

A Quality Improvement Initiatives to Enhance Breast Milk Expression among Mothers of Newborns Admitted to the Neonatal Intensive Care Unit

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ABSTRACT

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Background and Objective: When vulnerable infants are admitted to the neonatal intensive care unit (NICU), they often encounter barriers to breastfeeding that make the transition to oral feeding difficult. To increase the rate of early breast milk expression rate among mothers of infants admitted to the NICU, we have launched a Quality Improvement (QI) project.

Methods: A QI study with a quasi-experimental pre- and post-test design was conducted in the NICU between June 2020 and November 2021 at Niloufer Hospital in Hyderabad, India. All mothers who gave birth to babies younger than 35 weeks or 2 kg participated in the study. Mothers with certain health conditions, mastitis, or cytomegalovirus infection were not included. The rate of early breast milk expression within six hours of birth and the rate of exclusive breastfeeding at discharge were the main outcome indicators. Mothers and birth attendants were counseled immediately after delivery, posters were displayed in the maternity wards, and breast pumps and milk containers were distributed. A fishbone analysis was used to investigate the potential barriers to early expression of breast milk.

Findings: A total of 1359 mother-baby pairs were included in the study. During the study period, the rate of exclusive breastfeeding at the time of discharge increased (63% to 85%), and the expression of breast milk within 6 hours improved (29.7% to 74.39%).

Conclusion: Simple QI initiatives like lactation counseling, tags, posters, breast pumps, and provision of milk containers can promote early expression of breast milk and exclusive breastfeeding rates at discharge.

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Introduction

For every newborn, and perhaps even more so for preterm infants, exclusive breastfeeding is crucial [1-3]. The World Health Organization advises mothers to exclusively breastfeed their infants for about six months from birth [4]. However, placing infants in the intensive care unit (ICU) increases the barriers to early expression of breast milk and decreases the likelihood that they will be fed breast milk on discharge. We encountered the same difficulties. According to the recent National Family Health Survey (NFHS) in India [5], only 38.3% of mothers started breastfeeding within one hour of delivery. According to studies, women who pumped their breast milk within six hours were more likely to continue breastfeeding for up to six months and prevent breastfeeding failure [6,7]. With this in mind, the Quality Improvement (QI) initiative was launched to promote early expression of breast milk and exclusive breastfeeding in infants admitted to the special newborn care unit (SNCU). QI is a management approach that allows healthcare professionals to reorganize patient care at their level to ensure that patients receive good-quality healthcare. It is a problem-solving approach in the local context that usually does not require additional resources. QI focuses primarily on reorganizing care within existing resources, leading to a more efficient use of available resources that can solve at least some problems of scarcity. This QI project aimed to improve the rates of early expression of breast milk in mothers whose babies were admitted to the neonatal intensive care unit (NICU) for one and a half years.

The aim of this study was to increase the rates of early breast milk expression in the SNCU from the current 30% to 80% within a year and a half.

Methods

The QI study with pre- and post-test design was carried out between June 2020 and November 2021. The Osmania Medical College Ethics Committee approved the protocol with committee number ECR/300/Inst/AP/2013/RR-19. After obtaining written informed consent, mothers of infants admitted to the NICU were enrolled in the study.

The inclusion criteria were mothers who had given birth at less than 35 weeks gestation or with a birth weight of less than 2 kg. Mothers with health problems that required treatment in the ICU, mothers with mastitis or mothers with cytomegalovirus (CMV) infection, and mothers whose babies were admitted to the NICU were excluded from the present study. As our breast milk bank is large enough to supply premature neonates with milk, we only use human milk for premature babies. Over a four-week period, the baseline information on the rate of exclusive breastfeeding and early expression of breast milk was collected in the present study. The rate of exclusive breastfeeding was 63.35%. Early initiation of breastfeeding was usually within 1 hour. In the current study, the baseline median for the data was collected for early breastfeeding within 6 hours, which was 30%.

A multidisciplinary QI team was formed, consisting of neonatologists, head sisters, gynecological and pediatric resident nurses, lactation consultants, and professional nurses. Using fishbone analysis (Figure 1), the causes of the delayed expression of breast milk were investigated. It was found that mothers' lack of understanding, lack of proper emotional support, lack of a written policy for expressing breast milk, and lack of awareness among gynecological residents were the causes of delayed expression. Our team brainstormed to identify the top causes of delayed expression of breast milk: people, places, policies, and materials. The QI team discussed and created evidence-based treatments for local implementation as a solution. Over the course of eleven months, five Plan-Do-Study-Act (PDSA) cycles were utilized to develop and implement ideas for change, with each cycle lasting 3 weeks. There was a two-week break between cycles to take on other units and adjust to the new cycle. The changes they introduced during the PDSA cycles were maintained over the next five months. The planning, implementation, and adherence to each intervention were evaluated in the typical PDSA cycle format of a QI study.

The study was conducted in 7 phases, with a new group of newborns included in each phase. A total of 3922 newborns were included in the study. Phase

1 (June–July 2020)-baseline; Phase 2 (August–September 2020) breastfeeding counseling, Phase 3 (October, November 2020) posters, Phase 4 (December 2020–January 2021) posters and pumped milk for breastfeeding, Phase 5 (February–March 2021) posters and tags, Phase 6 (April–May 2021) posters and all of the above plus steel containers, and Phase 7 (June–November 2021) was the sustainability phase.

Data input was handled by the nursing staff and the head sister of the NICU. A register was kept in the NICU to record details of breast milk expression, including frequency of expression, timing of first expressing, and percentage of patients who had exclusively breastfed at the time of discharge. The data were entered every day and analyzed every week. The demographic variables were described using descriptive statistics.

The monthly fulfillment rates were then recorded and displayed using run charts created with the Microsoft Excel program. We defined a shift according to evidence-based rules. The new median was recalculated using the points that make up the shift and compared with the new data. For reporting, the guidelines of the Standards for QI and Reporting Excellence 2.0 were followed.

PDSA (Plan, Do, Study, Act) Cycles

1st PDSA Cycle

With the support of postgraduate students from the gynecology department, pediatricians, and lactation consultants, PDSA 1 Extended Breastfeeding Consultation was conducted. A discussion was held on the importance of breast milk output, which was then analyzed by the team by adding different columns to the case sheet for counseling. The knowledge of gynecology postgraduates was evaluated using a questionnaire about the expression of breast milk. Postgraduate students working in the SNCU and postnatal wards were invited to a meeting to learn about the best methods for expressing breastmilk. The discussion with the lactation specialists included the best methods for expressing milk.

The team also gave the obstetricians advice on how to pump breastmilk correctly and the importance of early expression (Figure 2).

2nd PDSA Cycle

PDSA 2 was initiated by displaying posters in the postnatal wards, SNCUs, and delivery rooms explaining the importance of breastmilk and milk-expressing techniques. The posters were used by PhD students and lactation consultants to inform women and birth attendants about the value of early pumping and the different expression methods.

3rd PDSA Cycle

During the third PDSA cycle, the breast milk pumping diaries were distributed to the obstetrician immediately after delivery. The booklet was explained to the mothers and obstetricians, and they were asked to circle it each time they expressed milk. The information collected was then entered into the register kept at the SNCU. In the following week, the pumping stations were made available in the maternity wards and 86% of mothers were able to use them.

4th PDSA Cycle

In the fourth PDSA cycle, wristbands and birth identity bands were provided and strapped to the mothers in the delivery room with the help of the head sisters stationed there. The information on the wristbands emphasized the value of breast milk expression. Early breast milk expression increased from 56% to 64% with the introduction of the wrist tags.

5th PDSA Cycle

It is suggested that mothers bring containers to the NICU. However, mothers were concerned about the supply of containers. In the fifth cycle, we gave participants steel containers in which to express their breast milk and asked them to bring the containers back when they were finished. They were instructed to return the milk containers to the NICU after each round-the-clock pumping. In the first week, only 50% of the participants brought the containers with them. In the following weeks, this figure increased to 88% as participants were made aware of the value and benefits of expressing milk. However, the majority of milk was expressed in containers brought in during the day. The percentage of participants who brought the

containers increased to 95% when the value of pumping at night was further emphasized.

Sustenance Phase

During the 11 months of intervention and the 5 months of sustenance phases, all strategies that

increased rates of exclusive breastfeeding at discharge and early breast milk expression were promoted. Additionally, the frequency of the main outcome and adherence to the various interventions were continuously assessed.

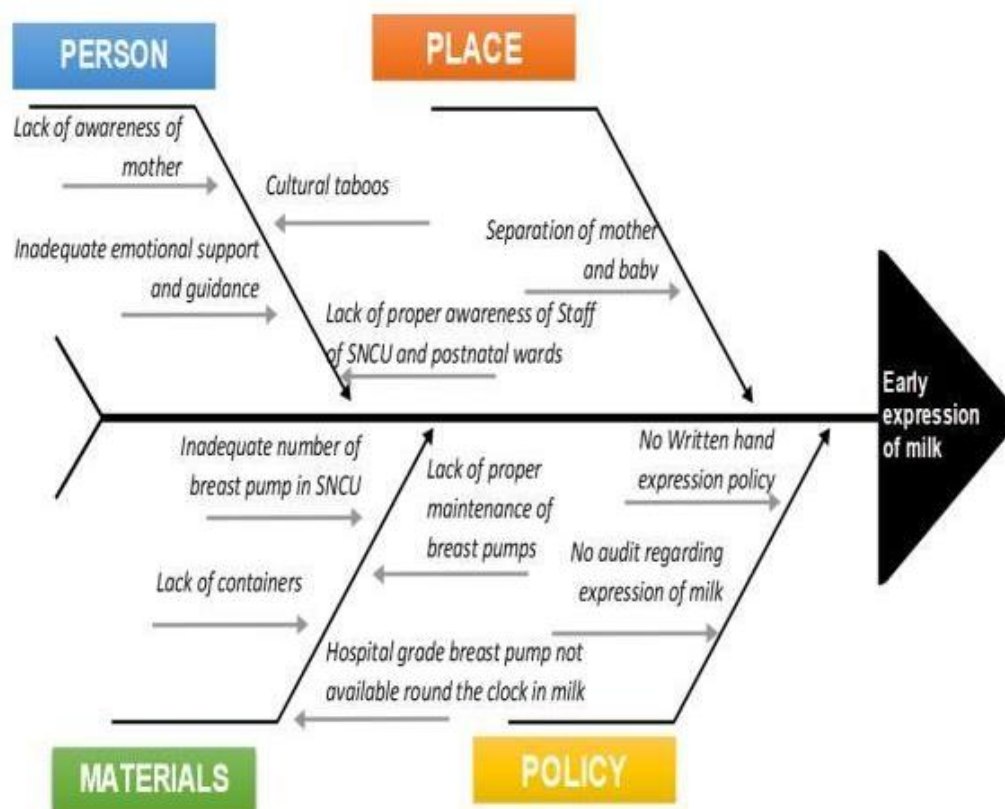


Figure 1. Fish Bone Analysis



Figure 2. PDSA cycle 1

Results

In the present study, 285 newborns with a mean gestational age of 34.77 weeks with a standard deviation (SD) of 3.51 and a mean birth weight of 2.035 kg with an SD of 0.79 were included in the baseline phase. In the sustenance phase, 1074 members were enrolled; in this group, the mean gestational age was 34.96 weeks with an SD of 3.24. The mean birth weight was 2.06 kg with an SD of 0.711. Both groups, the baseline group and the breastfeeding group, were statistically similar; there was no significant difference regardless of birth weight or gestational age ($P>0.05$). At baseline, 55.45% of the infants were male and 44.54% were female.

The average expression rate at the beginning of the study was compared with the rate after each PDSA cycle and the maintenance phase. Both in the intervention phase and in the maintenance phase,

the expression rate was higher than the baseline value and was statistically significant (Table 1).

The mean frequency of breast milk expression increased from 1.86/day at baseline to 5.01/day at the end of the maintenance phase ($P<0.001$) (Figure 3).

In the baseline group, 29.7% of the study participants expressed breast milk within 6 hours. Within 12 hours, 33.6% of the breasts expressed milk, and within 24 hours, 22.9% expressed milk. In June 2020, 13.74% did not express at all. At the end of the intervention phase, 74.17% of the study population had expressed breast milk within six hours. Within 12 hours, 18.77% of breast milk was expressed, and within 24 hours 5.63%. 1.4 percent of the women never expressed breast milk (Figure 4).

Compared to baseline, the rate of exclusive breastfeeding at discharge increased from 63% to 82% during the intervention phase and remained at 85.7% during the maintenance phase (Figure 5).

Table 1. Comparison between the baseline and various phases of breast milk expression

Intervention	Mean rate of expression/day	P-Value
Baseline or No intervention (n=288)	1.86±0.86	<0.0000001 (Significant P value)
Lactation counseling (n=355)	2.31±1.12	
Baseline or No intervention (n=288)	1.86±0.86	<0.0000001 (Significant P value)
LC+Poster (n=496)	2.41±1.56	
Baseline or No intervention (n=288)	1.86±0.86	<0.0000001 (Significant P value)
LC+Poster+pumping dairy (n=535)	2.51±1.98	
Baseline or No intervention (n=288)	1.86±0.86	<0.0000001 (Significant P value)
LC+Poster+Pumping dairy +Bands (n=539)	2.64±0.98	
Baseline or No intervention (n=288)	1.86±0.86	<0.0000001 (Significant P value)
LC+Poster+pumping dairy+tags+Cups (n=427)	3.45±2.01	
Baseline or No intervention (n=288)	1.86±0.86	<0.0000001 (Significant P value)
Sustenance period (n=1582)	5.05±3.29	

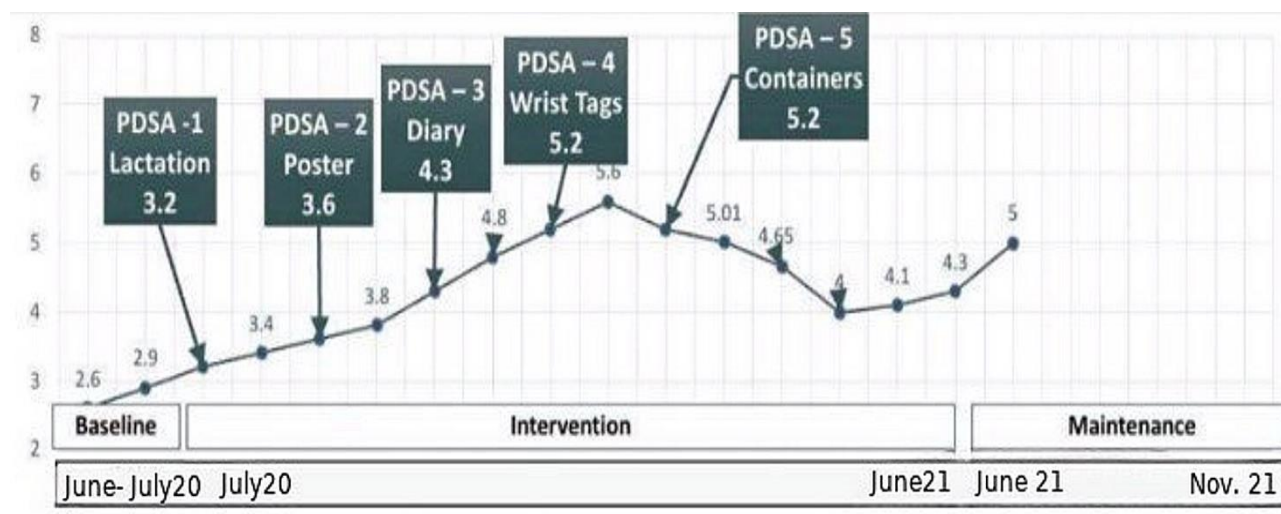


Figure 3. Mean rate of expression of breastmilk/day during the study period

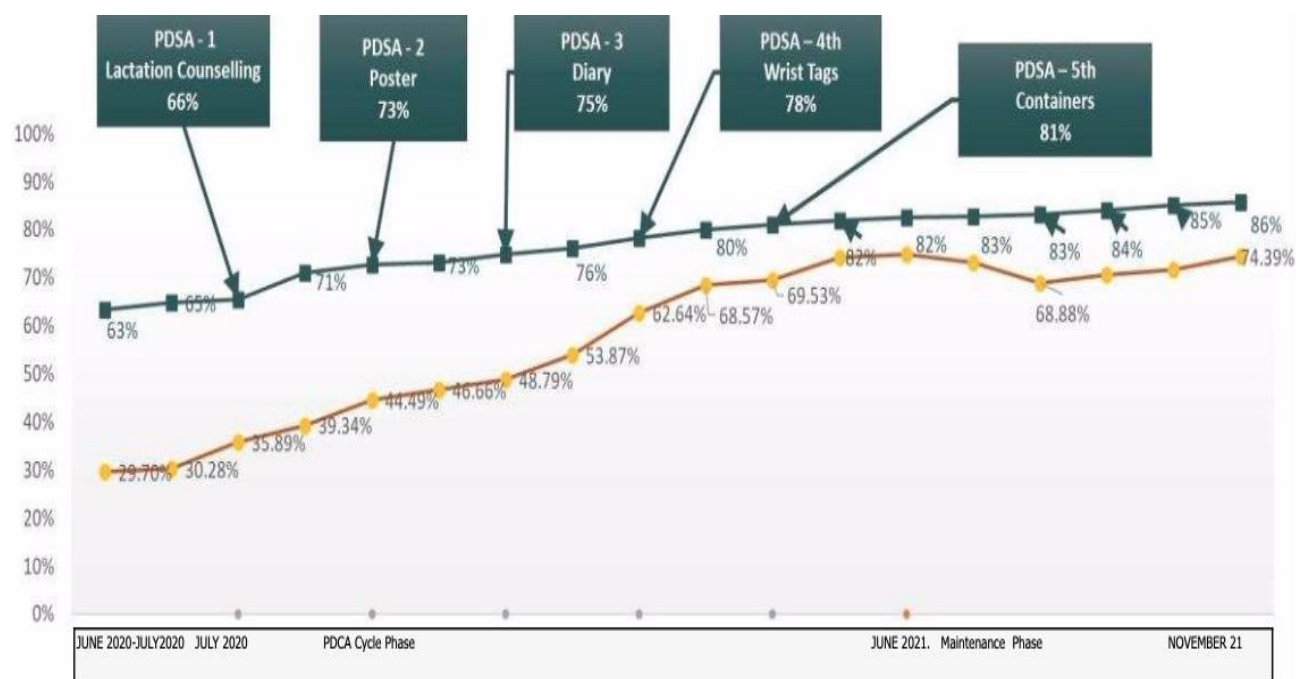


Figure 4. Rate of breast milk expression within 6 hours during the study period with different interventions

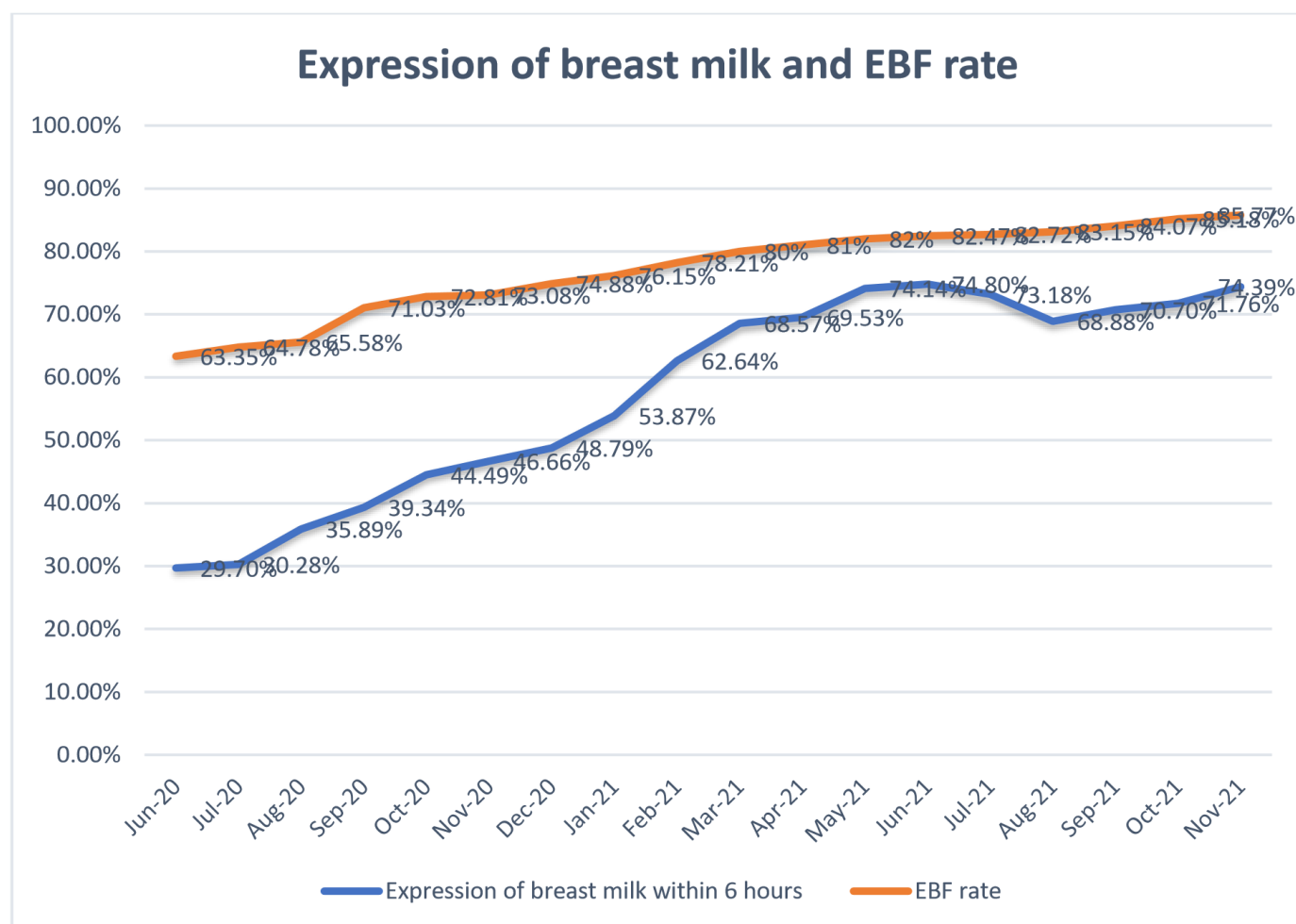


Figure 5. Run chart showing the rates of breast milk expression and exclusive breastfeeding

Discussion

We investigated the problems affecting our department and drew up effective intervention plans. During the observation period, it was found that parents of unwell preterm neonates are unfamiliar with the NICU environment and therefore rely on the medical staff for any form of support and guidance, before and after birth. There is evidence that support for mothers from peers as well as medical professionals can have an impact on the baby's ability to breastfeed successfully [8-10]. As a result, the gynecologists and pediatric residents provided immediate advice to mothers and the birth attendant. In the current study, the expression of breast milk was 29.7% at the baseline and increased to 74.39% at the end of breastfeeding. The mean milk expression increased from 1.86 /day to 5.05/day at the end of the sustenance phase. The exclusive breastfeeding rate rose from 63.35% to 85.77% at the end of the breastfeeding period. In all phases, the expression of breast milk, mean expression rate, and exclusive breastfeeding improved. However, during the intervention period after PDSA cycle 4, there was a peak rate of milk expression, which slowly dropped over time. During this time, the remodeling of our hospital began, and some pediatric departments moved into our building. In addition, the number of employees decreased abruptly when a private organization terminated its contract. The above-mentioned causes mainly explain the collapse of the curve.

In one study, Rosen-Carole et al. [11] assessed the effect of lactation counseling on the onset of milk expression and found that counseling mothers of VLBW infants increased the frequency of lactation initiation and breastfeeding without increasing the mothers' stress levels. Similar to the study of Rosen-Carole et al. [11], breastfeeding counseling in our study helped to increase the rate of early expression and exclusive breastfeeding at the time of discharge while reducing maternal stress and anxiety. After counseling, the rate of early breast milk expression increased from 30% to 40%.

According to studies, birth attendants are crucial for the early initiation of breastfeeding [12]. Posters were displayed in the postnatal wards and NICU

illustrating the importance and methods of early and frequent expressing of breastmilk, as emotional support from birth attendants is necessary to encourage expressing of breastmilk [13-14]. This strategy boosted the early breast milk expression from 40% to 47%.

We gave mothers an instruction sheet on pumping and tracked the frequency of pumping to encourage mothers to pump frequently. After this intervention, breast milk was expressed earlier. It has been demonstrated that after the introduction of dairying, more mothers were able to express milk. Although the daily amount of milk expressed by individual mothers was not documented, the frequency of expressing breast milk (EBM) increased. The introduction of a breast milk expression diary may improve the breast milk feeding of hospitalized newborns and increase the proportion of EBM feeding in preterm infants in the NICU [10]. In one study, Bin Wu [15] found that access to a pumping diary was associated with significantly higher consumption of EBM in hospitalized preterm infants.

The results of our study agree with the aforementioned literature. Bagga N. et al. took a quality initiative by offering structured antenatal counseling on EBM. They used videos and brochures during postnatal visits and established a breastfeeding support group. They found that after 7 days, the proportion of infants receiving EBM increased from 46% ($p = .02$) in preterm neonates to 73%. [16]. Lee HC et al. implemented a package of changes developed by a panel of experts in 11 NICU centers. They observed that the rate increased from 54.6% to 61.7% within 12 months, and to 64.0% in the following 6 months [17]. Sudatip Kositamongkol et al. motivated mothers by presenting a certificate with the infant's photo to mothers who fed their infants with their own milk more than 50% of the time, but in our study, we motivated each mother with wristbands [18]. Takako H et al. implemented the first three elements of Spatz 10-step model in their QI project, and the HM rate at discharge increased threefold to 47% after only four months [19]. Unlike many QI studies, the provision of containers for mothers in the current study was very unique.

Using our QI initiative, we were able to demonstrate how the establishment of a comprehensive lactation support group, methodical counseling, and the provision of wristbands and pumping diaries increased rates of early and frequent breast milk expression and exclusive breastfeeding at the time of the baby's discharge. Previous QI research on early milk expression and the benefits of coordinated strategies to increase exclusive breastfeeding served as the basis for this QI project.

It can be considered one of the most cost-effective ways to ensure that newborns are adequately nourished up to 6 months of age, which can reduce malnutrition, infant morbidity, and infant death.

Limitations: Because conducting a randomized control trial is unethical, we compared our results in this study using retrospective data. Due to the large sample size, we were unable to determine the amount of milk expressed by mothers in the different time periods. At discharge, we assessed the percentage of exclusively breastfed infants, but we were unable to follow these data for an additional six months.

Conclusion

The ongoing study shows that QI initiatives with low-cost interventions such as lactation counseling, breast pumps, wrist tags, and posters can increase the early expression of breast milk and the exclusive breastfeeding rate at discharge. It would be better to continue a larger quality initiative. There are different barriers to breastfeeding in each department that can be more easily addressed through QI initiatives. The team's strategy and effective channeling of existing resources through a basic quality initiative resulted in a significant improvement in milk expression.

Ethical Considerations

The Institutional Ethics Committee approved the protocol with committee number ECR/300/Inst/AP/2013/RR-19.

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The conduct of this study was not financially supported by any organization.

Conflict of interest

There was no conflict of interest.

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