

QUALITY IMPROVEMENT ARTICLE



Increasing usage of mother's own milk in neonates at risk of neonatal abstinence syndrome: MOM-NAS quality improvement initiative

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OBJECTIVE: To increase the usage rate of mothers' own milk (MOM) among neonates with prenatal opioid exposure from a baseline average of 47% to an average of 75% over two years.

STUDY DESIGN: Between October 2018 and December 2020, we implemented various Plan-Do-Study-Act cycles that involved engaging providers in postpartum counseling for mothers with opioid dependence, using electronic medical records to track the rate of counseling, providing NAS educational materials to parents, and establishing a rooming-in unit. Our outcome measure was the provision of MOM to eligible neonates, while our process measure was the rate of postpartum counseling.

RESULTS: During this initiative, we witnessed a special cause variation with an increase in the usage rate of MOM from a baseline of 47% to a 27-month average of 85% by December 2020.

CONCLUSION: A series of quality improvement efforts resulted in increased usage of MOM among infants at risk of NAS.

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INTRODUCTION

The incidence of opioid use disorder (OUD) during pregnancy has increased by up to four-fold in the last two decades [1, 2]. In parallel, neonatal abstinence syndrome (NAS)—a combination of clinical signs of drug withdrawal following prenatal opioid use exposure [3, 4]—has also become more prevalent. Nationally, the incidence of NAS increased almost five-fold from 2004 to 2014 and resulted in a significant increase in associated healthcare costs [5].

In Florida, the prevalence of OUD in pregnancy increased from 0.5 to 6.6 per 1000 delivery hospitalizations from 1999 to 2014 [1]. Consequently, the rate of NAS has increased more than 10 times in recent years [6]. Altered neurobehavioral signs exhibited by the neonate following prenatal opioid exposure are the hallmark of NAS [4]. Not only does NAS adversely affect the health of the newborn, but it also exacts enormous stress on families and imposes greater costs on the healthcare system [2]. Substantial efforts have been aimed at implementing strategies to reduce the severity of NAS that as a consequence would reduce hospital length of stay for these infants [7–10]. One such strategy has focused on increasing maternal breastfeeding, which has been associated with reducing the need for pharmacotherapy and reducing the length of hospital stay for neonates with NAS [11–15]. However, the likelihood that a mother with OUD will breastfeed is less than

the national average [14]. In one large population-based study, fewer than half of infants diagnosed with NAS were breastfed at discharge [15].

Women with OUD face many challenges in breastfeeding during pregnancy. Concomitant use of substances that are contraindications to breastfeeding is common [14, 16, 17]. An emphasis on educating and counseling women with OUD may mitigate deep societal stigmatization against substance use in pregnancy, which may then lead to improved outcomes, including increased breastfeeding rates [16, 18]. In addition to prenatal breastfeeding education to pregnant women using opioids, the immediate postpartum period provides another opportunity where mothers can be additionally counseled and encouraged to provide breast milk. Simultaneously, educating the entire healthcare staff regarding the benefits of breastfeeding to neonates at risk of NAS will encourage the providers to safely recommend breastfeeding.

In 2018, our NICU joined the Florida Perinatal Quality Collaborative (FPQC) initiative that sought to standardize care for neonates with NAS. One of the primary drivers of this statewide quality improvement (QI) collaborative was to improve caregiver education on NAS. By focusing on educating and counseling mothers with OUD, we aimed to increase the usage rate of mother's own milk (MOM), which we used as a surrogate for breastfeeding, among neonates with NAS.

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OBJECTIVE

Our specific, measurable, attainable, relevant, and time-limited (SMART) aim was to increase the usage rate of MOM among neonates with prenatal opioid exposure by providing extensive postpartum counseling to mothers with OUD from a baseline average of 47% (January 2017–September 2018) to an average of 75% by December 2020.

METHODS

Setting

University of Florida Health – Jacksonville (UFHJ) is a tertiary academic center that serves as a safety net hospital for a mostly inner-city population. UFHJ houses a busy newborn service with approximately 3000 deliveries yearly from January 1, 2017, to December 31, 2020 (range 2811, 3285). During the same period, we admitted 399 at-risk neonates for NAS observation and/or treatment in the NICU. In accordance with the guidance from American Academy of Pediatrics (AAP), we monitor infants at risk for NAS for clinical signs of withdrawal for three to seven days, depending on the details of maternal substance use. Initially, a medical team composed of a pediatrician, a nurse practitioner, and three to four pediatric and family practice residents cares for these infants in the mother–baby unit. The team will transfer an otherwise stable infant to the NICU only if significant signs of withdrawal develop and/or the infant requires further monitoring after maternal discharge.

Context

In our experience, parents frequently asked questions about the care their infant would receive after transfer to the NICU and inquired how they could actively participate. Apart from informal education provided in the obstetric clinic during a mother's prenatal visit, we lacked a formal counseling process on NAS in the postpartum period. The infant's initial stay with the mother in the mother–baby unit provides an opportunity for bonding and establishing breastfeeding. In our unit, infants with NAS had a low usage rate of MOM (baseline of 47% from January 2017 to September 2018). Breastfeeding by mothers with OUD can be an important means for parents to partner in infant care. We developed an interdisciplinary team that worked to increase the usage of MOM by developing strategies for more effective counseling of mothers with OUD. The number of providers whom we needed to influence was 62, consisting of five attending physicians, two nurse practitioners, 50 pediatric and family medicine residents, one nurse educator, one clinical quality nurse leader, and three lactation consultants. We identified key primary drivers (Fig. 1) and tested several Plan-Do-Study-Act (PDSA) cycles to improve the usage rate of MOM and the completion of parental counseling while the neonate is in the mother–baby nursery.

Our pragmatic approach was to provide extensive postpartum counseling and education to mothers with OUD with the exception of mothers who were incarcerated and unavailable, mothers with serious psychiatric or medical illness requiring hospitalization, and mothers who had chosen to transfer guardianship to an adoptive family. For the analysis for MOM usage rate, we included infants born at UFHJ at ≥ 35 weeks' of gestation who had been exposed prenatally to opioids and whose mothers had no contraindication to breastfeeding such as exposure to illicit substances or active human immunodeficiency virus (HIV) infection. Prenatal substance exposure was defined either by maternal history or by positive urine drug screen of mother and/or baby. We also excluded infants with coexisting medical conditions necessitating admission to NICU and infants transferred directly to NICU from outside hospitals.

Interventions in the MOM-NAS QI initiative

PDSA 1. Beginning in 2019, we developed a multidisciplinary team consisting of physician providers, nurse educators, and lactation consultants and conducted brainstorming sessions to identify key drivers for improving parental knowledge about NAS and increasing MOM usage. The team recognized that the immediate postpartum period of parental stay in the hospital was the ideal opportunity for counseling. Some mothers had irregular or infrequent access to prenatal care and less than optimal counseling about NAS and breastfeeding. Because parents room in with the at-risk infant for at least two days after birth, this was the ideal time to provide counseling on breastfeeding and education on NAS. Although every family received some routine postpartum support by lactation team members, we escalated education and encouragement among parents of infants at risk for NAS about the benefits of MOM.

PDSA 2. Participation in the NAS initiative from FPQC followed by frequent team meetings boosted initial enthusiasm. Due to escalated efforts by the lactation team, we witnessed an immediate increase in MOM usage from November 2018 to March 2019. However, we were unable to track our process measure because we had not developed a standardized means of documenting counseling. We created a SmartPhrase™ (Epic®, Madison, WI) that providers could use to document counseling in the electronic medical records (EMR). By integrating this process into routine clinical workflow, we encouraged accountability and facilitated our ability to track the rate of counseling.

At the same time, a core group of providers also started counseling these parents. The core group consisted of three pediatric residents involved with this project and two nurse practitioners. Counseling emphasized the benefits of breast milk and also focused on other aspects of NAS.

PDSA 3. Once the core group of providers started counseling, the team realized that individual members did not communicate consistent information in a structured format to parents. In response, we designed

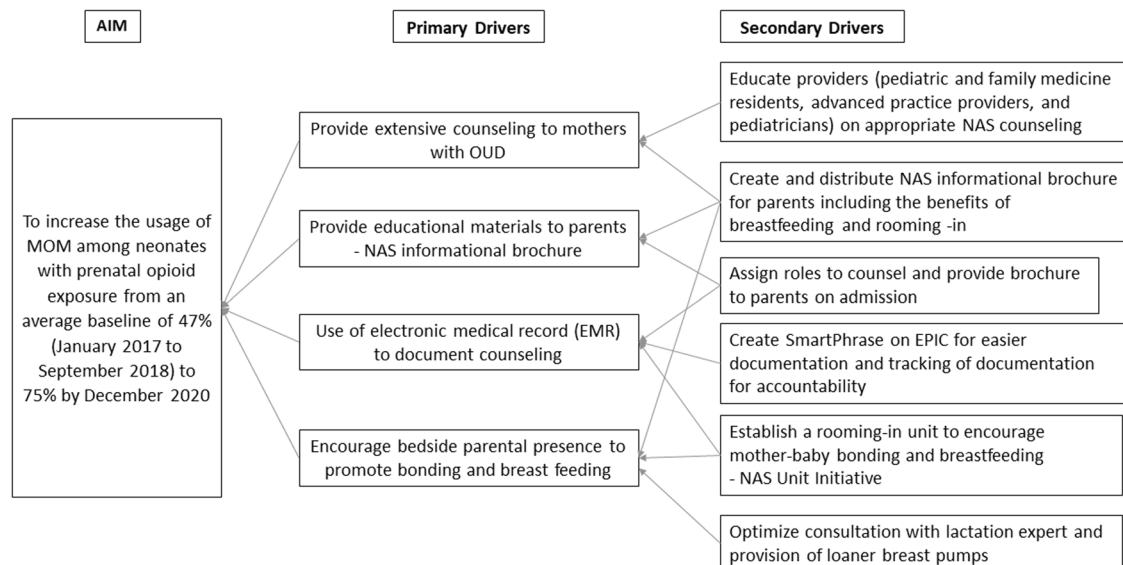


Fig. 1 Key driver diagram.

an information brochure on NAS as a resource for parents. Starting June 2019, the team members used this brochure to structure parental education and then provided a copy to the parents for their further reference. Subject matter included an explanation of NAS in simple terms, NAS management strategies, the range for the duration of infant hospitalization, the criteria for safe infant discharge, and the importance of breastfeeding, parental bedside availability, avoidance of unnecessary stimulation, and infant swaddling and consoling. Through this education, we hoped that parents could play a vital role in improving outcomes.

PDSA 4. We well understood that our NICU geometry did not allow parental rooming-in. Our NICU has an open floor plan with no private patient rooms. As a result, a mother with OUD was not able to room in with an infant at risk of NAS. We communicated this limitation with hospital administration and explained to them the benefits of rooming-in [19]. Providing an environment to promote mother–baby bonding would not only avoid family separation but also has the potential to reduce the need for pharmacotherapy and length of hospital stay, thus reducing hospital costs. We also reached out to the community and obtained financial support from Children's Miracle Network Hospitals (CMN) and Walmart to help us convert four regular medical-surgical rooms into an NAS unit. Starting in August 2019, we offered parents to room in with their infants and actively participate in the care including feeding, swaddling, and consoling the infant. In this setting, team members were better able to interact with parents and to reinforce the components of essential non-pharmacologic care for infants at risk for or with signs of NAS, including breastfeeding.

PDSA 5. By October 2019, the team identified several missed counseling opportunities due to the lack of daily availability of the core group of providers. To engage providers outside the core group, an educational conference was organized for all pediatric resident physicians on the aspects of NAS counseling. The residents were educated on the importance and timing of parental counseling along with the use of the NAS brochure for parents. All pediatric residents were then allowed to counsel the parents of at-risk infants.

PDSA 6. Although the rate at which the team counseled families about NAS did increase after December 2019, we identified intermittent missed opportunities. We started sending out email reminders to all the pediatric and family medicine residents rotating through the mother–baby unit at the beginning of their rotation. The email described how to identify at-risk infants, when and how to perform parental counseling, and how to document the counseling encounter in the electronic medical record. The email also reminded the providers to use the information in the NAS brochures for structured counseling and to provide these brochures to the families.

Measures

Our primary outcome measure was the usage rate of MOM, which we defined as the number of neonates receiving MOM for the first three days of life divided by the total number of neonates eligible to receive MOM, expressed as a percentage. These data were collected prospectively from 2019 per the requirements of the FPQC statewide QI collaborative on standardizing NAS diagnosis and treatment. We retrospectively collected data on the usage rate of MOM before 2019. We tracked the usage rate of MOM using a quarterly p-chart (Fig. 2).

As a process measure, we performed monthly retrospective chart reviews to identify parents eligible for counseling. Parents who were counseled were identified using the documentation in EMR via SmartPhrase™. We determined the rate of counseling by dividing the number of families counseled per month by the total number of families eligible for counseling in that month and updated this rate monthly on a p-chart (Fig. 3). We did not judge it necessary to employ a balancing measure.

Data analysis

Quarterly usage of MOM (primary outcome measure) among eligible infants was plotted in an annotated statistical process control (SPC) p-chart. The p-chart served as the primary tool for SPC analysis in distinguishing special-cause variation that might be attributable to our planned interventions versus common-cause variation that is secondary to inherent variability outside of our interventions [20, 21]. A similar monthly p-chart was produced for the rate of the process measure of counseling to

track the progress and eventual integration of postpartum counseling into regular clinical workflow.

Ethical consideration

This project was registered with the University of Florida Quality Improvement Performance Registry (QIPR) at <https://qipr.ctsi.ufl.edu> and was judged to be a QI and not a human research project. We did not share or disclose any sensitive or identifiable health information outside UFHJ.

RESULTS

From January 2017 through September 2018, the average usage rate of MOM was 47% (46/98) among neonates with a diagnosis of NAS for whom there was no contraindication to breastfeeding (Fig. 2). When the FPQC NAS quality collaborative started in November 2018, we formed our team to intensify postpartum counseling, and there was an immediate increase in MOM usage to 90% (9/10) in the last quarter of 2018, increasing further to 100% in the first quarter of 2019. We attributed this initial increase in MOM usage rate to the enhanced enthusiasm and efforts led by the lactation team to educate families about the benefits of MOM. However, four subsequent quarterly MOM usage rates did not reach these high levels, although they remained well above the baseline rate. We had created NAS brochures, established the NAS unit for rooming-in, and increased the number of counselors by conducting an educational conference for residents on NAS, but it was not until we started emailing reminders at the beginning of every four-week block of clinical rotation in March 2020 that we consistently sustained high rates of both MOM usage and counseling (Figs. 2 and 3). After conducting all our PDSA cycles, our MOM usage rates for each of the nine quarters from October 2018 to December 2020 exceeded the baseline rate of 47% demonstrating special cause variation associated with our multiple interventions. Of note, MOM usage rate of 85% (88/103) exceeded our goal of 75% (Fig. 2).

Our process measure was the rate of parental counseling that focused on NAS education and reinforcement of the importance of breastfeeding in the postpartum period (Fig. 3). Beginning in April 2019, we noted a gradual increase in counseling rates, but this increase lagged behind the initial increase in the rate of MOM usage. Because counseling by the lactation team in the first quarter of 2019 was not documented, we could not determine the counseling rate for this period. However, once the EMR SmartPhrase™ was created, documentation of counseling was present in the EMR for 20% of eligible parents in the first two months. During brainstorming study sessions, we judged that our non-standardized approach contributed to our lower than desired counseling rate. Beginning in June 2019, we started using standardized NAS handouts to assist physicians with structured counseling. Following this, documentation of counseling increased over the next three months to 65%. By October 2019, the team recognized that counseling did not occur when a member of the core group of providers was not available. In response, we augmented the number of providers who could counsel through an educational conference. By February 2020, the rate of documented counseling had surpassed 85%. In March 2020, we began to send email reminders to incoming providers on the newborn rotation about our NAS quality improvement initiatives and witnessed a sustained improvement in documented counseling rates through December 2020. Similar to our improvement in MOM usage rate, our interventions were associated with an improvement in the documented rate of postpartum counseling about NAS – there was a clear upward shift with 14 data points above the centerline of 49% in postpartum counseling, also a special-cause variation in our process measure suggestive of effective intervention.

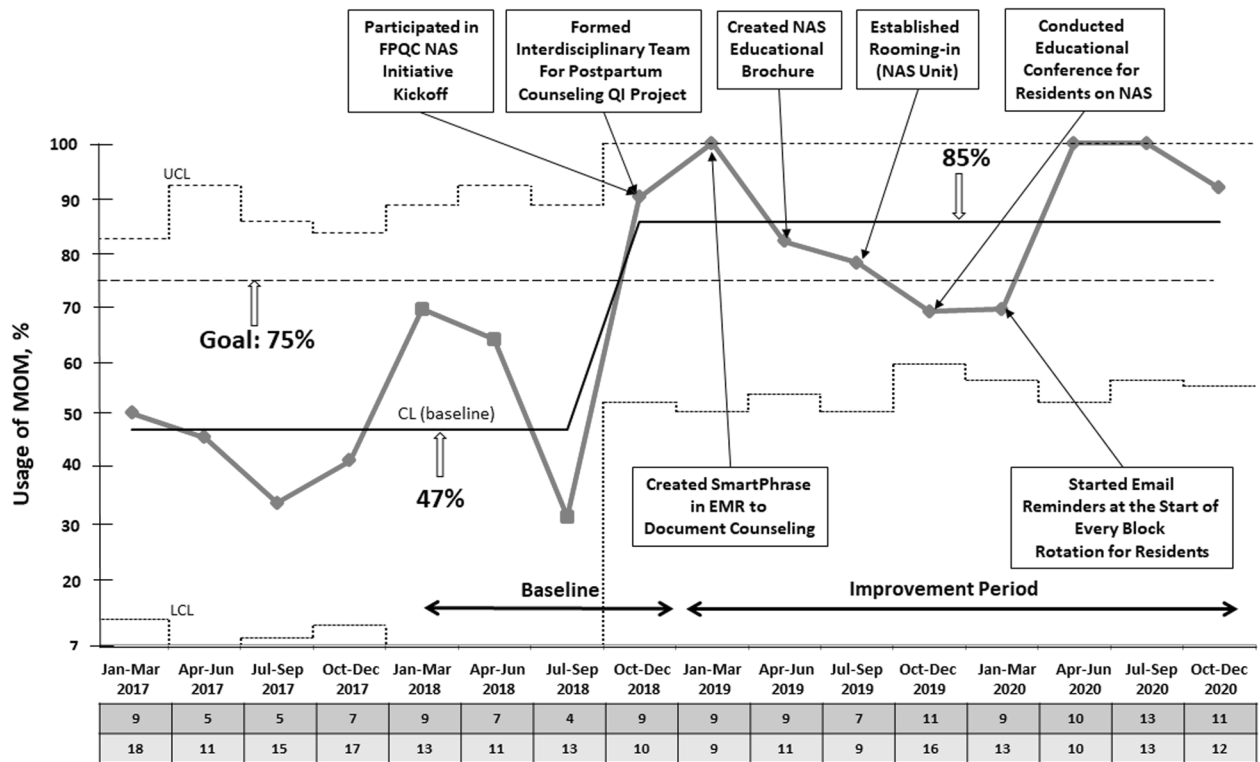


Fig. 2 Annotated SPC p-chart of MOM usage rate among eligible neonates. Solid red line with dot—MOM usage rate (%). Solid black line – central line (CL) or mean MOM usage rate (47% pre-, 85% post-intervention). Broken dash line – goal for MOM usage rate (75%). Broken dotted line—upper control limit (UCL) and lower control limit (LCL). Numerator on x-axis - number of neonates receiving MOM for the first three days of life. Denominator on x-axis - total number of neonates eligible to receive MOM.

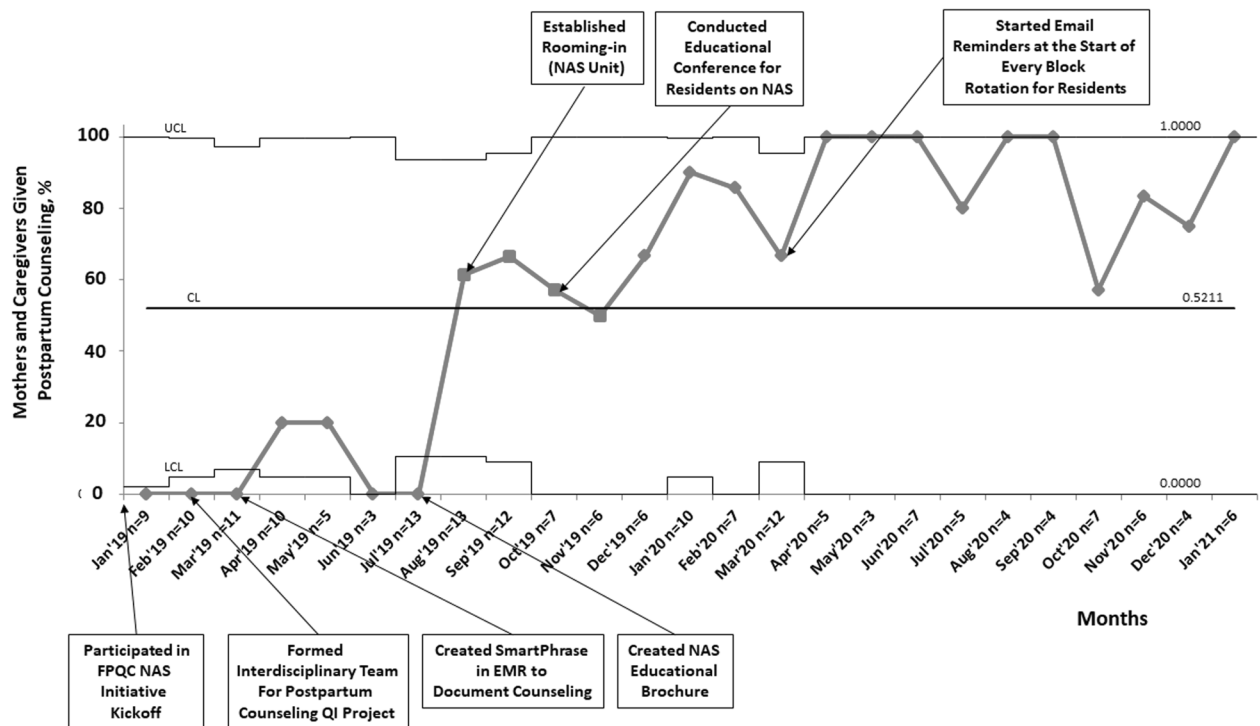


Fig. 3 Annotated monthly p-chart of postpartum parental counseling for neonates at risk of NAS. Solid red line with dot – proportion of mothers/caregivers given postpartum counseling. Solid thick black line – central line (CL). Solid thin black line – upper control limit (UCL) and lower control limit (LCL). n on x-axis - total number of mothers/caregivers of infants at-risk of NAS per month.

DISCUSSION

Through a series of quality improvement efforts, we were able to increase the usage rate of MOM among neonates hospitalized for NAS treatment and/or observation. Applying QI tools and methodology, we demonstrated improvement in postpartum counseling of mothers with OUD, and used this as a primary tool to improve MOM usage. We instituted formal education of providers, followed by structured counseling opportunities for parents of infants at risk of NAS. We integrated this process in daily clinical rounds of the resident physicians to reduce impediments to workflow and to achieve sustainability.

The rise of OUD in pregnancy and the corresponding increase in neonates at risk of NAS have led to longer hospitalizations and higher healthcare costs. In 2017, compared with other birth hospitalizations, neonates with NAS had longer length of stay (10.8 days [95% CI, 9.9–11.6] vs. 1.6 [95% CI, 1.6–1.6]) and higher estimated healthcare cost (\$18800 [95%CI, \$17400–\$20300] vs \$4200 [95% CI, \$4000–\$4500]) compared to comparable newborns, not at risk of NAS [2]. Clinicians have implemented many strategies to improve these outcomes including the adoption of consensus standardized management protocols, including the promotion of breastfeeding [10, 22, 23]. Although methadone and other opioids are secreted into human milk, the benefits of breastfeeding in neonates at risk of NAS are greater than the relatively small amounts of opioids that infants ingest [17, 24]. The act of breastfeeding itself as part of an intensive non-pharmacologic approach in NAS soothes at-risk neonates and is likely to reduce the severity of withdrawal signs [15, 23, 24]. In our initiative, we used the MOM usage rate as a surrogate for breastfeeding but a majority of our subjects were indeed engaged in breastfeeding. We defined MOM usage as the provision of mother's breast milk for at least the first three days of admission. This indicated a positive maternal intent to breastfeed and meaningfully participate in infant care. Beyond this, some of the parents had difficulty rooming-in with the infant or provide frequent breast milk due to varied social circumstances.

Our baseline MOM usage rate was less than 50%, similar to other centers' baseline breastfeeding rates among neonates with NAS [11, 15, 16]. We set the ambitious goal of increasing MOM usage rate to 75% and surpassed this aim due to our intensified focus on educating and counseling mothers with OUD. We identified two potential barriers to reaching our goal. The lack of a structured education process resulted in suboptimal counseling rates. We were able to overcome this barrier by creating a comprehensive NAS handout for providers and parents. This made the process of counseling easier for the providers, therefore, increasing provider adherence. As the NAS handout summarized the information, it acted as a guide for the mothers. The other significant barrier was the number of providers that were initially able to counsel. Structured resident lectures, emailing of educational resources for providers, and peer-to-peer education significantly increased the number of providers and substantially improved our ability to afford mothers on-demand access to counseling.

Establishing the four-room NAS Unit very likely contributed to our success in MOM usage. Rooming-in and breastfeeding play key roles in the non-pharmacologic strategy in managing neonates with NAS [19, 24, 25]. Rooming-in may have itself stimulated breastfeeding, hence our observed increase in our MOM usage. Encouraging parents to promote bedside presence and provide MOM requires a great deal of parental counseling. Families should be educated on interventions that can improve NAS outcomes. We focused on providing early and effective counseling to ensure that parents are well informed about the strategies they can adopt to help improve NAS care. Several factors other than parental counseling contribute to successful and continued breastfeeding. Maternal health conditions, socioeconomic factors, availability of transportation to and

from the hospital, and lactation support after hospital are some of these factors. Since our outcome measure was the provision of MOM for the first three days, we gave emphasis to education during the immediate postnatal period.

We recognize that multiple factors determine the short- and long-term outcomes of NAS infants and that achieving enhanced parental education and participation is only one of the aspects of a multidimensional approach. Efforts by our multidisciplinary team led to improved rates of parental education and counseling about the management of NAS, which ultimately led to improved MOM usage. We are beginning to collaborate with local organizations to start parental counseling in the prenatal period. We also plan to analyze the impact of these interventions on length of stay, cost of hospitalization, and rates of pharmacotherapy among neonates with NAS or at-risk of developing NAS.

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AUTHOR CONTRIBUTIONS

IH, SS, JC, MM, AE, PS helped design and implement the study. AA, JM collected data on MOM usage. JV helped to implement the study and educate the staff members. IH, SS, JC helped to write the manuscript. MLH provided guidance, mentorship, and reviewed and critically revised the manuscript.

COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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