
December	12	2219	11	794	19	646
Total per Protocol	94		101		103	
Average mL per year		1349		1014		782

Appendix F

Data Demographics 2020

Table 4. Number of participants from each episode and respective feeding protocol in 2020.

Additionally, average mLs per infant within each episode and respective protocol in 2020.

Episode: 2020	Protocol #1	Average mLs DBM	Protocol #2	Average mLs DBM	Protocol #3	Average mLs DBM
January	9	1398	7	1242	16	685
February	4	551	8	1433	15	1099
March 1st-27th	7	258	7	1307	7	588
March 28st-April 17th	6	1039	6	2488	4	310
April 18th-May 1st	3	506	7	512	3	1563
May 2nd-31st	5	562	17	1877	15	486
June	6	950	9	158	7	1194
July	9	1027	7	1274	4	972
August	13	1174	8	1566	7	599
September	7	1247	8	632	10	1167
October	9	790	8	563	7	548
November	10	1273	2	565	7	1295
December	9	1292	7	487	10	599
Total per Protocol	97		101		112	
Average mL per year		928		1085		854

Appendix G

Frequency Table for Staff Survey

Table 6: Frequency table for survey questions 1-3 for staff perception of perceived barriers and facilitators to lactation during COVID-19 (n = 10).

Questions	Strongly Agree	Agree	Disagree	Strongly Disagree
1. I feel mothers were more willing to engage in pumping or breastfeeding during the COVID-19 pandemic compared to 2019 prior to movement restrictions.	0% (n = 0)	40% (n = 4)	60% (n = 6)	0% (n = 0)
2. I feel mothers had more access to lactation support during the COVID-19 pandemic compared to 2019.	0% (n = 0)	10% (n = 1)	90% (n = 9)	0% (n= 0)
3. The lactation barriers mothers typically face in the NICU changed due to the COVID-19 pandemic.	30% (n = 3)	50% (n = 5)	20% (n = 2)	0% (n = 0)

Appendix H

Results for NICU Staff Survey

Table 6. Results from the free response questions on the NICU staff survey (n=10).

Q1	Q1	Q2	Q3	Q4	Q5	Q6
Consent	**I feel mothers were more willing to engage in pumping or breastfeeding during the COVID-19 pandemic compared to 2019 prior to movement restrictions.**	**I feel mothers had more access to lactation support during the COVID-19 pandemic compared to 2019.**	**The lactation barriers mothers typically face in the NICU changed due to the COVID-19 pandemic.**	**Fill in the blank: What were barriers to lactation during the COVID-19 pandemic?**	**Fill in the blank: What were facilitators to lactation during the COVID-19 pandemic?**	**Comments:**
Yes	Agree	Agree	Agree	Having to be 6 ft apart and not being able to have many people in the room		Due to the pandemic, it was hard to see patients and help schedule LC apts. Not knowing if patients have the COVID or not. It makes it difficult to know what regulations should be in placed of patients if they do have COVID and how to keep healthcare workers safe while still helping mothers with their breastfeeding.
Yes	Disagree	Disagree	Disagree	The only noticeable one was the need for mothers to wear masks and therefore		

				juggle another element during the lactation experience.		
Yes	Disagree	Disagree	Disagree			
Yes	Agree	Disagree	Agree	Visiting policies, Added stress outside of NICU experience.	More time to room in.	
Yes	Disagree	Disagree	Agree	being able to have appointments with lactation consultants. Ability for parents to leave the bedside more than once a day. If they had other kids, they couldn't leave and come back to breastfeed their baby.	For some parents having to be at the bedside more, or not at all, they made the choice to stay at the bedside.	
Yes	Agree	Disagree	Agree	Parents stress and anxiety was heightened because of the pandemic restrictions and fear. This affected their ability to produce sufficient	Mother's that were strictly in the hospital 24/7 had more access to lactation help. But I think being here fulltime added so	The mental and physical well-being of mothers was greatly affected my the fear of the pandemic and physical restrictions placed on them by the hospitals needs for infection control.

				breastmilk. Restrictions also kept parents in the unit exclusively or out the unit based on family needs.	much stress, which in turn makes milk production more difficult.	
Yes	Disagree	Disagree	Agree	Vistitation restrictions and having other children. Unable to visit as often as they'd like	When we were in full lockdown, parents that stayed at bedside had more accessability to lactation and more time at bedside to practice breastfeeding	
Yes	Agree	Disagree	Strongly Agree	stress; decreased family/friend support	during lock-down, if a parent left they had to stay gone. This meant some mothers had to stay out & try to deliver milk in order to work, care for other children, etc	
Yes				visitation restrictions	PAMC staff	

Yes	Disagree	Disagree	Strongly Agree	movement restrictions and passes for those who were breastfeeding and needing to leave between feeds	more time off work while shut down and	
Yes	Disagree	Disagree	Strongly Agree	initial restrictions in the hospital did not allow mothers to leave the hospital or risk not being let back in, this coupled with PPD made several mothers withdrawn and reclusive. As restrictions changed, and families were encountering issues gaining access to the bedside, sometime pumped milk wasnt brought in in a timely manner or at all.	The LC's themselves did good by engaging families once the PPE recommend ations were consistent. They went out of their way to engage families and promote good habits with parents.	