

QUALITY IMPROVEMENT ARTICLE



A quality improvement initiative to increase family engagement and reduce disparities in visitation via telehealth in a level III neonatal intensive care unit

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BACKGROUND: Parental presence at bedside is a critical component of family-centered care for infants admitted to Neonatal Intensive Care Units (NICUs) and their caregivers, allowing for engagement with baby as well as education from the care team.

LOCAL PROBLEM: Many families face barriers to physical presence, including transportation, childcare responsibilities, work, and illness, among others.

INTERVENTIONS: Telehealth can be an avenue for parents to be engaged while not directly at bedside. This project details efforts to launch virtual visits in a Level III NICU, including challenges and lessons learned, across 4 PDSA cycles.

METHODS: We measured the percentage of families on the NICU who attended 4 or more cares sessions per week. We obtained survey responses and open-ended feedback about the implementation from staff and patients.

RESULTS: Family engagement rates were higher during active PDSA cycles at trending significance level. Most providers and parents rated the intervention as highly feasible and satisfying. Attendance in cares sessions improved across the QI project, especially for families with public insurance.

CONCLUSIONS: We found that telehealth visits were able to lessen the disparities in cares participation rates between families with private insurance and families with public insurance.

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STATEMENT OF THE PROBLEM

Family-centered care is beneficial to both infants admitted to neonatal intensive care units (NICUs) and their families. In response, many hospital systems implement family engagement initiatives aimed at improving the infant-parent relationship and increasing parental readiness to care for their infant(s) after discharge. A vital component of family engagement is parental presence at bedside, which allows time for parent-infant bonding and parent education about their infant's care [1]. Unfortunately, engagement in regular visitation is challenging for many NICU families. This was identified as a key area for improvement in the University of Colorado Hospital (UCH) NICU.

AVAILABLE KNOWLEDGE

In the United States, families of an infant admitted to the NICU may face barriers to visitation and engagement at multiple levels. At the policy level, there is no national standard for paid parental leave benefits, leading families to determine what, if any, leave they qualify for and whether it will be paid or unpaid. While some parents have flexibility and resources to meet their participation and engagement needs, others must return to work quickly or

prefer to save their leave for when the infant comes home [2, 3]. Distance from the hospital is another barrier that can significantly impact parental presence at bedside [3]. Level III and IV NICUs often accept infants from large, multi-state catchment areas, meaning the hospital may be hours away from where the family resides. Transportation and childcare can also impact visitation [2]. While all families may be affected, these barriers are more likely to impact physical presence in the NICU for families with fewer financial resources and/or those who reside in rural/remote geographical regions.

RATIONALE

At our institution, the level III NICU treats a large population of infants born under 30 weeks from across the state and some surrounding states in the Rocky Mountain region. Premature infants are anticipated to have stays at least until their anticipated due date, if not longer, leading to lengths of stay of several months [4]. If additional medical complications occur (e.g., level III/IV intraventricular hemorrhage, sepsis, need for tracheostomy), infants may be transitioned to a nearby Level IV NICU and experience lengths of stay well beyond the estimated due date.

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In this NICU, a vital component of family engagement includes parents joining nursing care sessions (allowing the opportunity to care for and/or hold their often medically-fragile infant), interact when the infant is awake, soothe them when distressed, and receive education from nurses and the medical team about their infant's changing needs. Nursing care sessions occur up to six times per day during routine care for infants (e.g., physical exams, repositioning) and may be referred to as cares, care times, or care sessions interchangeably. When families work with nurses to carry out these activities, the opportunities for practice help prepare parents for the transition home and engage with the medical team. Many NICU families experience challenges with regular physical presence and participation in care sessions. From March 2020 to December 2020, 62% of families reported at least one barrier to visitation at two weeks post-admission, including: transportation (6%), distance from hospital to home (13%), work (21%), parental medical problems (16%), and care for siblings/extended family members (18%) [5]. Further, approximately 40% of the infants admitted to the UCH NICU are insured by Medicaid and represent a population that disproportionately experience these barriers.

SPECIFIC AIMS

The primary aim of this quality improvement (QI) project was to improve family engagement in care sessions by providing virtual opportunities to participate. A secondary aim of this QI project was to address disparities in engagement, specifically among families disproportionately facing barriers to physical presence on the unit. An initial chart review of family participation in care sessions across one week in April 2021 for families of infants over 14 days old found that 75% of families were present and joined care times at least once per day for most days of the week (i.e., 4 or more). The multidisciplinary team leading this QI initiative (described below) received funding from the University of Colorado's Institute for Healthcare Quality, Safety, and Efficiency to implement this initiative. The goal was to improve family participation in cares to 90% across the NICU among infants 14 days or older by establishing virtual opportunities for family participation.

METHODS

Setting/context

Family engagement was identified as a key priority to improve in this NICU, especially in 2021 as many families, especially families experiencing financial and geographical challenges, experienced barriers to physical presence related to the COVID-19 pandemic. Leaders from psychology, neonatology, and nursing designed this QI project in May 2021. The project began in July 2021 and implementation ended April 2023.

The UCH NICU is a Level III medical facility, offering specialized care to neonates born with complications. This 50-bed unit provides care to approximately 650 infants annually, with many born at less than 29 weeks of gestation or weigh less than 4 pounds. UCH has the capabilities to resuscitate and care for some infants as young as 22 weeks gestation. Of those admitted, approximately 40% have primary Medicaid insurance.

The team leading this QI initiative is composed of psychologists and psychology trainees who provide integrated care with medical providers, nursing staff, developmental therapists, and social workers for 5 days per week in the NICU. Psychologist and psychology trainees support the health and well-being of infants by supporting dyadic attachment and bonding, addressing parental behaviors and thoughts/self-narratives that may interfere with attuned caregiving, educating parents on specific developmental and behavioral needs of preterm and medically complex infants, and problem-solving barriers to engagement when possible. The team routinely supports improving services for NICU families and staff, and collaborates in a multidisciplinary approach with the medical team and nursing management.

Ethical considerations

The University of Colorado institutional internal review board determined this project was an exempt QI project. Data was kept in HIPAA compliant

systems (i.e., electronic medical record, REDCap, UCH encrypted Microsoft Teams).

Intervention

The intervention involved inviting parents to join a nursing care session once per day via videoconferencing on days caregivers could not physically be in the NICU. The virtual option was expected to improve participation in care by all families and address disparities in receiving care for those who could not be at bedside. The plan was to offer virtual sessions (sometimes referred to as virtual visits as named by the electronic medical record) to families of all infants admitted once they reached 14 days of life (DOL).

Preparation efforts in July and April 2021 included obtaining six tablets, locking cases, and moveable/hands-free stands, establishing HIPAA secure workflows for virtual visits, determining data capture methods, collecting baseline data, developing and refining proposed workflows based on feedback from involved parties, and training medical team members on workflows. Availability of interpreters was ensured and hotspots were available to families with limited internet connection at home.

Study of intervention

The implementation and impact of the virtual care sessions was monitored by (a) documenting when the go-live for each intervention element occurred; (b) mapping the go-live for each step onto run charts to visualize whether the step coincided with changes in outcomes; and (c) obtaining informal feedback about the implementation from impacted staff and patients.

Measures

Primary and secondary outcome metrics. The primary outcome was regular caregiver (parent or other family caregiver) participation in nursing care sessions (either in person or virtually), at least once per day for four or more days per week. Nurses documented parent/caregiver participation in cares in the electronic health records as part of routine documentation practices following care times. A secondary outcome metric examined how participation disparities, based on an indicator of socioeconomic status (i.e., Medicaid status of the birthing parent), changed over the length of stay.

Process metrics. Process measures indicated whether the intervention was implemented and acceptable. Tablet device usage logs were audited and cross-referenced with check-in and check-out logs for the tablets maintained by nurses. Feedback about the acceptability of the intervention was gathered using a survey sent to the staff/provider and families following each virtual visit. The 5-item survey asked about (1) ease of connecting to the visit; (2) quality of virtual visit; (3) family's perceived ability to interact with the infant during the visit; (4) perceived ability for the family and provider/staff to interact during the visit; and (5) perceptions about learning something new during the visit. Surveys were rated on a 5-point Likert scale (1 = *Strongly Disagree* to 5 = *Strongly Agree*) with higher scores indicating more feasibility or acceptability. Respondents were asked to provide open-ended feedback about their experiences with the virtual visit option. This approach allowed adaptation of the intervention to the specific context of the NICU and addressing emerging issues promptly.

Structural metric. We developed user-tip sheets for staff and families to set up and connect to video-conferencing. We also developed protocols/workflows for implementation.

Analysis

Regular participation in care sessions was tracked via data extracted from flowsheets documenting parental participation by nursing staff in the electronic health record. A QI team member reviewed these flowsheets for all infants in the NICU with age of 14 days or greater on a weekly basis and documented daily participation in a care session for each infant (i.e., 1 = participated; 0 = did not participate). The number of days at least one caregiver participated in cares (virtually or in-person) was summed for each week. Those with a total score of 4 or higher were dichotomized (i.e., 1 = joined 4 or more care sessions; 0 = joined 3 or less care sessions). Finally, we calculated the proportion of infants (14 days of age or older) with regular caregiver participation in nursing care sessions each week out of all infants in the NICU age 14 days of age or older. Descriptive analyses were completed to summarize responses to surveys.

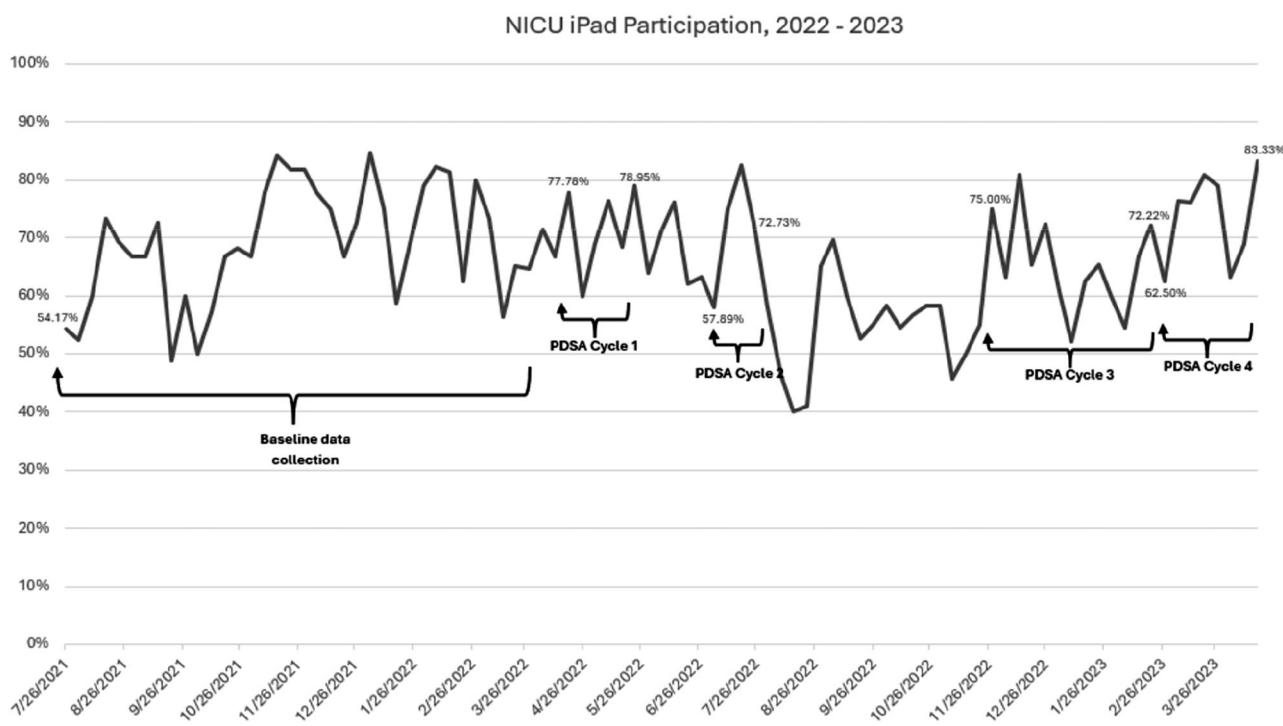


Fig. 1 Participation run chart.

RESULTS

Primary outcome metric

The run chart in Fig. 1 depicts the change in regular participation in nursing care times across all infants in the NICU each week. The four iterative phases in the intervention process are documented on the chart and described below. Baseline data from pre-implementation (July 2021 to April 2022) indicated that 69.0% of families, on average, joined 4 or more nursing care sessions per week. The family engagement rate improved to 71.7% during the 1st PDSA cycle. Implementation was paused between the 1st and 2nd PDSA cycles (May 2022 and July 2022) and the family engagement rate decreased to 67.3%. Family engagement slightly increased to 71.8% during the 2nd PDSA Cycle and then decreased to 55.4% between the 2nd and 3rd PDSA cycles. The family engagement rate was 64.9% during the 3rd PDSA cycle and improved to 72.4% between the 3rd and 4th PDSA cycles. Finally, the family engagement rate was 72.0% during the 4th PDSA cycle. A one-way ANOVA was conducted comparing the family engagement rate between non-active PDSA cycles (i.e., baseline, between cycles) and active cycles. Family engagement rate met assumptions of homogeneity (i.e., non-significant Levene statistics (1,88), $p = 0.22$) and normality (skew = -0.26, std. error = 0.25). Results indicated a marginally significant trend, $F(1,88) = 2.96$, $p = 0.09$, such that family engagement was higher during active PDSA cycles ($m = 69.0\%$; $SD = 8.67\%$) compared to non-active PDSA cycles (66.2% ; $SD = 10.5\%$).

Disparities in care session participation

Baseline data indicated that infants with Medicaid at birth (a proxy indicator for socioeconomic status) had lower rates of family engagement in care compared to those with commercial insurance. This gap increased over the length of stay. We noticed a trend that virtual care options mitigated the sharp decline in family engagement among families with Medicaid insurance who had longer NICU stays. At baseline, the family engagement rate for those with commercial insurance improved from 84.4% to 85.7% while the rate for those with Medicaid insurance dropped from 59.3% to 10.0% within the first 90 days of life (See Fig. 2). At the

end of the QI initiative, families with commercial insurance improved in engagement from 81.8% to 90.0%. Importantly, the family engagement rate among Medicaid-insured families remained steady (i.e., with limited decline) from 59.3% at the beginning to 50.0% at the end of the study, as shown in Fig. 2.

Feasibility and satisfaction

Survey responses indicated that most providers and parents agreed that: virtual visits were *easy to connect* (provider: $M = 4.24$; parent: $M = 4.92$), *technical quality was good* (provider $M = 4.35$; parent $M = 4.67$), virtual visits *allowed family interaction with baby* (provider: $M = 4.68$; parent: $M = 4.83$) and *family interaction with provider* (provider: $M = 5.0$). Most providers and parents agreed that the family learned something new about their baby's care during the virtual visit (provider: $M = 4.67$; patient: $M = 4.65$). See Table 1 depicting qualitative feedback stratified by barriers addressed by the intervention (i.e., facilitators) and barriers to implementing the intervention.

Implementation phases

Cycle 1 focused on the testing of initial technical and logistical workflows and ran from April to May of 2022. Cycle 2 focused on implementation with nurse champions to increase buy in from nursing staff and build more awareness of the intervention and was executed in June and July of 2022. Cycle 3 involved specific intervention with families who were not meeting the target participation metric as well as supporting staff more efficiently and ran from November 2022 to February 2023. Finally, Cycle 4 involved further refining workflows. All cycles and corresponding dates, steps taken, and lessons learned are summarized in Table 2.

Post implementation status

Currently, telehealth visits are recommended and available for all families. Statistically, we see higher usage rates coinciding with high rates of respiratory illness in the community. The QI team still receives the weekly list of families not meeting the metric of 4 care sessions per week and work with nurses and families to remind and encourage this option. Telehealth visits have been

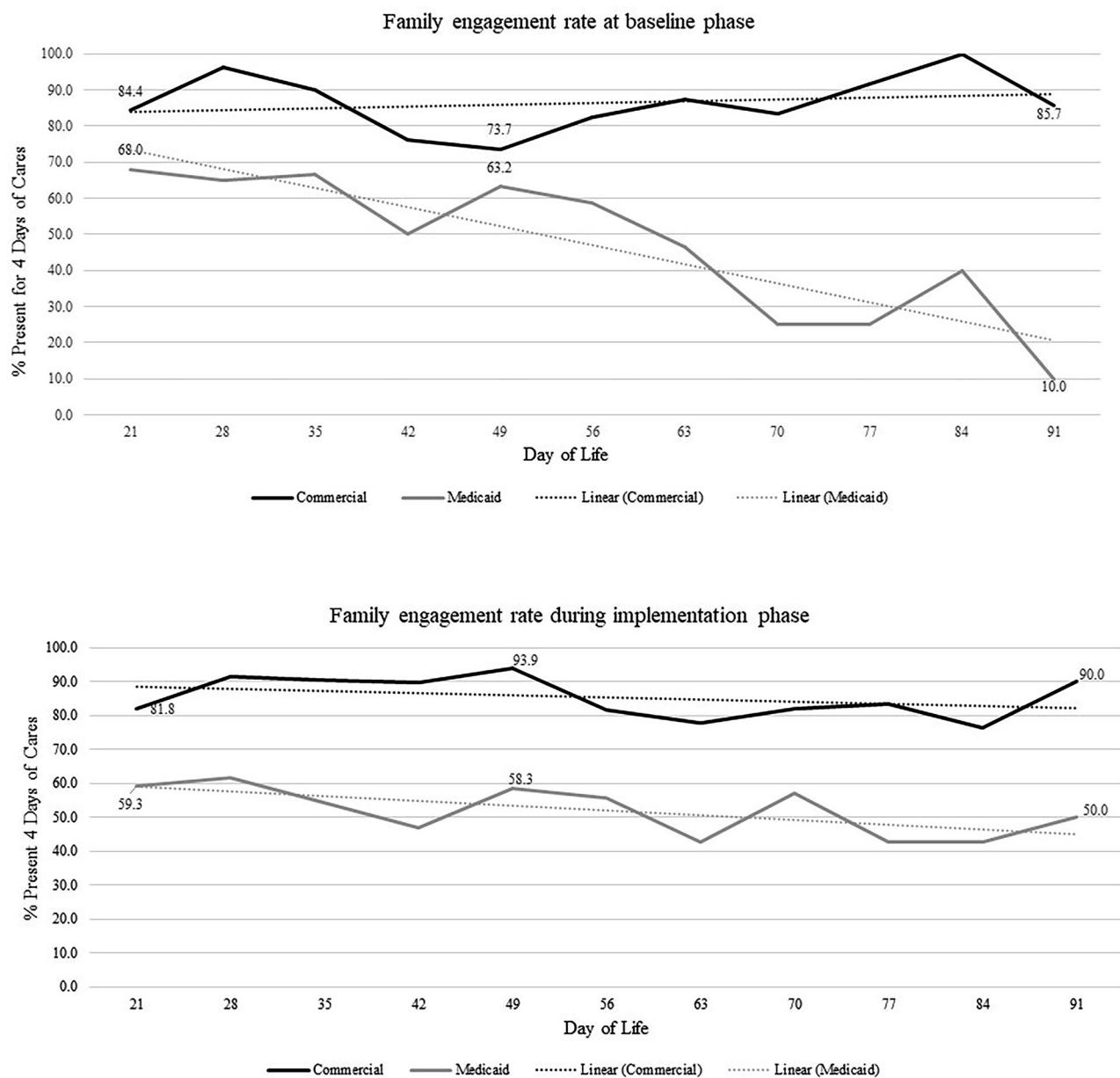


Fig. 2 Family engagement rates across baseline and implementation cycles stratified by insurance status.

adopted by other disciplines such as developmental therapies for their sessions when families are not physically present. Finally, the QI team periodically re-educates staff of the aim of virtual visits and how this differs from passive video systems where families join at will.

DISCUSSION

The implementation of a virtual option for NICU care was associated with a notable improvement in family engagement, reversing a concerning trend observed prior to the intervention. In particular, the improvement in engagement seemed to vary depending on family insurance status. For families with commercial status, engagement slightly improved closer to the target. Importantly, the virtual option appeared to mitigate significant decline in engagement that occurred while PDSA cycles were inactive among families with Medicaid insurance. These findings suggest that the introduction of a virtual care option not only improved overall parental engagement but also had a stronger

positive impact on families with Medicaid, who are disproportionately affected by adverse social determinants of health.

The findings of this study align closely with existing literature on family engagement in NICU care. Prior research has consistently shown that lower NICU engagement is often linked to caregiver employment challenges, such as inflexible work schedules and lack of paid family leave, which disproportionately affect low-income families [6]. Additionally, studies have demonstrated that household income is correlated with time spent by parents in the NICU, highlighting the economic barriers to engagement [7]. We document a similar trend, with overall lower engagement throughout the study period for families on Medicaid. Previous research has demonstrated that interventions aimed at increasing family engagement can significantly increase presence at bedside even for those at higher risk for lower engagement, such as those who live further away and younger parents [8]. While our study observed a 10% increase in engagement for families with commercial insurance, it is particularly noteworthy that engagement among Medicaid-insured families increased by

Table 1. Perspectives on feasibility.

| Qualitative | | |
|--------------------------|--|--|
| | Patient | Provider |
| Feasibility Facilitators | <p>Access Barrier Addressed: Physical Location "Please keep this program going it is beyond useful and helpful to those parents that are unable to be at the facility!" "I have gone through a couple of health issues lately. If there was not a program like this one, I would miss out on a couple days with my baby. It's amazing to be able to see her even if I couldn't physically be there."</p> | <p>Access Barrier Addressed: Time Constraints "I haven't been able to meet mom in person as our schedules don't align so it was amazing to be able to introduce our role and explain what we do via video."</p> <p>Access Barrier Addressed: Transportation "This was a wonderful way to connect with a family that is not able to come interact with their infant often due to transportation issues."</p> <p>Access Barrier Addressed: Language Preference "I love that this is something that we can offer our families including our families that require interpreter services"</p> <p>"It was great that we were able to have an interpreter on the video chat as well."</p> |
| Feasibility Barriers | No comments fell into this theme | <p>Staff Workload: "A virtual call for patients who can't visit is a good concept, in this unit, it's not optimal. [We have] busy assignments and short staff. Parents expect a lengthy interaction [and] virtual visits more frequently."</p> <p>Technical Issues: "Poor connection for the interpreter" "One iPad didn't work. [We] had to get a second iPad, which was a big challenge due the baby being under contact precautions."</p> |

approximately 40%. This significant improvement, and the lack of decline throughout the course of admission, suggests that the introduction of a virtual care option effectively addressed some of the systemic barriers to engagement for low-income families, contributing to a more equitable care environment.

Our findings highlight several key implications for practice at this academic center. First, the project provides a case example of successfully embedding technology into existing NICU care workflow. Second, the project assisted with shifting overall NICU culture around parental involvement. Survey data from nursing staff on the use and importance of virtual engagement improved throughout the study period due to partnering with interdisciplinary teams, involving focus groups, rapidly responding to feedback, and identifying nurse champions.

The implementation of this virtual intervention on a broader scale requires careful consideration of several factors. The benefits of increased parental engagement—correlating with better neonatal outcomes, stronger parent-child attachment, and a smoother transition from hospital to home—underscore the potential value of expanding this model [9]. However, balancing measures must be addressed, particularly the burden on nursing staff. Nurses initially reported feeling pressured by lengthy virtual visits, which competed with other duties. This highlights the need for balancing technology use with the practical demands of nursing care. Scalability and feasibility are also critical considerations. Implementing this model in other NICU settings would necessitate addressing issues such as technology access, staff training, and associated costs. In our project, the successful integration of a virtual option was closely linked to face-to-face interactions with NICU staff, allowing for individualized support and education. This level of personal engagement may be challenging to replicate. Additionally, the financial investment in tablets, staff training, and ongoing technical support poses significant challenges for broader adoption. These factors must be weighed carefully to determine the practicality of scaling this model to other NICUs.

Reflecting on our experience, a few key lessons emerged that could inform future efforts. Initially, our attempt to offer a virtual option across all nursing shifts created workflow confusion and inconsistent parental involvement. We learned that

implementation changes are more effective when done in small, incremental steps before expanding unit-wide. Starting with the night shift, where staff numbers are lower, could allow for more focused and individualized support, leading to better outcomes. Additionally, the identification of nurse champions, who naturally emerged as they recognized the project's benefits for low-income families, was pivotal in shifting NICU culture toward embracing virtual care. However, delays in formally recognizing these champions hindered early adoption. In future projects, early identification and formalization of these roles will be crucial. Lastly, establishing video connections was a consistent challenge, and distributing one-page instructional fliers earlier in the implementation could mitigate this issue and reduce reliance on research personnel for technical support.

Limitations and future directions

This project began during the COVID-19 pandemic. Our unit and hospital, like others, dealt with significant challenges as far as visitation policy changes, staff shortages, and increased distress, among others. While we gained buy-in from nurses and other staff, we had to recognize that new workflows were not the priority on the unit. Furthermore, the psychology team leading this project began services on the unit in late February of 2020, meaning we did not have baseline participation data from any significant amount of time prior to the COVID-19 pandemic. Additionally, an important limitation is that the disparities noted for families with public insurance as compared to those with private insurance was identified at the end of the project. If this had been the target of the intervention from the beginning, it may have changed workflows and data collection. Finally, implementation changes were often bundled, which made it challenging to determine which exact change led to engagement improvements.

Several future directions could be pursued. First, formalizing the process of relaying parental concerns and nursing observations to the remaining members of the care team could improve overall team communication. Second, integrating advanced technological solutions, such as streamlined video conferencing platforms or automated setup systems, could further reduce the burden on staff and increase the scalability of the intervention. Third,

Table 2. PDSA cycle descriptions.

| Baseline/Preparation (July 2021 to March 2022) | |
|--|--|
| Steps Taken | |
| <ul style="list-style-type: none"> Purchased tablets, cases, and hands-free stands Established HIPAA-secure workflows for telehealth visits Collected baseline data | |
| PDSA 1 (April 2022 to May 2022) | |
| Steps Taken | Lessons Learned |
| <ul style="list-style-type: none"> Psychology team identified eligible families (infant >14 DOL), extended invitations, and facilitated virtual visits (coaching and supporting nurses) Created fishbone diagram to identify key categories of challenges and potential solutions | <ul style="list-style-type: none"> Implementing unit-wide presented a challenge at the outset of a QI project Increasing nurse buy-in would help the process run more smoothly Specific, easily accessible information and teaching could improve uptake of intervention, especially around how to set up a virtual visit Materials such as tablet chargers were easily lost on the unit |
| PDSA 2 (June 2022 to July 2022) | |
| Steps Taken | Lessons Learned |
| <ul style="list-style-type: none"> Identified nurse champions who were willing to lead visits and share their experience Created a visual, step-by-step guide to improve clarity on workflows for connecting to virtual visits Created a guidance sheet to help families know when virtual visits would and would not be available Added stickers/signage to tablets and chargers so they would not get lost as easily | <ul style="list-style-type: none"> Nurse champions were appreciative of unofficial recognition as well as official recognition through the hospital 'kudos' system Nurses reported feeling "awkward" on video visits and unsure of how long to allow for a call |
| PDSA 3 (November 2022 to February 2023) | |
| Steps Taken | Lessons Learned |
| <ul style="list-style-type: none"> Identified families who were not meeting target visitation metric (involvement in person or virtually at least once per day, four days per week) Tailored outreach to both these families and their respective staff members (bedside nurse, developmental therapists) to enhance shared awareness of virtual option Revised tip sheets and distributed to staff and families, including tethering tip sheet to tablet stand Established workflow to add interpreter in virtual session | <ul style="list-style-type: none"> Families targeted for intervention often had multiple barriers and thus were difficult to contact in person or via telephone Higher rate of "no shows" when virtual visits were set up ahead of time (as compared to when virtual visits were offered, created, and carried out at the same time) led to staff and team dissatisfaction |
| PDSA 4 (March 2023 to April 2023) | |
| Steps Taken | Lessons Learned |
| <ul style="list-style-type: none"> Captured process data around how often the virtual cares are offered and completed, as well as reasons why they were not accepted De-emphasized scheduling ahead of time and outreached families right before care sessions | <ul style="list-style-type: none"> Flexibility in timing is important for both families and staff alike Smaller, systematic changes that occurred across PDSA cycles 2, 3, and 4 led to more meaningful change |

exploring partnerships with insurance providers, community organizations, or other strategies will be important for making a virtual service accessible and sustainable, particularly for smaller units. Fourth, telehealth could be helpful in other critical areas of family engagement, such as readiness for discharge. At present, our unit does group discharge teaching (including a class and CPR video) in person only. Only one primary caregiver is required to attend, but a virtual option may allow for multiple caregivers to receive the information. Fifth, post-implementation qualitative data around the nursing staff experience (fulfilling family interactions, professional growth, job satisfaction, etc.) could be beneficial to demonstrate positive impacts of a telehealth initiative despite significant initial hesitation. Last, this project was initially intended to focus on all families with an infant admitted to the NICU and not specifically on the sub-population who are more likely to face barriers to participation. Future projects that aim to address this disparity from the beginning would likely be very impactful.

CONCLUSIONS

Our QI project demonstrated that introducing a virtual option for parental involvement in the NICU care can significantly enhance

family engagement, particularly for families with public insurance. We especially highlight the importance of interdisciplinary project teams, timely response to concerns, and identifying nurse champions in shifting NICU nursing perception of this workflow change. These findings highlight the potential for virtual engagement to become an integral part of NICU care, ultimately improving engagement and thus neonatal outcomes and family satisfaction for all families.

DATA AVAILABILITY

Data may be shared upon reasonable request to the corresponding author.

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AUTHOR CONTRIBUTIONS

All author contributions are described using the CRediT (Contributor Roles Taxonomy) system. JK: conceptualization, methodology, investigation, writing—original draft, writing—review and editing. DC: conceptualization, investigation, data curation, and writing—review and editing. JH: formal analysis, data curation, visualization, writing—original draft, and writing—review and editing. AS: visualization, data curation, project administration, and validation. KH: data curation, validation, and investigation. SS: writing—original draft. LB: conceptualization and supervision. JB: funding acquisition and conceptualization. JD: data curation,

visualization, and formal analysis. AD: conceptualization, funding acquisition, supervision, and writing—review and editing.

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COMPETING INTERESTS

JB has been involved with content creation as Topic Co-Lead for the AI and Technology Forum on Healio Inc. and serves as the Site Co-Investigator for Aerofact Phase IIb clinical trial for Aerofact Inc. No other authors have conflicts of interest related to information presented in this manuscript to disclose.

ADDITIONAL INFORMATION

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