

Development and Implementation of a Protocol for NICU Discharge With Nasogastric Tube Feedings

Successes, Barriers, and Lessons Learned

Mayah Dozier-Lineberger, DNP, CPNP-AC, FNP-C; Erin Orth, MD, FAAP; Rémi Hueckel, DNP, CPNP-AC, FNP, FAANP, FCCM; Debra Brandon, PhD, RN, CNS, FAAN

ABSTRACT

Background: There is sufficient evidence to support safe discharge from the neonatal intensive care unit (NICU) with nasogastric tube (NGT) feedings when appropriate caregiver education, outpatient support, and feeding therapy are available.

Purpose: We sought to identify infants eligible for safe discharge with NGT feedings to reduce NICU length of stay and avert unnecessary surgical gastrostomy tube (GT) placement.

Method: A protocol with infant eligibility criteria for NICU discharge with NGT feedings was developed and implemented. A focus group was conducted to identify perceived successes, barriers and lessons learned.

Results: There was low uptake of the new protocol. Barriers to implementation included inconsistent protocol adoption by NICU providers, concerns about lack of outpatient support, and significant language barriers for non-English speaking families.

Implications: Outpatient multidisciplinary support is crucial to successfully implement home NGT feedings upon NICU discharge. A well-developed protocol provides eligibility standards and decision support.

Key Words: enteral nutrition, feeding tubes, gastrostomy, nasogastric tube, neonatal intensive care unit

Infants cared for in the neonatal intensive care unit (NICU) often require supplemental nutrition via enteral tube feedings until they can consume full oral feeding volumes. Inadequate oral feeding can be a significant barrier to discharge from the NICU, despite an infant being otherwise medically appropriate for discharge. In fact, inadequate oral feeding has been identified as the most common barrier to discharge of premature infants born between 29 and 33 weeks gestational age.¹ Surgical gastrostomy tube

(GT) placement is often recommended as an option to facilitate discharge, with up to 20% of infants born less than 32-weeks' gestation undergoing GT placement.² However, GT placement exposes the infant to general anesthesia,³ potential major and minor complications,³⁻⁵ and is associated with high health care utilization.^{2,3,5-7} Major complications include bleeding, injury to surrounding structures,⁴ early GT dislodgement, and peritonitis, with an occurrence rate of 2% to 32%.⁵ Minor complications include granulation tissue, local infections, and leakage at the GT site, with an occurrence rate of 43% to 74%.⁵ Both major and minor complications can result in increased clinic visits, phone calls, emergency department (ED) visits, and returns to the operating room.⁵ All of which have the potential to negatively affect the quality of life for patients and family members.⁴

Discharge with nasogastric tube (NGT) feedings has been identified as a safe alternative to GT placement for some infants^{4,6,8} and may be able to reduce an infant's hospital length of stay.^{2,6,9} The literature supports that many infants discharged with NGT feedings can achieve full oral feeding volumes within 3 months of NICU discharge¹⁰⁻¹² or by 6 months of age.² This also includes infants taking less than 50% oral feeding volumes at the time of discharge.^{2,10} In a retrospective study of 182 infants discharged with NGT feedings, 121 infants were able to wean from NGT feedings with a median time of 79 days to full oral feedings, and median oral intake of 20% at time

Author Affiliations: UNC Health, Pediatric Surgery, Chapel Hill, North Carolina; Cone Health, Greensboro, North Carolina (Dr Dozier-Lineberger); Pediatric Medical Group of NC, Moses Cone Women's and Children's Center NICU, Greensboro, North Carolina (Dr Orth); School of Nursing, Duke University, Duke Children's Hospital and Health Center, Durham, North Carolina (Dr Hueckel); and School of Nursing, Department of Pediatrics, School of Medicine, Duke University, Durham, North Carolina (Dr Brandon).

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Correspondence: Mayah Dozier-Lineberger, UNC Health/Cone Health, 1614 N College Park Dr, Greensboro, NC 27403 (mdoziel@lineberger@gmail.com)

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of discharge.¹⁰ However, the literature suggests infants with a diagnosis of a genetic syndrome or gastroesophageal reflux disease are more likely to require conversion to GT or gastrojejun (GJ) placement after discharge with NGT feedings.² For children with severe neurological disease who are not expected to orally feed, home NGT feedings can help families become more comfortable with tube feeding prior to GT placement.⁴

There is sufficient evidence to support safe discharge from the NICU with NGT feedings when appropriate parental education, outpatient support, and continued feeding therapy are available.^{4,6} However, there has been hesitancy to discharge infants with NGTs due to concern of potential complications such as incorrect NGT placement, aspiration pneumonia, perforation during placement,⁶ trauma related to repeated tube insertion, and oral aversion.⁸ Yet, a systematic review of 58 articles totaling a sample size of 16 823 patients/parents focused on themes of preoperative nasogastric feeding tube trials, decision-making surrounding enteral access, the role of preoperative imaging, and gastrostomy insertion techniques found no evidence to support NGTs as an unsafe method for home feeding.⁴ In fact, evidence suggests that discharge with NGT feedings is associated with fewer complications and decreased health care utilization compared to GT placement.^{2,3,6} For example, infants discharged with GTs compared to NGTs had higher rates of ED visits for feeding tube related issues.^{2,4,6-8} In a study of 238 infants discharged with GTs and 84 infants discharged with NGTs, 33.3% of infants with GTs had at least 1 ED visit within the first 6 months of discharge compared to 9.5% of infants with NGTs.³ Among those infants, 9.2% with GTs had multiple ED visits, while none of the infants with NGTs had more than 1 ED visit.³ Jackson et al⁵ found the average operative and anesthesia hospital cost for GT placement was \$87 857. Patients that required gastrocutaneous fistula closure after GT removal incurred an average additional \$29 989 hospital charge.⁵

Given that implementation of an enteral feeding protocol has been associated with higher rates of discharge with NGTs, decreased length of hospitalization, and decreased healthcare costs, it is reasonable for NICUs to implement this practice.⁶

PURPOSE

Our NICU recognized the need for a standardized approach to identification of infants eligible for safe discharge with NGT feedings and reduction of unnecessary GT placement. Previously, some infants were discharged from our institution's NICU with NGTs based on provider preference and parental request. Some parents expressed hesitation and

perceived pressure to proceed with GT placement as a last step toward discharge. Additionally, outpatient follow up was identified as a key component for management of NGT related concerns and achievement of full oral feedings after discharge. Therefore, we developed and implemented standard infant eligibility criteria and a protocol for discharge from the NICU with NGT feedings.

METHOD

Setting

The setting for the practice change included 2 clinical sites. The first was a 45-bed level III NICU in an urban area of southeastern United States. The NICU providers include 10 neonatologists, 11 neonatal nurse practitioners, and 3 speech language pathologists. The second location was an outpatient feeding clinic within the same health system located across the street from the NICU. The feeding clinic is managed by a pediatric neurologist, family nurse practitioner, 3 speech language pathologists, and dietician. Patients discharged from the NICU with NGTs receive outpatient feeding follow up at this location.

Design

A protocol and infant eligibility criteria for discharge from the NICU with NGT feedings were developed with the assistance of NICU nurses, neonatal nurse practitioners, neonatologists, and speech language pathologists, along with an outpatient feeding clinic family nurse practitioner and home health registered nurses. Table 1 demonstrates infant and parent/caregiver criteria for consideration of discharge from the NICU with NGT feedings, which were evaluated simultaneously. Table 1 also demonstrates discharge criteria and outpatient follow up criteria to be met once the infant and parent/caregiver have been considered eligible for discharge with NGT feedings. The outpatient follow up criteria were initiated upon anticipated discharge with NGT feedings. Criteria were based on available standards described in the literature and adapted to reflect local healthcare resources. Table 2 demonstrates content of education provided to parents/caregivers prior to discharge with NGT feedings. The health system IRB review board [reference #2006069-1] determined this project did not meet the definition of human subject research under the purview of the IRB according to federal regulations.

Correct NGT placement would be verified in the home and outpatient feeding clinic by pH measurement of gastric contents. Abdominal radiographs and pH measurement are the only valid methods supported in literature and are the standard for evidence-based practice methods.¹³ Outpatient NGT follow-up was managed by the

TABLE 1. Criteria for Infant Discharge With a Nasogastric Tube

Infant Criteria for Consideration	Parent Criteria for Consideration	Discharge Criteria	Outpatient Follow-Up Criteria
Minimum 36 weeks post-menstrual age	Parent/caregiver expresses willingness and desire to provide home NGT feeds	Infant maintains thermoregulation in open crib for minimum of 72 hours	Feeding pump, feeding bags (30-day supply), IV pole, tape, NG tubes (2), bulb suction, and pH paper delivered to bedside prior to discharge
Minimum weight of 1800 grams	Clinical social work consultation to assess family resources and support to provide home NGT feedings ^a	Infant without clinically significant bradycardia for 5 days	Home health nursing visits if available through insurance provider. The infant may require increased phone/virtual/in-person contact with feeding clinic nurse practitioner if home health nursing visits cannot be provided
Taking < full feeding volume orally, but consistency taking at least 50% of full feeding volume orally within 24 hours	Parents/caregivers have access to a working phone to maintain communication with health care team	Infant without apnea for 7 days	Avoid discharge on weekends or holidays
Stable treatment of morbidities		Infant has adequate weight gain to maintain or exceed current percentile	Primary care pediatrician identified and well check appointment scheduled. Hospital discharge summary sent to primary care pediatrician
Evaluation by speech and physical therapy		Parent/caregiver NG tube education provided by NICU nursing staff and documented in chart Ideally, 2 caregivers will receive education and demonstrate competence	Scheduled appointment with outpatient feeding team nurse practitioner within 1 week of discharge, then monthly
Evaluated and expected to achieve full oral feedings within 3 months		Written feeding plan for discharge determined by Neonatology team	Weekly weight check by home health nurse or office visit with outpatient feeding team
No evidence of aspiration based on modified barium swallow study, or adequately managed with thickened feeds		Infant tolerates bolus tube feeds and/or continuous overnight feeds (no 24-hour continuous feeds)	Parents will replace NG tube at home in the event of NG tube dislodgement if trained (placement confirmed with aspiration of gastric contents and pH paper). Otherwise, parents will contact home health nurse and/or feeding team nurse practitioner for NGT replacement.
		Documentation of nipple used for bottle feeding	Parent/caregiver will contact home health nurse and/or outpatient feeding team nurse practitioner for difficulty replacing NG tube
			Pediatric Surgery team will be available for gastrostomy tube placement if necessary

^aHome must have electricity and running water.

feeding clinic team. Some pediatric primary care providers would assist with frequent infant weight checks and oral feeding volume monitoring. Pediatric primary care providers could contact the feeding clinic for questions or concerns regarding NGT feeding. However, many pediatric primary care providers expressed discomfort replacing dislodged NGTs. Of note, after the NICU protocol was implemented, the inpatient pediatric service at the same institution developed a similar protocol for discharge from the pediatric unit with NGT feeds.

Project Adoption

The protocol and infant eligibility criteria were implemented in February 2023. Three infants with NGT feedings and 5 with GT feedings were discharged from the NICU in the year prior to implementation of the criteria. In the 10 months following criteria implementation, 1 infant with NGT feedings and 8 with GT feedings were discharged from the NICU. At least 2 other infants were identified as eligible for home NGT feedings, but parents declined. The infant discharged with NGT feeding after implementation

TABLE 2. Content of Parent Education

Discuss signs and symptoms of incorrect placement of NG tube; including coughing, choking, difficulty breathing, tachypnea, change in color
Parent/caregiver successfully inserts 2 NG tubes and demonstrates placement confirmation with aspiration of gastric contents and pH paper (parents/caregiver may decline to reinsert NGT at home). Parents/caregivers may choose to have NGT replaced by home health nurse, feeding clinic nurse practitioner, or ED provider.
Parent/caregiver successfully programs feeding pump and administers NG tube feeds. (DME company representative provides feeding pump training and initial feeding supplies to NICU bedside.)
Parent/caregiver successfully administers medication through the NG tube
Parent/caregiver completes education for infant CPR and choking

of the protocol was discharged within 2 days of the decision having been made. The infant progressed to full oral feedings within 3 months of discharge and did not require GT placement.

The initial NGT discharge protocol required parents/caregivers to learn how to replace the NGT at home. The protocol was revised to make NGT replacement by the parent/caregiver optional after the eligible infant's mother expressed discomfort reinserting the NGT at home. Parents/caregivers that declined NGT replacement training could contact the home health nurse and/or feeding clinic nurse practitioner for assistance with NGT replacement.

Due to the limited number of eligible infants identified, a focus group was conducted in February 2024 to examine the perceived successes and barriers of discharging infants from the NICU with NGT feedings. Eight medical staff members participated in the focus group, including 2 neonatologists, 1 neonatal nurse practitioner, 1 pediatric feeding clinic nurse practitioner, 1 NICU charge registered nurse, 2 speech language pathologists, and 1 NICU dietician. The focus group took place in the NICU Conference Room. The session lasted 1 hour and was transcribed verbatim. The first author facilitated the focus group with note taking performed by a Medical Service Fellow. The facilitator interfered only if a subject was not addressed, if the discussion came to a halt, or to prompt a response from a particular individual.

FOCUS GROUP RESULTS

The findings from the focus group were categorized using the a priori codes of successes, barriers to discharge with NGT protocol, and lessons learned by MD-L and DHB.

Participants described changes in clinical practice among neonatologists, nurse practitioners, registered nurses, and speech language pathologists related to discharge with NGT feedings. Some participants discussed initial resistance to discharge with NGTs but are now accepting of the practice change, particularly after observing consistent outpatient support. Participants also discussed the benefit of having a standardized

protocol and criteria to determine infant eligibility for home NGT feeding. One participant stated, "It is nice to have a consistent protocol so we as a team are consistent with families when talking about it." However, participants felt it was hard to know the full impact of the practice change due to a limited number of eligible patients in the NICU. Several focus group participants also assisted with discharge with NGT feeding from the pediatric unit. Some participant responses were reflective of experiences with infants and children discharged from the pediatric unit with NGT feeding and infants discharged from the NICU prior to implementation of the protocol.

Successes

Focus group participants reported that earlier identification of infants who could be eligible for discharge home with NGT feedings was beginning to occur. This now occurs more often when completing swallow studies, examining feeding skills, bedside rounding with patients and families, and assessing capabilities at home. Several focus group participants had prior experience discharging infants with NGT feedings in other hospital settings. One NICU provider who expressed comfort discharging infants with NGTs stated,

"I start introducing these practices to families when I am thinking about discharging them from the NICU. It has given me a better way of approaching families about what we could do. It has helped when I am getting to the 40–41-week mark with families. If it was one of the families that we thought would qualify, we can provide it as an option earlier which gives them more decision-making power."

Once an infant is determined to be eligible for discharge with NGT feeding, participants described the planning and preparation as similar to discharge with GTs. The parent education was "about the same" when teaching parents how to program the feeding pump and administer tube feedings. Participants were unable to identify any delays in discharge once a plan for home NGT feeding was determined. One provider

felt discharge was expedited once the decision was made for home NGT feedings. Finally, the participants expressed a desire to use the protocol more in the future.

Barriers to Implementation of NGT Discharge Protocol

Despite previously expressing benefits of having consistent criteria for infant eligibility, multiple participants discussed inconsistencies among neonatologists and nurse practitioners willing to consider discharge with an NGT. Participants reported some providers will consider discharge with an NGT early in the infant's hospitalization while other providers may never consider the option of home NGT feedings. One participant stated, "There are providers that will mention it before others. Those that provide information earlier tend to consider it more of an option for discharge in general. Families that have had it offered to them earlier have more time to think about it as a tool to get to discharge." Another participant stated,

"As providers change each week, some weeks the NGT is an option and other weeks, it is no longer an option. It can be hard because we are not consistent. It can be challenging for us as for what we are suggesting and recommending. Families become frustrated as the plan keeps changing and it is hard for them to know what to expect."

Participants discussed a similar inconsistency when evaluating an infant for GT placement. The neonatologists within the focus group expressed unawareness of this inconsistency among providers. Bedside nurses rarely initiate the conversation for discharge with NGT feeds in rounds but may become more comfortable after receiving more education on the eligibility criteria. Providers discussed the importance of receiving input from bedside nurses due to nurses spending more time with patients and families.

There was concern of difficulty incorporating the new infant eligibility criteria into everyday clinical practice. One provider stated, "For me a barrier is identifying which babies qualify. With all the things that need to be considered it is hard for me to determine who does qualify. Sometimes they have been in the NICU for so long that it is not something I think about them qualifying for." The entire meaning of this statement was unclear. Creating a flowchart that shows a pathway to discharge was suggested as a possible solution. In response, a provider commented,

"The original gestational age often helps us with decision making. For example, a mother with

diabetes with a 34-week infant is very different than an infant that was born much earlier. There would need to be a lot of caveats with the flow sheet [flowchart] to account for things like that. I think the flowchart in general would help people feel more comfortable in putting in the tube for discharge, especially if we have included these things."

This comment prompted another response when referring to the NGT criteria,

"I think it is a good tool in the families that can manage it. It can be hard to find the perfect family that will benefit. In the future, I see it as a tool we have available that families can use when appropriate."

Participants voiced that the biggest parental concern was, "what to do if the tube comes out." Some families were taught how to replace the NGT, based on parental choice, while other parents were advised to contact the home health nurse and/or feeding clinic nurse practitioner. The outpatient support has been less adequate for families without home health nursing, particularly with NGT dislodgement. This is complicated by the fact that some infants are eligible for home health nursing, while others are not based on insurance coverage and local availability.

The lack of written materials in multiple languages is also identified as a barrier to outpatient support for non-English speaking parents and caregivers. One participant discussed increased expressions of frustration from parents and caregivers who spoke any language other than English or Spanish. Participants also discussed concerns regarding inconsistent language fluency of interpreters. The development of information sheets with instructions for NGT use and necessary supplies written in multiple languages and containing detailed photos and images was offered as a possible solution for improvement.

Lessons Learned

When discussing how to sustain the practice of discharging infants with NGT feeding, participants unanimously expressed the importance of consistent outpatient follow up. With increased outpatient feeding clinic demand, scheduling timely appointments became an unexpected new barrier to discharge with NGTs. Several participants discussed the high patient volume in the outpatient feeding clinic and the current wait list for new patient appointments. One participant discussed being very worried about what happens after discharge. The participant questioned, "Are they thriving? Are they getting follow up in

a timely manner?” The feeding clinic nurse practitioner attempts to see the infant in the hospital and within 1 week of NICU discharge. Having a nurse practitioner in the feeding clinic has helped to assess infants’ feeding progress in between visits with the entire feeding team. The option to create a feeding clinic appointment schedule with time slots blocked specifically for infants with NGTs was discussed as a potential solution. Many patients have spent weeks to months in the NICU with some parents accustomed to having significant support from the NICU staff. Regarding parental perceptions with home NGT use, “generally, parents are much happier to just get out, however, they are stressed about a sudden lack of support.” The feeding clinic nurse practitioner has been helpful to assist with parental concerns which are often, “reassurance calls.”

Participants discussed the potential frustration among parents if the infant does not progress to full volume feeds after discharge. Some families may leave the NICU with the expectation that the infant’s oral intake will improve at home, without considering the need for ongoing feeding support via surgical tube placement. It can be difficult to have conversations regarding GT placement if the family has firmly decided they do not want a GT. This led to a discussion of benefits for scheduling an outpatient pediatric surgery consultation approximately 6 weeks after NICU discharge to discuss potential GT placement. This could provide an alternative plan if the infant is not progressing with oral feedings. Two participants discussed this as the standard practice in other NICUs where they had worked. In response, a participant offered, “Some parents latch onto their hopes and ignore all other tools. Having it [an appointment] on the books makes them acknowledge that getting the GT is a real possibility.” Having a pediatric surgical consultation prior to discharge was also discussed as an option.

Additionally, participants discussed the difference in education regarding NGT home management taught in the NICU versus the pediatric unit. The use of pH testing of gastric contents for NGT placement verification was provided as an example of educational differences. Participants also discussed the need to provide NGT feeding education to pediatric primary care providers who care for these infants following discharge. The discussion led to the comment that having an NGT does not always indicate the infant is sick or unhealthy. Creating a flyer to provide information for pediatric primary care providers regarding NGT feedings was suggested as an outreach tool.

DISCUSSION

We developed criteria to standardize infant eligibility for safe discharge from the NICU with NGT feedings, along with a protocol to standardize parental education and outpatient feeding clinic follow up. There was low utilization of the infant eligibility criteria due to a limited number of eligible infants, parental preference, and acceptance of practice change by NICU providers, resulting in 1 infant discharged from the NICU with NGT feeding after implementation. The focus group provided insight regarding perceptions, feasibility, perceived successes, barriers, and next steps for using the criteria to successfully and safely discharge infants from the NICU with NGT feedings. Initial perceptions regarding use of the criteria and discharge with NGT feedings were influenced by prior experiences of individual providers. Provider and staff support for discharge with NGT feedings was significantly influenced by the perceived ability to provide adequate outpatient follow up. The outpatient feeding clinic nurse practitioner was viewed as a valuable contributor to parental support and progression of infant oral feeding. Therefore, using nurse practitioner models of care is one strategy to deliver holistic care to infants requiring discharge with an NGT.

The inconsistent criteria use among NICU providers was a barrier to identification of eligible infants and ultimate discharge with NGTs. Inconsistency in a patient’s care plan due to individual providers’ preferences can cause frustration for families and staff. We recognize the need for ongoing discussions regarding provider hesitation and concerns regarding NGT and GT feedings. This realization within the focus group will allow for improved discussion and collaboration among the NICU providers and staff. The feasibility and ease of criteria use was also questioned, specifically in the setting of infants with complex medical needs and extended hospitalizations. Multidisciplinary involvement inclusive of bedside NICU nurses would help monitor infant eligibility and parental attitudes toward home NGT feeding. A visual flowchart with criteria for eligibility for discharge with NGT feedings will be created to prompt NICU team members to consider discharge with NGT feedings earlier in the hospitalization. Earlier consideration and discussions can provide parents and caregivers with additional time to ask questions, learn how to manage NGT feedings in the NICU, and become comfortable with the idea of home NGT feedings.

Language barriers have the potential to negatively impact patient safety and parental satisfaction with home NGT management. This was a significant concern for focus group participants. Increased efforts to improve communication access and support for non-English speaking patients and families

Summary of Recommendations

What we know:	<ul style="list-style-type: none"> • Inadequate oral feeding is a significant barrier to discharge from the NICU • Discharge from the NICU with NGT feedings is safe and feasible when appropriate parental education, outpatient support, and continued feeding therapy are available • Hesitancy among NICU providers can limit infant discharge with NGT feeds
What needs to be studied:	<ul style="list-style-type: none"> • Strategies to ensure early identification of infants eligible for NICU discharge with NGTs • Incidence of NGT and GT related emergency department visits for English speaking compared to non-English speaking patients/families • Parental comprehension of NGT/GT education when using video/phone assisted interpreter compared to in-person interpreter
What we can do today:	<ul style="list-style-type: none"> • Consider infant eligibility for safe discharge from the NICU with NGT feeds early in the hospitalization • Multidisciplinary involvement when assessing infant eligibility and parental attitudes toward home NGT feeds • Utilize multiple methods of education, including the teach-back method when providing NGT/GT caregiver education • Consider telehealth visits in between monthly in-person feeding team appointments • Consider language preferences and barriers when providing NGT education and written or visual materials • Consider recorded instructions in the preferred language when written materials are unavailable to difficult to obtain • Ensure adequate outpatient support is available for infants discharged with NGT feeds • Provide NGT education to PCP providers to improve transition to home NGT use

are needed. Focus group participants identified an action item to develop new printed resources written in multiple languages, along with the inclusion of pictures to accommodate all literacy levels.

There are differences in the NGT discharge instructions provided to parents and caregivers in the institution's NICU versus the pediatric unit. This can cause additional confusion for the patient's family if they are readmitted to the pediatric unit after initial discharge from the NICU. There is an opportunity for further collaboration between the NICU and pediatric unit to provide consistent caregiver NGT discharge education.

The developed criteria require infants to consume at least 50% of feeds by mouth for home NGT eligibility. Using the 50% oral feeding volume as a guideline rather than a requirement may identify more infants capable of achieving full oral feeds after discharge with NGTs. The solution to these barriers is less about finding the perfect candidate and more about finding the potential candidate.

Implications

Home NGT feedings are safe and feasible with adequate outpatient support and realistic family expectations, made possible by a well-developed set of eligibility criteria and discharge process standardization. Implementation in our NICU was challenging due to inconsistent preferences and interpretation of the criteria among NICU providers, perceived competing interests and priorities of care, and suboptimal team communication regarding the option of home NGT feedings.

These issues were elucidated by a focus group, which paved the way for future improvements. By establishing buy-in and consensus among NICU providers and staff, home NGT feedings can be introduced earlier in the hospitalization to allow improved family comfort and acceptance of home NGT feeding. This provides the opportunity to increase the frequency and quality of home NGT discharges.

Next steps for improved outpatient support include increased feeding clinic appointment slots for infants with NGTs and consistent NGT discharge education from the NICU and pediatric unit. Finally, increased efforts to provide accessible resources and support for non-English speaking families are necessary to improve parental satisfaction and optimal home NGT feeding management. Future studies are needed to determine which infants would benefit most from home NGT feedings.

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