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Early Discharge for Preterm Infants Partially Tube Feeding

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Attestation of Authorship

“I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgments), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning”.

Signed: Andrea King

Date: 15/03/2023

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ABSTRACT

Neonatal Intensive Care Units (NICU) and Special Care Baby Units (SCBU) around the world have adopted the practice of discharging late preterm infants home partially tube feeding, enabling infants to complete the transition to full oral feeds at home. The detrimental effects separation has on mental health and the parent-infant attachment when infants remain in neonatal units is well researched, thus getting infants home to their natural environment as soon as possible is crucial to reduce long term implications of prolonged NICU stays.

The aim of this project was to develop a pathway for earlier discharge for pre-term infants partially tube feeding. Early discharge support packages implemented within New Zealand and internationally were reviewed and used as a guide to tailor a package for a Special Care Baby Unit in Hawkes Bay hospital. The potential financial gains of discharging infants' home two weeks earlier was illustrated by comparing home visits to hospital stays. The support networks within Hawke Bay Special Care Baby unit were discussed, outlining what each service can provide with the aim of creating a collaborative and supportive pathway for infants and their families in the community.

To guide this project, Rosswurm and Larrabee's (1999) model for change to evidence-based practice was utilised. Moving through the steps of this model, an early discharge pilot proposal was developed along with key stakeholders to explore what input and timeframes each service can provide necessary to assess the feasibility of implementing this proposed practice change in our unit.

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CHAPTER ONE

Depending on the birth gestation preterm infants can spend weeks to months in neonatal intensive care units (NICU) or Special Care Baby Units (SCBU) separated from their families until they are ready for discharge. More often the final milestone for preterm infants is being able to transition from partial to full oral feeds. Many preterm infants have overcome their medical issues but their discharge is delayed owing solely to being partially tube dependent (Ermarth et al., 2020). In this chapter I will discuss the anticipated feeding progression from 32-40 weeks in a well preterm infant, outlining the necessity of nasogastric tubes (NGT) to supplement oral feeds, to deliver nutrients to support growth and development. Many NICUs both nationally and internationally have successfully discharged late preterm infants home early partially tube feeding allowing them to transition to full oral feeds at home. I will outline the benefits of early discharge for infants and their families, such as reducing hospital stays, increased breastfeeding rates and facilitating the parent-infant bond. With reference to the already established early discharge education programmes within other neonatal units, I will highlight the importance of providing comprehensive resources for families to ensure the transition is successful and those involved feel supported and comfortable with the process once home.

The aim of this project is to develop an evidenced based tube feeding support programme to enable families to safely transition infants from NGT to breast/bottle at home. Following the development of this programme, a pilot project will be designed to trial within the Hawkes Bay region which will require ethics approval from both Hawkes Bay Hospital and AUTEC. The model I am using to guide my project is Rosswurm and Larrabee's model for change to evidence practice (Rosswurm & Larrabee, 1999).

Preterm feeding patterns and progression

Preterm infants, defined as being born before 37 weeks of completed pregnancy are categorized according to their gestational age (WHO, 2023). An extreme premature infant is born less than 28 weeks, a very preterm infant is born between 28-32 weeks and a moderate to late preterm infant is born from 32-37 weeks (WHO, 2023). Regardless of their birth gestation all preterm infants have targets they are required to achieve before they are discharged home from the neonatal unit. These targets are specific to central nervous system development and can be identified as: temperature stability, the absence of apnoeic and bradycardic events, and the ability to fully oral feed either by breast or bottle (Edwards et al., 2019). Oral feeding skills commence in the beginning of the second trimester of pregnancy (weeks 13-27) when the foetus is seen to practice sucking and swallowing amniotic fluid (Kamity et al., 2021). In the third trimester (weeks 28-40) the fetus continues to

practice sucking further developing their "pre-feeding" abilities, bringing about mature sucking by full term (Kamity et al., 2021).

When infants are born preterm, from around 28-33 weeks gestation, they can practice non-nutritive sucking on a pacifier which facilitates the mature suck-swallow coordination without the fluid bolus (Kamity et al., 2021). By 32-34 weeks gestation as the infant matures they move from non-nutritive sucking to nutritive sucking whereby milk is introduced which necessitates the suck-swallow-breathe coordination, a complex skill required to successfully breast/bottle feed (Kamity et al., 2021; The Royal Women's Hospital, n.d.). Despite preterm infants having successful attempts to orally feed around 32-34 weeks, they often lack the stamina to maintain all of their full feed requirements (The Royal Women's Hospital, n.d.). A 'full feed' is a prescribed amount calculated according to the individual infant's age and weight and growth trajectory (Hawkes Bay District Health Board, 2014; Aloysius et al., 2018). Once the infant tires at the breast/bottle, NGTs are used to deliver the remaining volume without any further energy expenditure for the infant, and maintaining the infant's nutritional needs (Edwards et al., 2019). Once preterm infants reach 35 weeks they begin to feed more efficiently and require less NGT top ups, indicating they are nearing ready for discharge (The Royal Women's Hospital, n.d.).

Delayed discharge from NICU/SCBU

As survival rates and prognosis of preterm infants continue to improve, neonatal services are increasingly under pressure (Ministry of Health, 2019; Menczykowski et al., 2018). Even the extreme preterm infant will only require intensive care for a very short part of their inpatient stay, after this they progress to the less acute areas of the unit. One of the primary reasons for the delay in discharge from NICU is for infants to reach their "full oral feeding milestone" (Viswanathan & Jadcherla, 2019, p. 1257). Reaching this full oral feeding milestone can take anywhere from 36 to 38 weeks depending on the infant's respiratory function and ability to coordinate breathing whilst feeding (Bertoncelli et al., 2012; Horner et al., 2014; Ross & Arvedson, 2022; Park et al., 2015). Infants who remain on respiratory support have less opportunities to suck feed which can further inhibit their progress (Kamity et al., 2021; Park et al., 2015; Barlow et al., 2010). As the weeks and months go on, the long wait for infants to transition to full oral feeds is not only frustrating for parents but it also puts stress and strain on already burdened neonatal services (Menczykowski et al., 2018). In addition, the Covid pandemic highlighted how important it was to get infants home to their families as soon as possible, to avoid the potential hospital acquired exposure of this virus along with other viruses.

Nasogastric feeding for preterm infants

Nasogastric tubes (NGT) are commonly seen in neonatal units across the world and are considered a lifeline for preterm and compromised infants (Krom et al., 2018; Gardiner et al., 2014). A nasogastric tube is a thin hollow device inserted into the infant's nose and directed down into their stomach, this is measured from the tip of the ear to a point halfway between the xiphoid process and the umbilicus (Lyman et al., 2018). Once inserted, to confirm correct placement the contents of the stomach are aspirated with a syringe and tested either using litmus paper or with pH strips depending on hospital protocols (Fan et al., 2017). Fan et al. (2017) looked at the safest way to ascertain if an NGT is correctly placed and indicated the 'gold standard' was x-ray confirmation, however this is not obviously feasible in the community setting and exposes the infant to unnecessary radiation. The most common method of ensuring NGT placement is by litmus paper, however the guidelines for the benchmark pH varies (Metheny et al., 2018). Having limited evidence to guarantee the best method of ascertaining NGT placement leads to frustration in staff and parents (Fan et al., 2017). Most NICU's around the country including Starship and Wellington NICU use litmus paper that measures the pH acidity with 5 or below being the benchmark to ascertain that the NGT is in the stomach (C. Dunn, personal communication, November 15, 2021; Starship, n.d.a). Hawkes Bay, where this project is based also uses litmus paper without pH markers however the evidence suggests that this may need to change.

Once the placement of the NGT is confirmed, a 20-30ml syringe is attached to the NGT and milk is transferred into this which moves from the syringe down into the NGT and into the infant's stomach via gravity, the speed of the feed is determined by how high the tube is held. Nasogastric tubes (NGT) are not only used to deliver milk to infants but medications as well (Starship, n.d.a). The advantage of giving infants medications vis their NGT is not having to wake them if their medications are indicated to be taken on an empty stomach, or when infants simply do not enjoy the taste, contributing to a negative oral experience. According to Lubbe (2018), feeding success is dependent on positive oral experiences which helps when the infant is provided with pleasant taste and smells, negative tastes may lead to feeding aversion.

Impacts of SCBU/NICU for infants

Being separated from parents and exposed to the anomalous NICU environment is seen to have negative effects on the neurodevelopment of premature infants (Grunau, 2013; Cheong et al., 2020; Pavlyshyn et al., 2022). Premature infants, particularly those born extremely premature are faced with multiple invasive and painful procedures while in NICU/SCBU leading to increased levels of cortisol, a key hormone released in stressful situations which may lead to disruptions in neuron pathways and

even neuron death (Fumagalli et al., 2018). Increased cortisol levels in infants contributes to developmental delay and behaviour and attention deficits later in life (Fumagalli et al., 2018). These traits are described as challenging for parenting (Lean, et al., 2018; Vanderbilt & Gleason, 2011). To minimize the increase in cortisol levels parents are encouraged to participate in skin to skin cuddles often referred to kangaroo care, where the infant is placed in a nappy only, directly on the parent's bare chest (Campbell-Yeo et al., 2015). The importance of kangaroo care is not new to neonatal practice/medicine and the benefits include, regulation of infant's vital signs, reduction in infant's pain response, improves breastmilk supply for mothers and facilitates the parent-infant bond (The Royal Women's Hospital, n.d.; Ozdel & Sari, 2020). When infants have kangaroo care with parents their oxytocin levels increase which in turn results in a decrease in cortisol levels (Pavlyshyn et al., 2022). Oxytocin is known as the hormone that is key for "love, bonding and attachment" generating calm and peace, and therefore activities that produce oxytocin, are seen to relieve stress and decrease anxiety (Pavlyshyn et al., 2022, p. 640). Additional stressors infants face in the SCBU/NICU are bright lights, excessive noise and disrupted sleep, very different to what they would be experiencing in the womb (Levy et al., 2017). Sleep is a basic yet crucial human need, disrupted sleep can hinder normal progress and growth in infants impacting on their predicted outcomes resulting in extended length of hospital stay (Park, 2020). Another consequence for infants having extended hospital stays is the impact this has on breastfeeding, when infants are separated from their mother they have missed opportunities to suck feed (Ermarth et al., 2020), a skill that requires repetition to master (Tubbs-Cooley et al., 2015).

Impacts of having an infant in SCBU/NICU for parents

Parenting an infant in NICU is far from normal, the parental role is disrupted and the unfamiliar NICU environment can cause apprehension (Flacking et al., 2012; Vittner et al., 2018). Parents with premature infants' express emotions such as guilt, shame, anxiety and extreme stress (Driver et al., 2021). Parents have voiced that they found NICU challenging and extremely unnatural to be separated from their infants (Brodsgaard et al., 2022). Some parents witness their infants experiencing life threatening episodes of desaturation and bradycardia causing distress and concern for their infant's wellbeing (Makela et al., 2018). Mothers of premature infants are one to 18.4 "times more likely" to suffer from postpartum depression compared to mothers with full-term infants (Axelin et al., 2022, p. 1677). Maternal depression combined with having an infant with complex medical needs can interfere with parent-child attachment and lead to faltering growth in the infant/child, mistreatment, and neglect (Driver et al., 2021; Edwards et al., 2019). This points to the vital roles of neurodevelopmental therapists, paediatricians and child development therapists for continued support for preterm infants. Additionally, well child providers, such as Plunket, general practitioners (GPs) and midwives may refer mothers to maternal mental health services if required.

Families with low socio-economic status are more likely to deliver a preterm infant, and with limited resources and a vulnerable preterm infant, the risk for a poorer outcome is twofold (Vanderbilt & Gleason, 2011; Malatest International, 2019). Having a preterm infant puts a financial strain on parents, some of these costs are owing to transport, parking food and drinks during hospital visits (Wilson, Nzirawa & Mannan, 2020; Hookway, 2013). Additionally, single mothers of low socio-economic status struggle with support and childcare for other children, making visiting their infant in hospital extra challenging (Axelin et al., 2022). Since the Covid pandemic in 2020, no children under the age of 14 years are permitted in SCBU due the potential risk of transmission for vulnerable preterm infants, which is important however adds additional barriers for single parent families. Although it appears families living in higher social deprivation should have their infant prioritised for early discharge to ease the strain, having a lack of social support and no access to a car or phone may mean they are ineligible for some early discharge programmes (Starship, 2022).

Family-Centered Care

Family-centered care (FCC) is defined as an integral part of care planning within the NICU and is underpinned by the principle of parental participation, where parents are encouraged to contribute to the decision process and care delivered to their infant thus enabling them to feel more in control (Mirlashari et al., 2020). When parents are actively involved in their infant's care they are more prepared for discharge and experience less anxiety when taking their infants home (Aloysius et al., 2017). Parents rank being able to feed their infants as a high indicator of their parenting abilities (Philbin & Ross, 2011). In some neonatal units' parents are taught to administer NGT feeds themselves with guidance and supervision from nurses. Once home, parents have to shift from relying on charts and measurements to observing and interpreting their infant's abilities and feeding cues which can create worry (Aloysius et al., 2018). Parents need to move from a volume driven to cue-based feeding or responsive feeding their infant. Neurodevelopmental therapists and speech language therapists play a key part in teaching parents how their infant communicates and educate parents on signs to look out for when the infant is becoming stressed or overwhelmed during feeds and interactions. When parents are taught the unique ways, their infant communicates and their infants' feeding cues, they are able to respond to them appropriately and feeding tends to become a more positive experience for both the infant and their family (Philbin & Ross 2011). Furthermore, Brodsgaard et al. (2015), points out when parents are educated on infant behaviour and feeding cues this supports infants to transition to oral feeds earlier.

Transitional Care

"Neonatal Transitional Care (NTC) supports a resident mother to be or to become the primary care provider for a baby with care requirements in excess of normal newborn care, but which are not sufficient to require admission to a NNU" (British Association of Perinatal Medicine, 2017, p.1) Transitional care models enable parents to stay in NICU/SCBU with their infants and develop independence in all cares with the support from staff as required (British Association of Perinatal Medicine, 2017). Transitional care is useful for families with small infants or late pre-termers to enable an easy transition to home with support from the NICU/SCBU team members (British Association for Perinatal Medicine, 2017). Transitional care is an ideal way to support parents from NICU/SCBU to home with their infants on partial NGT feeding, fostering the parent-child attachment and confidence when caring for their infants. This is however not always easy for mothers with other children at home who have limited support from family and/or friends (Menczykowski et al., 2018).

Hawkes Bay SCBU demographics and service

Hawkes Bay (HB) is on the east coast of the north island with a population of more than 165,000 people (Hawkes Bay District Health Board, n.d.). Hawkes Bay has one of the highest fertility rates in New Zealand, second to Northland (Malatest International, 2019). Variabilities in birth rates are one of the challenges neonatal units face with bed availability, especially in units with low bed numbers (Malatest International, 2019). HB SCBU is a level 2A unit with 12 beds and which covers the surrounding areas as far north as Wairoa and south as Takapau. HB SCBU has two ventilator bed spaces, a Criticool machine and accepts infants over 1000 grams and over 28 weeks gestation (Neonatal Nurses College Aotearoa, 2014). Occasionally mothers in preterm labour present outside SCBUs criteria and are unable to be transferred safely so once their infant is delivered, they are stabilized for transfer to Hawkes Bay's main tertiary centre (Wellington NICU) as required.

Current tube feeding/weaning practices in Hawkes Bay SCBU

Depending on parental preference infants are fed via breast or bottle and NGT until they have reached full term age or until they can manage all oral feeds in a 24-hour period. In Hawkes Bay SCBU's current nasogastric tube feeding policy, there is no plan or criteria for tube weaning or tube exit (Hawkes Bay District Health Board, 2019). Infants nursed in Hawkes Bay SCBU do not routinely have individualized feeding plans unless these are made up specifically by nurses or the speech language therapist (SLT). Hawkes Bay SCBU uses breastfeeding codes which can be helpful to gauge how much top up an infant requires (Hawkes Bay District Health Board, n.d.). Despite these codes being useful at times it is just intended as a guide and not a true reflection on the feeding ability of the individual infant, for instance how well individual infants can transfer milk. SCBU's lactation consultant (LC) recently provided an alternate breastfeeding guideline more appropriate for preterm

infants for staff review and to potentially replace the current one. There are other breastfeeding codes/guides more appropriate to premature infants, however there is little evidence in the literature to support these. Regardless of using the breastfeeding codes, some infants appear uncomfortable after top ups and vomit, suffer with reflux symptoms and are unable to be woken for the next feed which gives the impression they have been overfed. Despite preterm infants requiring additional nutrition, they have a low threshold for tolerating larger volumes (Lubbe, 2018). Infants are often pushed to feed when they are clearly exhausted, which may in turn lead to oral aversion, a detrimental side effect for this already vulnerable population (Watchmaker et al., 2020). In addition, over feeding preterm infants runs a risk of them potentially developing complications later in life such as obesity and diabetes (Lubbe, 2018).

Hawkes Bay SCBU has a staff nurse who is also a lactation consultant (LC) and she works one day/week solely in this role for breastfeeding support and advice for SCBU mothers. Hawkes Bay hospital midwives who practice as LCs are also available for support/advice for breastfeeding mothers in SCBU. Hawkes Bay SCBU strongly encourages breastfeeding or for mothers to at least express breastmilk as this is undoubtedly the best nutrition for premature infants (NZBA, 2020). There are many breastfeeding support groups in the Hawkes Bay community including La Leche League, Plunket, Te Tai Whenua O Heretaunga Tamariki Ora, Mamia, Miraka Mama, and Lactation Consultants who do private consults. Additionally, there are some great apps available such as BreastFedNZ and Mama Aroha (Hawkes Bay District Health Board, 2022).

Bottle fed infants

In accordance with the Unicef/WHO breastfeeding hospital initiative (BFHI), infants in HB SCBU are not fed via bottle unless their parents have indicated they intend to bottle rather than breastfeed (NZBA, 2020). If infants are going to be breastfed and are showing feeding cues when the mother is not available, nurses can feed them orally using a cup (in accordance with BFHI no other teats offered to baby if breastfeeding). In HB SCBU, when bottle fed infants show feeding cues a bottle is offered, and whatever remains in the bottle once the infant tires gets fed down the infant's NGT. The advantage of bottle feeding is that the volume is measurable and infants in SCBU are usually put on a four hourly feeding schedule allowing for more rest between feeds. If nurses or parents have concerns with infants' bottle-feeding skills or abilities, a speech language therapist (SLT) referral is made. The SLT observes the infant's feed, teaches staff and parents feeding cues infants are/or may display, she discusses signs of feeding distress and teaches side lying bottle feeding techniques useful for preterm infants based on the SOFFI method. The SOFFI method (Supporting Oral Feeding in Fragile Infants) is an algorithm that assesses individual infants' feeding status with Yes or No steps guiding the person feeding to continue, modify the infant's position or environment or cease the oral feed (Philbin &

Ross, 2011). Our SLT may also make recommendations such as alternate bottles with slow flow teats and/or pressure valves, swallow studies, and suggest reflux medications that may help with feeding comfort. Similar to many areas in nursing, although not intentional, feeding advice is at times inconsistent leading to further frustration and exacerbation in parents. By providing consistent advice to parents and individualized feeding plans inconsistencies would be avoided with parents and staff having the same plan for the infant (Briere et al., 2014; Holloway, 2014).

Tube weaning programmes in New Zealand

In New Zealand there have been several nasogastric tube community weaning programmes developed and implemented in various neonatal units. Neonatal clinical nurse specialists in Wellington NICU recently developed a programme called DOTS (**D**ischarge **O**n **T**ube **S**upport) which is a great resource for parents with images of the NGT insertion procedure and comprehensive troubleshooting for feeding infants at home (C. Dunn, personal communication, November 15, 2021). Anecdotal evidence from staff working with this programme report on its ease and success although it has yet to be formally evaluated. Auckland's National Women's hospital has also developed a resource called a Corpack to support infants and families to go home with an NGT (Auckland City Hospital, 2013) as well as a home weaning support programme. This weaning support programme is however designed for infants who are tube dependent rather than stable preterm infants simply transitioning onto oral feeds. For the families living in Hawkes Bay utilising these tube weaning supports from Wellington or Auckland can be beneficial however, they do result in extra travel costs, additional time away from the rest of the family and potentially exposure to virus' and/or infection.

Currently in Hawkes Bay there is an ad hoc approach to discharging infants' home with NGT's and there is no established evidenced based programme to support families to undertake tube weaning at home. Generally, those infants who are permitted to go home earlier are those with developmental issues, extreme prematurity and/or parental requests often owing to exhaustion and frustration with their prolonged stay. Like many neonatal units Hawkes Bay SCBU has peaks and troughs in patient numbers. At times the unit is extremely busy, which creates a challenge in maintaining a safe level of staffing and equipment.

Chapter Summary and Project Aim:

It is clear there is room for improvement in neonatal care to optimize infant's long-term outcomes, minimize parental demand and mental health effects in addition to relieving pressure on neonatal units. Having the ability to routinely discharge infants earlier with a more streamlined package of care

so they can safely complete their tube wean at home, would reduce the inpatient stay of infants who are otherwise well but lacking the endurance to transition onto full oral feeds. With well researched and already developed programmes both nationally and internationally for home tube weans this provides a benchmark for other units to aim to reunite families with their infants and support family-centered care, the optimal for neonatal care.

CHAPTER TWO: METHODOLOGY AND FRAMEWORK

In this chapter I will outline my personal motivation for undertaking this project, discuss the guiding framework used, and the rationale for choosing Rosswurm and Larrabee's model for evidence-based practice (1999). I will outline the steps involved in the project including the planned activities within each step. The research question I set out to answer is 'Can preterm infants safely transition from nasogastric tube (NGT) feeds to oral feeds at home with a comprehensive support package and community follow-up?'

Background and personal positioning

I have worked in Hawkes Bay for 20 years in a variety of roles, a staff nurse, a homecare nurse and more recently as a clinic nurse coordinator. Over that time, I have developed skills, experience and knowledge in tube feeding and weaning and have always had an interest in this area. I looked after two preterm infants in my homecare role who unfortunately became tube dependent after discharge and I felt at a loss as we were unable to provide additional support with no tube wean programmes in Hawkes Bay. After months of frustration, both families enrolled their infants into international tube wean programmes and paid substantial amounts of money for this support. In 2015, along with our SLT, I attended a conference in Sydney on Feeding and Dysphagia. I found this conference so beneficial for my practice in particular the importance of side lying and comfort for oral feeds. In 2020 I completed a **N**ewborn **B**ehavioural **O**bservation (NBO) certification enabling me to perform NBO's with preterm infants. I really enjoy this aspect of neonatal care and had the expertise of our amazing neurodevelopmental therapist (NDVT) to guide me through this process.

Why this project?

There are several reasons I chose early discharge for preterm infants partially NGT feeding for my practice project, firstly I noticed an increase in inconsistent information and opinions provided by staff to parents in Hawkes Bay Special Care Baby Unit (SCBU) in regard to breastfeeds and nasogastric tube (NGT) tops ups. With a number of new staff starting in SCBU, I noticed that many seemed to have a reluctance to challenge babies to fully oral feed. The reason for this is unclear, presumably lack of experience working with preterm infants may have created fear about weight loss or disrupting the feeding schedule. It is my experience that it is common for mothers to spend all day in SCBU trying to establish breastfeeding, with infants still receiving partial to full NGT top ups post breastfeed. Therefore, often infants will not wake again for subsequent feeds while their mothers are present. This is likely due to the infant being overfed, and the infant therefore misses out on additional feeding opportunities. I also became more aware of a decline in maternal mental health at the end of the neonatal journey as mothers waited for their medically stable infant to have the stamina to fully oral feed and go home. I noticed that many were getting frustrated and impatient, some even

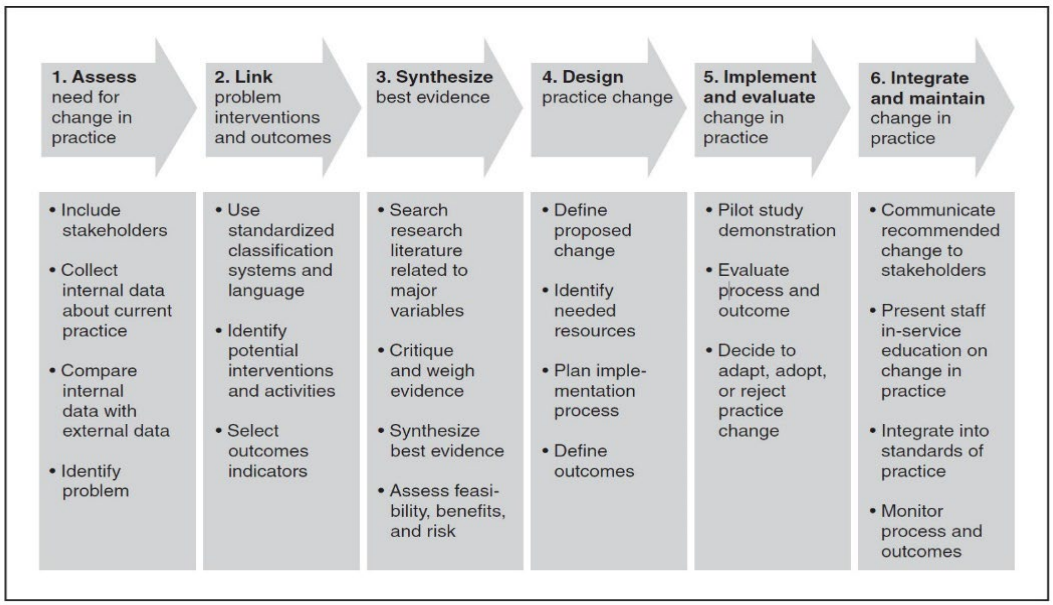
switching to bottle feeding predicting this would get their infants home earlier rather than persevering to establish breastfeeding. One mother said her toddler daughter cried every time she left the house to come to SCBU to visit her infant, and would say "*not the hospital Mummy*", this mother said she felt guilty in either location. This clearly demonstrated the overwhelming stress that having an infant in SCBU while trying to manage other children at home was having on this mother. Working through the Covid pandemic also highlighted the need to discharge infants home as soon as possible to avoid potential exposure to this and other viruses. There was a strong sense of urgency within the unit to make sure that infants were discharged home as soon as possible. Rather than taking a reactive approach, I felt that a more comprehensive planned approach to infant discharge was required in our unit. Nurses are in a good position to facilitate practice change as they are working in the frontline (Rafferty, 2018; Lusardi, 2012). As Rosswurm and Larrabee (1999) state, professionals' dedication to practice change may be sparked by recognising patient desires or displeasures, staff reviewing quality improvement and assessment data, new research and general staff inquiries.

The framework (methodology)

Rosswurm and Larrabee's framework was chosen due to its relevance to the project. As discussed previously, the aim was to develop an evidenced based tube feeding support programme to enable families to safely transition infants from NGT to breast/bottle at home, with the intention of developing a pilot project to trial in Hawkes Bay SCBU. Rosswurm and Larrabee's framework seemed most fitting given it provided a clear step by step process in and was suitable for nursing led practice change projects (Rosswrum and Larrabee, 1999). The model directs practitioners in a comprehensive way moving towards evidence-based practice starting with assessing the need for change through to incorporating an evidence-based practice into the workplace (Rosswurm & Larrabee, 1999). This methodological approach to practice change has been successfully used for evaluating service delivery (Anderson, 2022), designing a transition programme (Blamires, 2011) and implementing a clinical care pathway (Pole et al., 2022).

In planning this project, I used the six main headings to develop and guide activities and in the following section I will describe these according to the six phases.

Figure. 1. Rosswurm & Larrabee model for change to evidence-based practice (Rosswurm & Larrabee, 1999)



Step One: Assess the need for change in Practice.

Step one of Rosswurm and Larrabee model starts by assessing the need for practice change. Within this there are several activities that can be undertaken to achieve this including, inviting stakeholders to be involved, collecting internal and external data and then comparing the two. In addition, as part of this phase the comparative data can be presented to stakeholders to highlight the problem and to justify the importance of the proposed practice change. In the following section I will outline the key planned activities as part of step 1.

Include Stakeholders: For this activity I planned to discuss the project plan with key stakeholders. To select the appropriate stakeholders, I thought about the services that would need to be involved in the transition from inpatient to outpatient services or from Special Care Baby Unit (SCBU) to home. For inpatient services, this is very similar to the support currently provided to families in SCBU. When infants have issues feeding, they are referred to the Speech Language Therapist (SLT), and when infants are having issues with digestion or growth a dietician is contacted to assess them. The service predicted to be most involved with early discharges was the outpatient neonatal homecare team (referral criteria listed below). Therefore, the key stakeholders that were identified as important for this project included SCBU's Acting Clinical Nurse Manager (ACNM), lead neurodevelopmental therapist (NDVT), x2 speech language therapist (SLT), the dietician allocated to SCBU, two neonatal homecare nurses, our lactation consultant/RN from SCBU and two lactation consultants who work in community services. Meetings were scheduled via email where the meeting was to be 'in person' and

in a location that enabled all stakeholders to attend. According to Jabbour et al. (2018), regardless of the motivation and goals an investigator has for practice change without the enthusiasm from the Multidisciplinary Team (MDT) it will unlikely gather momentum. Rosswurm and Larrabee (1999) suggest, successful group meetings with stakeholders may be enhanced by group discussion, diagrams and charts and collective voting to gain buy-in.

The neonatal homecare service supports infants at home and their criteria includes:

- Infants born <34 weeks and/or less than 2kgs
- Infants discharged home on caffeine or oxygen and/or requiring repeat oximetry
- Infants requiring repeated follow-up bloods, e.g. those with hypothyroidism
- Infants with neonatal abstinence syndrome weaning from oral Morphine
- Infants having palliative care
- Infants with abnormalities, i.e. cleft palate
- Infants discharged home on NGT feeds and
- Other (infants the medical team requests to have further follow up in addition to the midwife if still involved and well child providers.

In 2020 my colleague and I produced the above SCBU homecare criteria using a combination of national and international guidelines and Wellington NICU's criteria **(See Appendix 1).** This criterion was adjusted to suit HB SCBU and approved by the HB Paediatricians for use in our unit.

Collecting internal data: Internal data or baseline data is essential to collect to compare with external data to help highlight the need for practice change and present the desired outcome effect (Perry et al., 2022; Rosswurm & Larrabee, 1999). It is recommended to ensure data collection required is not costly, to use existing resources if possible and to have a method of noting data (Centers for Disease Control and Prevention, 2021). To collect internal data, my intentions were to illustrate the current tube feeding and weaning practice in HB SCBU and to explore staff knowledge and prior education on tube weaning to assess areas where further teaching is required prior to setting up a pilot. According to Apte et al. (2021), staff resistance to change often stems from lack of knowledge and unfamiliarity in the proposed practice change. I also planned to compare the gestational age of infants on discharge from SCBU once fully oral feeding with the gestational age of infants entering already established early discharge programmes to measure cost savings. To obtain the required data, I set out to:

- Collect data over 6 months for infants that were NGT fed in SCBU
- Collect data over a 4-month period of infants born <37 weeks in SCBU. I recorded infants' birth gestation, their discharge gestation and number of total inpatient days **(See Appendix 3)**
- Review of Hawkes Bay's current nasogastric feeding policy regarding tube management **(See Appendix 2)**

- Distribute a Qualtrics survey to all RNs in SCBU, RNs from the Paediatric ward who frequently get redeployed to SCBU, Paediatricians, SLTs, and NDVTs. **(See Appendix 4).**

Collecting external data. To collect external data, I set out to contact other NICUs and SCBUs both within New Zealand and internationally to explore the already established tube wean programmes available for stable preterm infants transitioning onto oral feeds. I explored how these programmes audit themselves/what parameters they use to measure success. I also searched for staff and parent resources appropriate for early discharge with preterm infants partially NG feeding.

Compare internal with external data. According to Rosswurm and Larrabee, comparing internal and external data validates the need for practice change (1999). By comparing internal data to external data, hypotheses can be made and shared with colleagues to explore potential change in practice to achieve best patient outcomes (Rosswurm & Larrabee, 1999). I wanted to compare discharge age when fully oral feeding from HB SCBU to discharge age from NICUs that have early discharge programmes. It was felt that this data would allow me to estimate the cost savings based on inpatient days saved and examine outcome indicators from programmes such as Wellington's DOTS and Starship's early discharge programme. The aim of this was to explore factors such as breastfeeding rates and safety for infants in their pilot programmes.

Identify the problem. According to Rosswurm and Larrabee, if there is insufficient data to identify the need for practice change, subsequent data may need to be obtained (1999). Activities planned to aid with identifying the problem included highlighting the issues that contribute to unnecessary and prolonged stays in NICU/SCBU causing a burden on neonatal units, and the negative effects of hospitalisation and separation on infant and parental mental health which substantiates the need for early discharge for preterm infants.

Step Two: Link problem with intervention and outcome

Step Two within the model for change to evidence-base practice involves organizing knowledge obtained and defining the problem using classification systems and language (Rosswurm & Larrabee, 1999). This step helps to acknowledge the required resources for the change and provides an estimated cost. In addition, as part of this step the projected outcome indicators are identified to explore the positive effects the practice change may create. Therefore, the key activities planned within this step include to using standardised classification systems and language, identify potential interventions and activities, and to select potential outcome indicators. Along with reviewing early local discharge programmes within New Zealand, this step also includes an exploration of parameters and methods of audit used by these programmes to measure success. The *outcome indicators* selected for this this project were:

1. Is there a reduction in hospital stays (days) compared with infants in SCBU/NICU who are waiting to transition onto full feeds? If yes how many on average?
2. Does earlier discharge result in greater breastfeeding success, i.e. are infants fully breastfeeding and maintaining stable growth pattern.
3. Are infants weaned off their NGTs sooner when discharged home early compared with SCBU/NICU inpatients?
4. Explore the cost of SCBU stay/day and compare with community nurse visits

Step Three: Synthesize best evidence

Step Three of Rosswurm & Larrabee's model describes the importance of synthesizing the evidence. This involves a review and critique of the literature (Rosswurm & Larrabee, 1999). (See Figure 1). The practitioner weighs up the strengths and weakness in the literature recognizes missing factors and looks for inconsistencies with the information gathered (Rosswurm & Larrabee, 1999). I planned to have discussions with stakeholders around the feasibility of implementing an early discharge programme into our unit along with the potential risks and benefits this may have for infants, and their families in Hawkes Bay.

The *planned activities/phases* included a review and critical appraisal of the literature to highlight any gaps in studies and results. This is an important step as it enabled the identification of common themes in the literature and an exploration of the risks involved in the implementation of an early discharge programme in HB SCBU. Along with reviewing the empirical literature and synthesising the evidence, a review of the international guidelines and educational packages was completed regarding home NGT weaning in neonates. The intention of this activity was to explore already established guidelines and resources as it was deemed they would act as a guide to tailor a programme to HB SCBU. The literature search planned for included looking at major variables such as readmissions, infection, breastfeeding rates. As always when undertaking a review of the literature a critique and weighing of the evidence is required. This was particularly important in this project to explore outcome indicators of early discharge programmes and measure this against the risk and benefits. Discovering discrepancies in the literature is key in deciding if the literature is trustworthy (Alahdab et al., 2017).

Step Four: Design practice change. In Step Four of Rosswurm and Larrabee's model following synthesis of the evidence, the practitioner is able to design the potential practice change with input and discussion with stakeholders to obtain buy-in and to ensure success. Continuous communications are vital for stakeholders to accept practice change. While looking through the evidence and weighing

up the pros and cons the practitioner and nominated stakeholders can chose to adapt, adopt or reject the practice change (Rosswurm & Larrabee, 1999). The goals for Step Four were to:

- Develop selection criteria and present to the medical staff for home NGT feeding to ensure they are comfortable with the process in the hope to gain buy in. Use Wellington's Discharge On Tube Support programme (DOTS) and Starship resources as well as international criteria as a guide.
- Present the modified DOTS programme and Starship's resource to stakeholders as an example of a comprehensive resource that could be modified for Hawkes Bay parents.
- Use the modified DOTS/Starship task list for parents to complete pre-discharge, i.e. tube insertion, tube feeds, medication administration via NGT.
- Develop a Homecare plan for follow-up with visits two-three times a week, create a standard list of supplies required at home for tube feeds.
- Written information for after-hours support for parents, provide contact numbers for SCBU, Paediatric Assessment Unit (PAU), emergency department (ED), neonatal and paediatric homecare service.
- Develop individual weaning plans with criteria for medical review for parents.
- Create implementation plan based on successful development of the full NGT weaning programme as above which will include, staff education, parent education, developing guidelines on when to seek medical advice and an early discharge plan for individual infants.

Step Five: Implement and Evaluate Practice Change & Step Six: Integrate and Maintain Change in Practice

Due to the timeframe of this project Steps Five and Six as shown in Figure 1 were not planned for, however the goal is to continue after this project to complete and implement a pilot programme in Hawkes Bay SCBU which will require ethics approval from both Hawkes Bay Hospital and AUTEC.

Ethical Considerations

This project is deemed an important and needed quality improvement project for Hawkes Bay SCBU managers and lead clinicians. I have discussed my project with our local research office regarding ethics for this project and have sent the appropriate forms with a copy of my proposal to my nursing director. The plan will be to include one-two infants in a pilot study in Hawkes Bay's SCBU that meet the criteria for tube weaning at home, and whom can be supported by neonatal homecare service. It also recognised that the MDT team will need to provide information and seek consent from the families who meet the criteria agreed upon by members of the MDT. Families will be provided with comprehensive and extensive information for the early discharge programme and will be given the opportunity to proceed or opt out if they are not comfortable to partake in the pilot. Parents will be

given information around the risks associated with NGT feeding including tube dislodgement, aspirations, readmissions, and the potential for tube wean failure within a predicted timeframe. Ethical deliberations should be emphasized for infants and families should be considered in regards to the strict criteria for infants to be selected for the pilot programme.

CHAPTER THREE: LITERATURE REVIEW (Step 3)

Although Rosswurm and Larrabee present their framework as a linear process, in practice many of the steps are intertwined and interconnected some often occurring at the same time. In order to follow an academic format, this chapter will present the results of step 3 first, which is the synthesis of the evidence or the literature review. Chapter 4 will then present steps 1, 2 and 4 which represent all activities and 'findings' that relate to this project. The search methods will be described outlining the selection classifications used and the key themes that were discovered in this process. A summary of the overall results will be presented to the reader.

Step Three: Synthesize best evidence.

According to Rosswurm and Larrabee, in this step the practitioner critically appraises the literature to assess the strengths and weaknesses in order to discover any gaps and conflicts in the research obtained (1999). As a result of this process, the practitioner is then able to evaluate the feasibility of incorporating the desired practice change into their workplace weighing up the potential risks and benefits for patients and families (Rosswurm & Larrabee, 1999).

Formulating the research question. According to Bramer et al. (2018), taking time to compose a searchable question pays off as it enables the researcher to fine tune search terms and helps to limit databases in order to find suitable literature. For the purpose of developing a searchable question linked to this project, the PICO framework was used to provide an opportunity to create a well-built question. The PICO framework identifies four key concepts: **P**opulation, **I**ntervention, **C**omparison (or control) and **O**utcomes for research (Greenhalgh, 2019). Using the PICOT design to organize appropriate research terms, helps the researcher to focus on the words that are most important (Staffileno et al., 2021). Please see Table 1 below which outlines the key concepts that informed the literature search for this project.

Table 1. PICOT Framework

Population (P):	Premature Infants <37 weeks gestation.
Intervention or Exposure (I or E):	Premature infants discharged home early on partial nasogastric tube feeds (NGT)
Control (C):	Infants <37wks managed in NICU/SCBU until fully orally feeding.
Outcome (O):	Infants <37wks can be managed safely at home with community support and transition to full oral feeds.
Timeframe (T)	1 year

Search strategy. The Cochrane medical terms (MeSH) search manager was used for a definition of a premature infant: **"**A human infant born before 37 weeks of GESTATION" (Cochrane Library, 2000-2023). MeSh thesaurus matches or synonyms were used to ensure all possible alternative keywords for the search were included. Alternative words were sourced for premature infant, enteral nutrition, patient discharge, and length of stay using CINAHL. Articles were selected between the years 2012-2022, and were limited to English language and from countries with similar demographics to New Zealand. Databases used included Pubmed, ClinicalKey, Cochrane library via Wiley and Ovid, Joanna Briggs, Medline EBSCO and Google Scholar. I also discovered additional references within articles that were appropriate for this project. Boolean operators AND and NOT were used which Greenhalgh discusses are useful for excluding or increasing keywords facilitating in a more specific and constructed search (2019). As some search results produced articles about intubated infants, endotracheal tubes were omitting using the Boolean operator NOT as these were irrelevant to my topic. Multiple results were obtained for weaning programmes for tube dependent infants and children, again irrelevant to my topic and these studies were therefore omitted. The search terms table below outlines the search terms that were used:

Table 2. Search Terms

Preterm AND partially tube feeding or enteral feeding AND outpatient clinics
Preterm infants AND tube feeding AND outpatient clinics or ambulatory care or outpatient services or outpatient care
*Preterm infants or premature infants or preterm baby or premature baby or neonate or preterm AND tube feeding or enteral feeding or nasogastric feeding or gastric feeding AND Early discharge or reduce length of stay from hospital
Preterm infants or premature infants or preterm baby or premature baby AND tube feeding or enteral feeding or nasogastric feeding or gastric feeding NOT ventilation or mechanical ventilation or ventilator or intubated
(Premature infants) AND (early discharge) AND (tube feeding)
Neonate AND early discharge or reduced length of stay

Results:

The search revealed 34 articles relevant to the topic. After exhausting the search, I had concerns about the limited number of articles collected so my supervisor suggested I contact an AUT library academic to ensure the search strategy used was robust. The library academic was confident that the right tools and databases were used for the search, but suggested I break up my search into three parts which proved useful for locating additional articles. I proceeded to separate my search into preterm infants, preterm infants and temporary tube feeding, and preterm infants and resource packages/support or advice on discharge planning. This was a useful recommendation which assisted with the discovery of fresh articles relevant to my topic which I was grateful for. The results varied in origin, with the majority of articles sourced from the United States of America (8) and United

Kingdom (6), others were from Denmark, Sweden, Canada, South Africa, Ukraine, Australia, New Zealand, Norway, Spain, and the Netherlands. The articles selected were those exploring the application of early discharge programmes for preterm infants. The majority of the articles were retrospective data reviews (Ermarth et al., 2020; Ahnfeldt et al., 2015; Rosen et al., 2014; Sturm, 2005 & Williams et al., 2019) prospective studies (van Kampen et al., 2019; Dixon et al., 2011; Fumagalli et al., 2018, White et al., 2020; Edwards et al., 2019; Viswanathan & Jadcherla, 2019), and systematic reviews (Gonzalez-Gil, 2016; Grunau, 2013; Cheong et al., 2020, Nzirawa, 2017; Menczykowski et al., 2018). The remaining articles included three randomised trials (Cristofalo et al., 2013, Robinson et al., 2016; Gunn et al., 2000), one secondary analysis on a randomised controlled trial (Brockway et al., 2023), one data analysis review with Cochrane (Collins et al., 2015), two control studies (Meerlo-Habing et al., 2009; Ortenstrand et al., 2001), one baseline response design (Pavlyshyn et al., 2022), one qualitative thematic data analysis study (Madiba & Sengane, 2021), one qualitative synthesis (Brodsgaard et al., 2015), one qualitative exploratory study (Brodsgaard et al., 2022), one narrative review (Granger et al., 2021), one phenomenological hermeneutical interview study (Dellenmark-Blom & Wigert, 2013), one observational study with control group (Rasmussen et al., 2020), one theoretical model and instrument study (Boykova & Kenner, 2012), one longitudinal multicentre cohort study (Axelin et al., 2022) and two evidence based practice articles (Westrup, 2015; Aloysius et al., 2018)

What does the research suggest for early discharge for preterm infants partially tube feeding?

The practice of discharging preterm infants who are partially tube feeding but otherwise stable and allowing the tube wean to happen at home have been reported in the literature for some time (Evans, 1988). International research and pilot programmes in countries such as Denmark, the Netherlands and Utah have supported infants to successfully wean from their NGT's at home with positive results (Ahnfeldt et al., 2015; van Kampen et al., 2019; Ermarth et al., 2020). The findings from the literature review highlighted seven key themes as listed and discussed below. They are breastfeeding rates, quality of life for infants, parental stress and satisfaction rates, inpatient days, cost, safe practice/outcomes, and discharge planning.

Promotion of Breastfeeding

One of the strong themes from this literature review was related to the indication that when infants were discharged earlier from NICU they had increased breastfeeding rates (Ahnfeldt et al., 2015; Westrup, 2015, Dixon et al., 2011, Meerlo-Habing et al., 2009). Ahnfeldt et al. (2015) undertook a retrospective case-control study over a 11-year period and compared infants in an early discharge programme with a control group, they measured weight, breastfeeding and admission times and found that breastfeeding rates had improved in the early discharge group by 88% versus 80%. However, the

infants' who were discharged earlier were followed up for longer duration than the infants who remained in NICU until fully oral feeding (Ahnfeldt et al., 2015). Other studies suggest, when infants were discharged early with NGT not only did they successfully transition to breastfeeding but they also had a longer duration of breastfeeding with more time available to facilitate feeding with their mothers (Westrup, 2015; Meerlo-Habing et al., 2009; van Kampen et al., 2019). Meerlo-Habing et al's study did acknowledge that the selection of mothers in their study were more likely to breastfeed as they had higher education levels and lower rates of smoking (2009). Three studies from Ortenstrand et al. (2001), Gunn et al. (2000) and Collins et al. (2015) hypothesized there was no increase in the duration of breastfeeding in their early discharge groups with home support, however as Meerlo-Habing et al. (2009), points out home visiting nurses were inexperienced with the care of premature infants, and described this as crucial for the breastfeeding outcomes in their study. Both Dixon et al. (2011) and Gonzalez-Gil (2016) reported no reductions in breastfeeding rates for those discharged earlier from NICU, indicating early discharge does not alter breastfeeding success.

Quality of life for infant

The importance of getting infants home with their families has been well reported in the literature, the implications of the NICU/SCBU environment is detrimental for infant's health and the effects may extend into childhood (Grunau, 2013; Cheong et al., 2020; Pavlyshyn et al., 2022, Fumagalli et al., 2018). Reducing infant's hospital stay improves infant's quality of life and enhances the parent-child bond (Nzirawa, 2017; Rosen et al., 2014; Dixon et al., 2011). It has been suggested that it is more beneficial for infants to be weaned at home with their parents/caregivers where they are able to feed at their own pace in a calmer environment, with reduced harmful stimuli enabling them to concentrate on the task at hand (Collins et al., 2015; van Kampen et al., 2019). In Sturm's study, parents hypothesized it was more beneficial to their infant's health getting discharged home earlier (2005). Another disadvantage for infants in NICU is the separation from their mothers which adds a barrier to breastmilk production (Madiba & Sengane, 2021). It is well published in the literature the numerous benefits breastmilk has for the wellbeing and neurodevelopment of preterm infants (Granger et al., 2021; Brockway et al., 2023). Infants who are breastfed are less likely to develop necrotising enterocolitis (NEC), a life-threatening condition preterm infant are susceptible to (Granger et al., 2021; Cristofalo et al., 2013). Therefore, to enhance breastmilk production by having mother and infant together will improve infant's wellbeing and quality of life overall.

Reduction in parental stress/satisfaction rates

Getting infants home earlier has positive effects on parents' emotional and psychological wellbeing and attachment along with higher satisfaction rates especially when they felt supported with phone or video communication with nurses (van Kampen et al., 2019; Menczykowski et al., 2018; Brodsgaard

et al., 2015; Dellenmark-Blom & Wigert, 2013; Robinson et al., 2016; Ermarth et al., 2020). In Sturm's (2005) study, parents voiced gratitude with a home tube feeding programme commenting they simply enjoyed getting home which resulted in reduced expenses, enabled them to feel better prepared for the future, and they felt more inclusive in the care of their infant (2015). Only one parent out of the fifty- two participants in Sturm's (2005) early discharge study said they would not recommend home NGT feeding, the reasons for this were not stated, when looking through the results, there was one family in this study who reported feeling stressed with home NGT feeding due to their infant repeatedly pulling their NGT out which is likely the same parent and the reasons behind this. In Gonzalez-Gil's 2016 study, parents displayed slightly higher yet not statistically significant results in feeling more equipped in caring for their infants when they were discharged home earlier, however there were no major differences in anxiety or confidence markers in parents when handling their infants (Gonzalez-Gil, 2016). It was not mentioned in Gonzalez-Gil's (2016) study if parents were given the opportunity to room in with their infant the weeks leading up to their discharge. I have witnessed the increase in parent's confidence levels when they have been given the opportunity to room in with their infants, particularly when they are on oxygen therapy which creates apprehension for some. After a few days, parents become more comfortable with the equipment with staff support and teaching. According to Aloysius et al. (2018) when parents are given the opportunity to room in with their infant this facilitates confidence in caring for their infant with the support of NICU staff.

Inpatient days

It is of no surprise that the literature states infants who were discharged home earlier from NICU have a reduced length of stay (Collins et al., 2015; Gonzalez-Gil, 2016, van Kampen et al., 2019). Ninety five percent of infants were discharged home 9.30 days earlier in Gonzalez-Gil's study compared to those infants who remained in NICU until they transitioned to full oral feeds (2016). Similarly, in van Kampen et al. (2019) study, infants were weaned off their NGTs after 9 days of being at home, therefore had they remained in NICU they would have an additional 9 inpatient days before they were fully oral feeding. Sturm's study had even greater results with infants discharged on average 10-12 days earlier than infants who remained in NICU until they achieved full oral feeds (2005). The literature suggests, if parents are able to room in with their infants they would achieve oral feeds much earlier than those separated from their parents with missed opportunities to suck feed (Ermarth et al., 2020). It would be interesting to explore, if the infants who remained in NICU for 9-12 days more than those in the early discharge group had delayed discharges contributing to mothers having difficulties getting into breastfeed their infants with the demands of other children and family life. The above articles do not indicate if parents in the control group were given opportunities to room in with their infants prior to discharge.

Cost

Although most of the home tube feeding studies did not directly evaluate cost savings for infants', many studies estimated the savings based on the inpatient expenses involved in NICU or SCBU/day compared to being at home with community homecare visits (Gonzalez-Gil, 2016; Ermarth et al., 2020; Dixon et al., 2011; and White et al., 2020). Similarly, in Sturm's (2005) study she estimated a savings of $12,428 USD per infant ($19861.102 NZD) related to shorter hospital stays (xe, 29/3/23). Rasmussen et al. (2020) calculated the cost of neonatal tele-homecare compared with hospital care and stated it is clinically conducive and less costly than other equivalent hospital services. Furthermore, when infants were given longer time frames at home to transition to full oral feeds they avoided unnecessary and aggressive surgical measures such as gastrostomy tube placement, an additional cost saver for healthcare services (Edwards et al., 2019; Ermarth et al., 2020).

Safe practice/good outcomes: *How is it measured?*

Most early discharge studies concluded that early discharge for preterm infants partially tube feeding is a safe practice (van Kampen et al., 2019; Viswanathan & Jadcherla, 2019; Sturm, 2005). Some studies measured safety in the number of hospital readmissions directly related to nasogastric tube, i.e. aspiration as a result of tube dislodgement, there were no reported admissions owing to NGTs in these studies (Edwards et al., 2019; van Kampen et al., 2019; Sturm., 2005; Gonzalez-Gil, 2016). Dixon et al. (2011) reported reduced readmissions in their early discharge study with Gonzalez-Gil reporting no significant difference in readmissions or an increase in healthcare services in the one-year post intervention (2016). Boykova & Kenner (2012), suggest preterm infants discharged early are more likely to be readmitted to hospital in the first two weeks post discharge which may be seen as a negative result of early discharge, however many preterm infants are readmitted with issues such as jaundice, and infections in their first year of life regardless (Brodsgaard et al., 2015). However, as Brodsgaard et al. (2015) points out readmissions of infants from early discharge programmes for reasons such as dehydration, failure to thrive or parental uncertainties could be avoided with careful monitoring from parents and practitioners. Ermarth et al. (2020) cohort, found positive findings with projected savings in healthcare complications for infants as outpatients. Prolonged stays in NICU lead to an increased risk of contracting secondary illnesses, the potential to be victim to medical mishaps, and further impedes infant development (Ermarth et al., 2020; Collins et al., 2015; Gonzalez-Gil, 2016). Menczykowski et al., (2018), suggested reduced readmissions in early discharge groups may be owing to breastfeeding success and its protective properties. Viswanathan & Jadcherla, (2019) suggest there is no benefit to keeping NGTs in place until infants achieve their full oral volumes, but recommend discontinuing NGT feeds when the infant reaches 75% of their prescribed volume claiming it to be safe and appropriate for stable preterm infants. Growth is another important measure of success of home NGT feeding, according to Williams et al. study (2019), when infants were sent

home early, regardless of achieving full oral feeds earlier they were still able to uphold satisfactory growth curves. Gonzalez-Gil also stated they had no substantial alterations in weight gain for their early discharge study group (2016).

Discharge planning

According to Dixon et al. (2011) early discharge improves the discharge planning process and avoids disjointed delivery of healthcare (Ermarth et al., 2020). Infants in early discharge programmes have feeding plans set out for them and information on weaning which may be more comprehensive than what a parent would get when their infant is in NICU surrounded by health professionals. According to Hookway, (2013) despite parents longing to get their infants home, once discharge day comes, it can be extremely intimidating. It is the practitioner's responsibility to ensure, parents are prepared for discharge and given the opportunity to room in with their infants and to ensure all necessarily supports are in place for a safe and comfortable transition to home**.** Taking a preterm infant home has been described as a double transition for parenthood (Boykova & Kenner, 2012), early discharge programmes provide parents the chance to bridge that gap between NICU and home (Dellenmark-Blom & Wigert, 2013).

Assess Feasibility, Benefits and Risk

Step Three of Rosswurm & Larrabee's model asks that project leaders Synthesize Best Evidence along with assessing the feasibility, benefits and risk of implementing the proposed practice change (Rosswurm & Larrabee, 1999). Although my intentions for the research search was to explore both risks and benefits for early discharge programmes, the benefits out-weighed the risks for infants and families. It appears this practice is primarily safe and effective with positive outcomes for infants and families. I had hoped to see an increase in confidence levels with parents getting their preterm infants home earlier however it is understandable that these group of parents may be more vulnerable and have been exposed to stressors unique to those parents with full term infants (Axelin et al., 2022).

Key messages from the review of the literature/Chapter summary

It is clear early discharge for preterm infants partially tube feeding is a well-researched topic both in New Zealand and internationally. There have been a number of early discharge programme studies in the literature each with their own unique outcome criteria specific to their study. Overall it appears this practice is safe, with benefits such as similar or improved breastfeeding rates, high parental satisfaction, reduced or similar readmission rates, improves discharge planning, decreases inpatient days resulting in reduced healthcare costs and most importantly is beneficial to the vulnerable preterm infant to be home with their families to be nurtured and developmentally supported.

CHAPTER FOUR: Results of activities undertaken (Steps 1, 2 and 4)

In this chapter I will discuss Rosswurm and Larrabee's Steps One, Two and Four by presenting the results of activities that were undertaken for the purpose of this project and for feasibility of implementing an early discharge programme for preterm infants partially tube feeding in Hawkes Bay Special Care Baby Unit (SCBU). I will outline the steps taken to gather data both internally and externally and discuss an implementation plan for a potential pilot programme in Hawkes Bay SCBU.

STEP 1. Assess need for change.

Include Stakeholders: The first step in Rosswurm and Larrabee's model as shown in Figure 1, is to assess the need for change in practice. In order to successfully make change the researcher needs to seek stakeholders in order to gain 'buy in'. According to Rosswurm and Larrabee, stakeholders can incorporate specialised professionals, those from multi-disciplinary practices, officials and patients who have a special interest in the practice (1999). The stakeholders selected as previously discussed were chosen based on the services that will be affected and resourced to support infants both in SCBU and in the community setting. Before commencing this project, I discussed the topic with my manager and Associate Clinical Nurse Manager (ACNM) and they were very supportive, and both agreed many infants remain in the nursery for prolonged stays and could easily be challenged with individualised feeding plans and a comprehensive early discharge programme. My manager and ACNM could envisage the parental satisfaction and cost savings this could potentially have if this was successful and suggested I contact our neonatal lead clinician to initiate my project. According to Levin et al. (2011), cost savings are a significant upshot of evidence-based practice. I emailed and met with our neonatal lead clinician to discuss my expectations. Our lead clinician was also very supportive of the project and had been exploring early discharge programmes in New Zealand himself. Our lead clinician suggested that a multidisciplinary team (MDT) meeting be set up for the services that would be involved in the pilot programme. (See **Appendix 5** for MDT meeting agenda and minutes)

Collect internal data about current practice.

For this phase I reviewed the current tube feeding policy in Hawkes Bay SCBU **(See Appendix 2).** This policy is titled 'Naso-Gastric, orogastric and naso-jejunal- insertion and management of' (Hawkes Bay District Health Board, 2019). Please note pages 3-8 of this policy were omitted as the information pertained to naso-jejunal feeding tubes only. This policy begins with a purpose and principle and scope for enteral tubes. The policy is then broken down into naso-gastric and oro-gastric tubes and outlines the equipment required for insertion of same. The next section talks about the procedure, with a step by step instructions on how to insert the tube and to check the safety elements

by testing with litmus paper. To finish it discusses when to consult with the medical team, i.e. If the abdomen becomes “distended, tense or tender”, has visible bowel loops or erythema is visible (blood vessels), if the nurse has aspirated blood or bile from the stomach contents, blood stained stool or absent bowel sounds on auscultation (Hawkes Bay District Health Board, 2019). There is no plan for tube exit within this policy nor is there recommendations for tube weaning and highlights an area for improvement not only within this document but directly relates to the need for this project. As discussed earlier in this project there is no tube wean programme for Hawkes Bay infants. Families within the Hawkes Bay region are therefore required to travel to Starship hospital in Auckland in order to take part in their outpatient programme designed for children with tube dependencies an (Starship, n.d.b). This involves personal costs to the family including travel and accommodation costs. The referral criteria for already established early discharge programmes i.e. Starship and DOTS stipulates that the family must live within the catchment area of the hospital providing the service which would exclude them from entering these programmes.

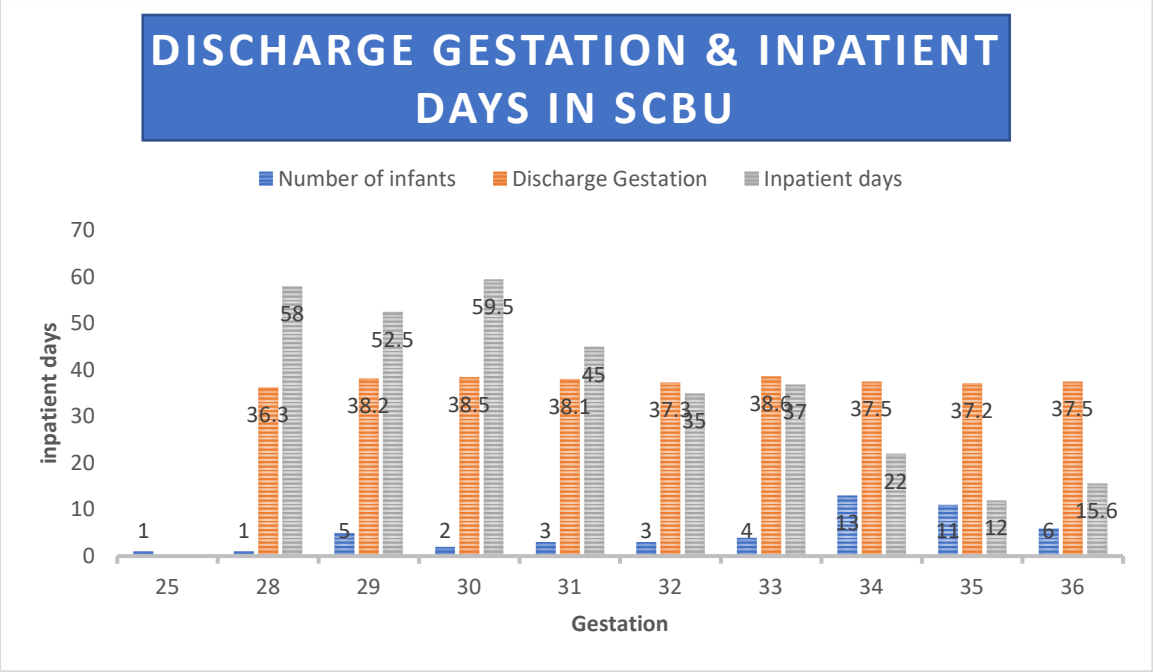
Data collection for all infants NGT feeding in SCBU

Over a 6-month period from 28th September 2021- 28th of March 2022 data was collected for all infants who were NGT fed in SCBU. The purpose of this was to explore the number of NGT fed infants in SCBU some of whom would meet criteria for early discharge. The number of tube-fed infants I collected over the 6-month period was 120, one of these infants went home partially tube feeding and remains partially tube dependent at 20 months with elements of cerebral palsy.

Data collection for all infants <37 weeks NGT feeding in SCBU

The purpose of this data collection was to calculate potential savings related to inpatient days if an early discharge programme is implemented in Hawkes Bay SCBU using the discharge criteria stakeholders agreed on, that is 36 weeks corrected age. Data was collected over a 4-month period from the 27th November 2022- 19th March 2023 on all infants <37 weeks in Hawkes Bay SCBU (**Table 3**). Birth gestation and discharge gestation was recorded along with the total number of inpatient days spent in NICU/SCBU. The average gestational age at discharge and average days spent as inpatients according to birth gestation was calculated. The average age at discharge and average days spent in HB SCBU when combining all gestations together was also calculated and recorded.

Table 3. Birth Gestation vs Discharge Gestation and Total Inpatient Days



The average gestational age at discharge was 38 weeks and the average amount of inpatient days was 40. For interest, as there were 4 sets of twins, their data was used to compare with singleton infants at the same gestation to see if they were discharged any later as in my experience, twins are typically slower to progress overall. Interestingly, the data showed twins in this group discharged at the same age or earlier than singletons infants at the same gestational age. For example, three sets of 34-week-old twins had inpatient stays averaging 23.3 days, the average stay for a 34-week singleton infant was 21 days, with the average discharge gestation 37.3 weeks compared with the average discharge gestation for the 34-week twins was 37.2 weeks. The 33-week-old twins (1 set) inpatient stay was 31 days, the average stay for 33-week-old singletons infants was 42.5 days, the average gestational age at discharge for 33-week singleton infants was 39.2 weeks, the twins were discharged at 38 weeks of age.

Costs associated with stay in Special Care Baby Unit. Obtaining an exact figure for the cost of a SCBU bed in Hawkes Bay proved difficult. After several months and two attempts to obtain data from the accountant, an estimated figure was obtained between $3000-$3100 for an inpatient stay/day versus the cost of a neonatal homecare nurse visit equating to $210 for a 30-minute visit or $420 for a one-hour visit (J. Brightwell, personal communication, March 16, 2023). The discharge criteria agreed on for Hawkes Bay SCBU's pilot programme is 36 weeks corrected age, therefore if infants are discharged home partially tube feeding at 36 weeks, (Two weeks earlier than average discharge gestation currently in SCBU), this has a potential savings of $42,000 per infant (based on $3000 per day) minus the cost of three one-hour community visits/week for two weeks $39,480. Figures were not sourced for the cost of SLT/NDVT/dietician community visits, but assume they would be similar

to that of the community nurse. Community visits from NDVT would likely not be over and above their usual visits as NDVT visit all infants born under 34 weeks gestation. If infants in the community need feeding support they are referred via homecare nurses. Given the infants who meet criteria for early discharge will be taking half of all feeds orally and managing these well, the SLT service would only be required if issues were to arise post discharge. There still however need to be provisions in place for this to support these infants to ensure success of the pilot. The dietician allocated to SCBU is referred all infants who go home tube feeding and has input if there are any concerns with growth or digestion/absorption. Lactation consultant (LC) hours would need to be addressed in a business case as they do not usually visit infants outside of SCBU.

Qualtrics survey methods. A copy of a survey from Queensland Children Hospital (formally lady Cilento Children's Hospital), with similar goals was used as a guide. The survey questions in Queensland survey focused on improving practice for children with temporary feeding tubes. A Qualtrics survey was created for staff at Hawkes Bay SCBU, to gather data on staff knowledge and prior education around tube feeding and weaning (**See Appendix 4**). The survey was sent out to all current registered nurses (RNs) working in SCBU, RNs from the Paediatric ward who frequently get redeployed to SCBU, paediatricians, and allied staff such as SLTs and NDVTs via email. The survey results were anonymised and staff were advised that it was optional for them to complete it. Before sending out the survey to colleagues, the questions were piloted through sending the survey to an AUT colleague and Masters student who works in a similar field. The student was asked to test the survey and provide feedback/suggestions before sending it out to colleagues in Hawkes Bay.

Feedback on Qualtrics pilot: The feedback from the AUT colleague was well received, after completing the survey I received comments around her perception of over-feeding in her neonatal unit and what indicators they use to assess for tube wean readiness. My AUT colleague also discussed her perception on the importance of individualised feeding plans for infants and the use of breastfeeding codes.

Qualtrics survey: The initial survey was sent out in April 2022 to 57 staff, with fifteen surveys completed. Although the completed surveys only accounted for 26% of those distributed, the comments and feedback received was beneficial for the project. After discussions with my supervisor it was decided I should send the survey out a second time to try to capture staff that had returned from maternity leave and additional new staff in SCBU. The same survey was sent out again in November 2022 with a much better uptake with 28 out of the 49 surveys completed, 57%. The number of survey invites differed from April due to staff movement, 3 nurses were on maternity leave, 8 staff had resigned and 3 new staff had been employed.

Results: The participants of the survey consisted of 16 neonatal nurses and 11 paediatric nurses who occasionally work in SCBU. Years of experience ranged from 1 year to 20+ years. The answers to the questions from the survey were grouped into common themes and these are described below.

Breastfeeding codes: When staff were asked "Do you find the breastfeeding codes useful as a guide for top up amounts?", two staff members didn't know about the breastfeeding codes, others answered, "*Yes, however sometimes it can be hard to find the BF codes and when I ask SCBU staff they aren't always sure*". Another respondent commented how it '*Would be good to have a copy (easily accessible) in CHU*" (Child Health Unit). Interestingly some of the staff who had not previously been aware of the codes commented how they had "*Just found out about them, but after a little education I feel it would be useful*". The responses to the question about the breast-feeding codes indicate that staff deemed them as helpful although they are not accessible in all areas and further education on the application of these is needed. One of the nurses in the children's ward who I will refer to as nurse P approached me after the survey had closed wanting to know more about the breastfeeding codes. The children's ward receives a number of infants admitted with jaundice or infants who are 'failing to thrive' often accompanied with feeding issues, and I suggested to Nurse P, the breastfeeding codes could be useful in those circumstances. Comments from other staff members around the breastfeeding codes varied, some said they found them *"subjective"* or *"vague",* and they prefer to ask Mum her thoughts, i.e. "*are her breasts less full after the feed, what her supply is like*", and staff looked at previous volumes' infants had been given post breastfeed. Some staff based top up amounts on the individual infant, i.e. how well they felt they have been sucking, what their growth trend is and calorie requirements are, and how satisfied the infant appears after the feed. Some staff found the current breastfeeding codes "*term baby focused*" and not particularly "*user-friendly for Mums to interpret the quality of the feed*". Some staff said they do not use the codes for infants who were learning to feed and some staff found infants spilling during the NGT top up despite using the codes. One staff member made an interesting comment that she felt using the breastfeeding codes "*helps to get parents involved*" and that "*some Dads like to use them to get the top ups ready*".

Reducing top ups: When staff were asked "Do you have any concerns when reducing tube top-ups?" seven people answered yes, however most who had replied yes to this question indicated in their answers that they worked outside of SCBU, for example, "*as SCBU is not my normal area, I just ask for guidance from SCBU RNs*", and "*not comfortable to do this on my own as I only occasionally help out and would seek advice*". Other staff member had worries around weight when reducing top ups however they said they relied on measures such as stable blood sugars and weight gains to ensure the infant was receiving enough volume. One staff member said they were *"more concerned with overfeeding with tubes and therefore baby not getting hungry enough to feed".*

Indicators for tube wean readiness in preterm infants: Only three staff members had had formal training in weaning preterm infants, 11 staff members indicated that they wanted more education on tube weaning. When asked "Do you think individualised feeding plans would be beneficial for infants, their families and staff in SCBU?" 19 staff answered *'yes'*, one answered '*no*' and eight answered '*maybe*'. Staff felt individualised feeding plans would be useful for consistency and continuity, with better communication between staff and parents and would be particularly *"useful for staff coming from other areas"*. Staff voiced having individualised plans would avoid *"differing advice"* and confusion for parents would stop *"personal as opposed to professional opinion"* around feeding techniques. There were a few comments from staff that no two infants are the same and plans should be adaptable according to 'this' infant's nutritional needs. Staff addressed the importance of education on cue-based feeding giving them the ability to *"feel more in control of feeding their baby"* and that we should be moving from a *"volume driven"* to cue-based feeding. Although most staff members ranked the itemized tube feeding indicators high, not one staff member felt infants were ready for tube weaning when they can take three or more feeds in 24-hrs by breast or bottle. This was surprising and highlighted the lack of knowledge around tube weaning as infants who meet these criteria are considered ready for early discharge home in some units (See Table Four).

Teaching parents insertion and maintenance of NGT: When educating parents on inserting and managing NGT tube feeds some staff answered they were not confident and needed support when teaching parents how to measure the NGT on infant, insertion procedure of NGT, how to tape and secure the NGT and how to check for correct placement. The results of the survey were interesting and highlighted education was required particularly in areas around tube weaning, signs of tube wean readiness and teaching parents how to insert and manage an NGT.

Collecting External Data

International early discharge programmes

As discussed earlier sourcing the evidence of already established international discharge programmes did not come without hitches. I attempted to contact international NICUs such as The Royal Women's Hospital Victoria, Australia, The Children's Hospital Westmead, Sydney, Australia, Sheffield Hospital England, Australia, Queensland Children's Hospital Australia and Magdalena Lawrence NHS London. After reaching out to other units, I either had no response or was cc'd into emails forwarding on my original request to the appropriate person. However, I persisted and contacted units more than once. I also researched for online resources available for parents for early discharge programmes. In 2022 the Covid pandemic was still prevalent, in addition to worldwide nurse shortages which I predicted may have impacted on services lacking the time and resources to reply.

The early discharge programmes and resources I was able to obtain were from the United Kingdom (UK) and Australia.

Nepean Hospital, Australia is a 36-bed unit with 11 level three cots, and 25 level two cots in the Nepean Blue Mountains in Penrith Australia (Penrith RSL, 2017). They have an early discharge program and infants meet eligibility into the programme when they meet the following criteria: ≥35+0 weeks with the single reason of their current NICU stay being delay in feeding, taking alternate NGT and suck feeds, no apnoea or bradycardic events for 72 hours and off caffeine for 5-7 days, weight gains according the individual infant, and maintaining their temp within normal limits. Infants are excluded from this programme if they are considered complex, i.e. neuromuscular disorders or syndromic, and if families have a history of domestic violence, drug use, live more than thirty minutes from the hospital and are non-English speaking. The Nepean Hospital early discharge programme has not yet been audited however the unit manager did comment that they do get a couple of readmissions the most common reason was for jaundice and they are looking at establishing phototherapy treatments at home.

Sheffield Teaching Hospital, England is a 45-bed neonatal unit with 15 intensive care cots, six high dependency cots, 18 special care cots and six transitional care cots and covers areas in Sheffield, South Yorkshire, Mid Yorkshire and North Derbyshire in England. After no reply from this unit, an early discharge policy for parents was sourced online, a very clear and simple guideline for parents. Their discharge criteria for this programme is included in their policy which stipulates, infants are expected to be >34 weeks, off heart monitoring, >1500gs growing and gaining weight well, maintaining temperature in a cot and taking some feeds orally (Sheffield Teaching Hospital, 2023). Community nurse visits and 24-hour phone support services are available for parents. Similar teaching required as other unit's policies state with Infant Life Support, practical skills training sessions and education on tube feeding and maintenance.

The Grace Centre, Australia is a 23-bed neonatal unit in Westmead, Sydney Australia (NPESU, 2013). The Grace Centre is the only accredited Newborn Individualised Developmental Care and Assessment Programme (NIDCAP) training centre and are the pioneer for developmental care in infants (The Sydney Children's Hospitals Network, 2021). The key contact person emailed through their Homecare guideline for insertion and care of a feeding tube at home, this guideline was another comprehensive parent resource including criteria for early discharge, important points when using the NGT, the insertion procedure with a diagram of an infant showing the position, troubleshooting, i.e. if no aspirate obtained and helpful hints for example tapes to use if the infant is experiencing skin irritation.

STEP TWO: Linking problem with intervention and outcomes

In Step Two (see Figure 1), practitioners are required to outline the practice dilemma using standardized classifications and marry this up with intercessions and patient end results (Rosswurm & Larrabee, 1999). Classification organisation aids in defining and gathering the technical facts and promotes conversation within professions, delivers criteria for defining the validity and costings and highlights the supplies that are required for practice change (Rosswurm & Larrabee, 1999). By researching already established early discharge programmes and research literature, I hoped to be able to present encouraging results to assist in my plan to implement a similar programme in Hawkes Bay SCBU.

Interventions and activities:

NICUs and SCBUs throughout New Zealand were contacted in order to review already established early discharge programmes. After reviewing each of the early discharge documentation and programmes, I spoke with the lead practitioners for each of the programmes and asked what parameters they used to measure success and how they audit their programmes**.**

Starship, Auckland City Hospital. Starship have 40 resourced bed spaces, with 30 level two cots; and 18 level three cots. They have 1000 annual admissions with a flight and retrieval team (Neonatal Nurses College Aotearoa, 2014). Starship had an early discharge programme accompanied with a Corpack, a comprehensive resource package for parents taking their infants home partially NGT feeding (See Table 4 for programme criteria). The contents of the Corpack include contact numbers for support, information explaining what a nasogastric tube is and the rationale around the need for NGT feeds. The Corpack includes instructions for inserting a NGT, administering milk feeds and medications via the NGT and troubleshooting. There is a section in the front of the pack where parents/nurses can record the measurement of the infants NGT and date it was last replaced. Parents are required to fill out 'homecare feeding forms' to assess their feeding progress. Homecare nurses are responsible for assessing hydration indicators every 48-hours post an infant weaning from the NGT which may be via phone if parents have been supplied with scales at home. Starship have individualised weaning plans for infants with support from homecare team and their senior medical officer. Infants in this early discharge programme do not have allocated community SLTs or dietician referral as the aim is to have the NGT removed within 10-14 days after discharge from NICU. If this fails, they will have a consultant review and community allied health personal practitioners may be involved. Starship also use breastfeeding codes for a guide to gauge NGT top ups (Auckland District Health Board, 2013).

Wellington Neonatal Intensive Care Unit (NICU). Wellington NICU is a 40-bed unit with 18 level three cot spaces and 22 Level two cots spaces, they have a flight retrieval team (Neonatal Nurses College Aotearoa, 2014). One of the neonatal CNS' in Wellington NICU has recently completed an

early discharge programme called DOTS (**D**ischarge **O**n **T**ube **S**upport), another well detailed package similar to Starship's and tailored to their unit. (See Table 4 for programme criteria). The DOTS package contains similar information to Starship's Corpack in addition to a discharge criterion, securing the NGT, feeding cues and transition to full oral feeds, and instructions on how to use the Freego pump. The DOTS package includes recording sheets for parent education and skills required prior to discharge as well as a parent feedback questionnaire at the back of the package for auditing purposes. Parents in the early discharge groups are supplied with a set of scales to monitor their infant's growth (C. Dunn, personal communication, November 15, 2021).

Waitemata Te Whatu Ora. Waitemata Te Whatu Ora covers Northshore, Rodney District and Waitakere City, Waitakere SCBU and Northshore SCBU are under this umbrella. Both Waitakere SCBU and North Shore SCBU are similar in size and demographics to Hawkes Bay SCBU, both having 350 annual admissions with 12-15 cots (Neonatal Nurses College Aotearoa, 2014). Waitakere and North Shore SCBU have an early discharge programme using Sheffield Teaching hospitals guideline and with permission was modified to their unit. Waitakere and North Shore SCBU have a community nurse, SLT and dietician involvement (See Table 4 for criteria). Waitemata's discharge criteria have a similar process for infants who are more complex and who may not be taking oral feeds for various reasons, yet are still given the opportunity to discharge early on NGT feeds, a good way to incorporate all infants in the programme which was actually suggested by one of our Paediatrician's in the March MDT (See meeting minutes **Appendix 6**). Waitemata's support package for parents is very similar to others and includes their discharge criteria, instructions for removing the NGT, an agreement of care that is signed by staff and parents and checklists similar to DOTS for parents to complete prior to discharge. Waitakere SCBU supply parents with a tablet installed with a recently introduced app specially designed for parents in their early discharge programme. Parents are also supplied with a set of scales to record their infant's progress. Waitemata SCBU says they are cautious when sending infants home as to not overload workloads of other services.

Christchurch NICU. Christchurch NICU have recently incorporated and modified the DOTS programme to their neonatal unit.

Auditing.

The principal intention of clinical audits is to distinguish practice areas that may benefit from improvements and/or progress (Ullman et al., 2018). Enquiries were made with the neonatal units (NNU) previously discussed regarding their outcome indicators, how they measure success and if they had performed any audits for their programmes. As most of these programmes were newly introduced they had not yet officially audited them, however the overall consensus from anecdotal results were positive. The feedback received focused around the importance of community support in particular.

The key contact I spoke with in Waitemata discussed the need to pause their pilot as one of the infants in their study was found to be losing weight and had no lactation consultant support available. They had recognised this was crucial for their programme to have success going forward. The key contact in Wellington NICU said infants in their pilot were discharged home 7-10 days earlier than infants who remained in NICU until they had established full oral feeds, had better breastfeeding outcomes and parental satisfaction, and they said their results were "much like what the research shows". Waitemata SCBU discovered their homecare team needed education on how to use their teaching app to be able to educate parents on the same. When asked if infants in their pilots were readmitted, Nepean NICU said they did have infants who were readmitted due to needing phototherapy to treat jaundice and they are currently looking into being able to manage this at home rather than having to readmit these infants. Starship NICU are still working on collating their data but they are finding their pathway is still "unutilised so evaluating its success is challenging".

Actions following audit of other units. After collecting the above information, I arranged an additional MDT with stakeholders to present my results of the research for early discharge partially tube feeding, to discuss and tease out any concerns/comments on the pilot programme, and to confirm the discharge criteria for the Hawkes Bay SCBU pilot programme. I presented a table outlining a comparison of the selection criteria programmes used within New Zealand and one from Australia- (See Table 4). The blue font in Table 4 highlights the discharge criteria the MDT stakeholders agreed to. One of the paediatricians said he would be happy with some infants being discharged home at 35 weeks if they were feeding well, however to start the pilot programme it was decided that 36 weeks was the most appropriate and safe age. The group decided this could be amended depending on the success of the programme. The results of the literature were presented at the MDT meeting, along with a discussion of successes from other already implemented early discharge programmes. I outlined the outcome criteria I was aiming for as a result of the implementation of an early discharge pilot programme in our Hawkes Bay unit. The difficulties encountered getting costs for a SCBU inpatient stay as well as a community homecare visit was mentioned to stakeholders which they agreed was frustrating. As a group we brainstormed parameters and deliberated over any concern's stakeholders had for the Hawkes Bay SCBU early discharge pilot programme. One of the paediatricians reinforced that community supports need to be established prior to the pilot study to ensure it is successful, which was an important aspect highlighted after talking with other units. Another paediatrician had concerns that this programme would further overload the already busy services and wanted to ensure that there were provisions in place for services to meet the demand rather than trying to fit this into their schedules. (For meeting minutes see **Appendix 6**).

Table 4: Comparison of early discharge criteria for MDT

	Wgtn DOTS:	Starship	Waitemata
Gestation: **Blue Font indicates criteria HB SCBU are comfortable with**	≥36 weeks corrected or ≥38 weeks for mildly complex preterm born ≥26 weeks. Decision to partake by named Consult if birth gestation <32 or Consult of the week if birth gestation ≥32 weeks	≥34	>35 weeks gestation
Weight:	Not mentioned	≥1800gs	Not mentioned
Temp:	Able to maintain temp >36.5 in cot	Not mentioned	Can maintain temp in open cot
Monitoring:	Must have finished all monitoring for at least 48hrs or for planned bitmos monitoring at home	Off all monitoring for at least 48hrs	Heart rate monitoring has been stopped
Blood sugars:	BSL stable and within normal range	Not mentioned	Not mentioned
Growth:	Weight gain along percentile, no dietician concerns, off additives	Stable weight gain	Baby growing and gaining weight
Medical:	Medically fit for discharge	Not mentioned	Not mentioned
Feeding:	Infant having no more than 4 NGT feeds within 24hrs with a feeding score ≥5 and reduced top ups (evidence of basic feeding skill but lacking stamina)	Infant is able to take >50% oral feeds	Taking at least 50% suck feeds
Functional swallowing abilities:		No upper airway anatomical or functional swallowing abnormalities	Oral feeding structures intact
Parental requirements:	Parent/carers must have completed the NGT feeding teaching package: and be confident in all aspects of care	Parents will be excluded if unable to engage with training	Parents are willing to learn how to tube feed. Parents have completed the training for home tube feeding
Social:	Risk assessment, no social work concerns	Parents will be excluded if no 24hr access to phone or transport	
Demographics:	Neonatal Outreach Team is able to provide a safe service with appropriate staffing levels and equipment	Parents excluded if have no access to Newborn Homecare nurse follow up- i.e. Waiheke Island	Family live in the Waitemata DHB

In addition, I reviewed the audit practice of Nepean Blue Mountains, Local Health District Australia and found that they had the following criteria for neonatal discharge. The neonate must be:

- Apnoea free and off caffeine for 5-7 days
- Weight gain individualized to each infant
- Maintaining body temperature within normal limits 36.5-37.5°C.

The Nepean Blue Mountains local health district eligibility for discharge on home tube feedings were as follows:

- ≥35+0 weeks (only reason for staying in NICU is feeding)
- Maintaining temperature in a cot
- Alternate tube & suck feeds (could be breastfeeding)
- Off Caffeine- 5-7 days monitoring as per the protocol
- No cardiorespiratory events for 72hours
- Complex babies (e.g. neuromuscular disorders, HIE, severe GER, Syndromic/congenital anomalies, etc.)

Their exclusion criteria included: History of domestic violence, Drug use, non-English speaking parents, families requiring an interpreter, or more than half an hour travel time by a car within LHD.

Outcome indicators

Rosswurm and Larrabee (1999) highlight the need for selecting outcome indicators in Step Two of the model (See Figure 1). Outcome indicators are critical for evidence-based practice pilot projects and involves having an awareness of the appropriate measures to collect with consistent and reliable data collection tools. The chief indicator for this project is early discharge for preterm infants partially tube feeding with the outcome of implementing a tube wean pilot programme for Hawkes Bay's SCBU along with individualised feeding plans. This programme will be audited on factors such as age of discharge to the programme, age NGT is removed, readmission and breastfeeding rates. I also hope to enhance staff knowledge on tube weaning and signs of oral feeding readiness with additional education.

STEP FOUR: Design Practice Change.

In step four Rosswurm and Larrabee describe the need to design the practice change. Informed by all the previous steps undertaken as part of this project, the plan for the pilot early discharge programme for Hawkes Bay SCBU is mostly complete with some activities to be undertaken as part of the pilot itself. These activities sit outside of the framework of this project report.

Some of the key activities undertaken towards the practice change include the development of selection criteria, which includes:

- Select one-two infants for the pilot programme ensuring they meet all criteria
- Use the modified DOTS/Starship Corpack tailored to Hawkes Bay SCBU which will include a task list for parents to complete pre-discharge, for tube insertion, tube feeding, and medication administration.
- Develop a parent introduction/explanatory document to assist parents to make an informed decision to decide if early discharge partially tube feeding is something they would be interested in (**Appendix 9**).
- Develop written information for after-hours support for parents, including contact details for SCBU, Paediatric Assessment Unit (PAU), emergency department (ED), and neonatal and paediatric homecare service contact numbers. (**Appendix 8**)
- Develop individual weaning plans with criteria for medical review for parents
- Develop a Homecare plan for follow-up, with a standard list of supplies required at home for tube feeds (**Appendix 7**)**.**
- Prepare a document for all staff who will be involved in the early discharge on tube feeds pilot outlining the discharge criteria, details and timeframe for the pilot
- Schedule a teaching session for nursing staff in SCBU to discuss the proposed pilot programme, include education of tube weaning and oral feeding readiness, shifting parents

from scheduled feeds to cue-based feeds and the implications of infants experiencing feeding discomfort.

- Discuss breastfeeding codes in the children's ward in a paediatric study day
- Prepare a business case for allocated lactation support for SCBU and community for the proposed pilot programme, present the potential cost saving this could have for SCBU
- Apply for ethics approval from both Hawkes Bay Hospital ethics committee and AUTEC

Chapter summary: This chapter explored many aspects around early discharge for partially tube fed infants. With the data gathered on tube feeding and tube weaning from Hawkes Bay SCBU, collating the average length of stay across gestations was a useful task to compare the projected impatient days saved for infants if an early discharge programme was implemented in this unit. The Qualtrics survey was a good indicator of the education needed and highlighted the mixed messaged staff and evidently parents are receiving around tube feeding and weaning. The exploration of other units already established early discharge programmes both nationally and internationally was useful as a guide for a pilot programme for Hawkes Bay SCBU families. A lack of audit and outcome measures was disappointing however the anecdotal evidence was positive and supports the results from the literature as discussed in chapter three. Following Rosswurm and Larrabee's step four 'Design Practice Change', a proposed plan for a pilot programme for Hawkes Bay SCBU was designed to prepare for implementation of a similar early discharge programme for Hawkes Bay's SCBU.

CHAPTER FIVE: DISCUSSION, RECOMMENDATIONS & CONCLUSION

In this chapter the overall findings of the practice project will be summarised stressing the need for change in current practices for tube weaning for the benefit and wellbeing of infants and their families in Hawkes Bay's Special Care Baby Unit (SCBU). Moving through Rosswurm and Larrabee's Steps one two and three, the results obtained from the internal and external data combined with the literature search results will be collated and summarised to outline the benefits and risks of early discharge for preterm infants partially tube feeding. The difficulties faced obtaining the required information to support this project will be revealed. I will discuss the simplicity of using Rosswurm and Larrabee's (1999) framework to guide this project along with the challenges I faced to maintain the flow while still incorporating the steps. The final stage of this project will conclude with the suggested final recommendations and implications of early discharge programmes and a discussion of the feasibility of implementing a pilot programme in Hawkes Bay's Special Care Baby Unit (SCBU).

In chapter one feeding patterns and progression of preterm infants was explored highlighting issues around delayed discharge owing to infants' lack of stamina in reaching their full oral feeding milestone despite being medically well and fit for discharge. The implications of parent-infant separation were drawn identifying the undesirable effects this has on infant neurodevelopment, maternal mental health and disruptions for attachment and bonding all which may have lasting effects (Grunau, 2013; Axelin et al., 2022; Driver et al., 2021). Returning infants to their families as soon as this is safely possible is paramount to maintain the family unit, reduce unwanted and unpredicted expenses due to travel and food, and to enhance the parent-child bond (Wilson, Nzirawa & Mannan, 2020; Hookway, 2013; Nzirawa, 2017). Family-centered care is a key concept in neonatal units including families in the care and decision making for their infant and acting and nursing in a way that enables them to take control of their infant's care. Transitional parent rooms are useful to ease the family into transitioning from NICU/SCBU to home with ongoing support from staff (British Association of Perinatal Medicine, 2017). When parents are given opportunities to room in with their infants they develop confidence and the skills required to care for their infant at home (Menczykowski et al., 2018; British Association of Perinatal Medicine, 2017). Hawkes Bay SCBU do not have an existing tube weaning programme, therefore infants and their families are required to travel out of the region for tube wean programmes resulting in further financial expenses and stress. Having a tube wean programme would be idyllic for families in Hawkes Bay.

Overall findings: The evidence that was obtained with internal and external data was useful for comparative measures to predict the reduction in inpatient days and the cost savings for infants in Hawkes Bay SCBU. When looking at the data collection for all infants born <37 weeks, regardless of their birth gestation infants were discharged at similar ages, i.e. 36-38 weeks. For the late preterm

infants without the complexities of prematurity often referred to as ‘feeders and growers’ I had predicted they would be discharged home earlier than 38 weeks if they were making good feeding progress interestingly this was not necessarily the case looking through the data. The average discharge gestational age from Hawkes Bay SCBU overall was 38 weeks, when comparing this with discharge criteria of other early discharge programmes most infants are discharged home partially NGT feeding between the ages of 34-36 weeks corrected gestation. This comparative data highlights the predicted and substantial cost savings for healthcare in Hawkes Bay SCBU if an early discharge programme was implemented for infants and families. The Qualtrics survey was useful to explore prior education of staff on tube weaning and the differences in education and advice currently provided to mothers around breastfeeding and gauging a ‘good breastfeed’. The survey highlighted varied use of the breastfeeding codes and which may be particularly beneficial for staff that only occasionally work in SCBU to use as a guide for NGT top ups post breastfeeds avoiding confusion and differences in opinion received from SCBU staff. The survey also emphasized the conflicting advice given around feeding, if staff are confused and unsure, this must be twofold for parents. The overall results of the survey highlighted that staff education is required around areas such as tube wean readiness, teaching parents how to insert NGTs and test for correct placement.

When exploring already established early discharge programmes, I discovered the crucial elements of ensuring success for a similar programme for Hawkes Bay’s SCBU. It was evident when talking with the key contacts for the early discharge programmes that a wraparound service is needed to safeguard infants and families once discharged home for a higher chance of success for a pilot programme. The anecdotal results were however promising with key contacts reporting great results, very similar to what the research suggests along with high parental satisfaction rates. The discharge criteria varied slightly between the different units explored mainly in regards to gestational age, by including stakeholders in selecting a discharge criterion that is right for our region was paramount to ensure all involved are comfortable with the proposed practice change. Research around the different methods of ascertaining nasogastric tube placement, emphasized the need for a change in practice in Hawkes Bay SCBU to source litmus paper with pH indicators.

The literature search highlighted the benefits of early discharge for preterm infants with some reporting improvements in breastfeeding success and duration, parental satisfaction, improved discharge planning and reduced length of stay for infants resulting in substantial cost saving for healthcare services, freeing up much needed bed spaces in over-resourced neonatal units (Ministry of Health, 2019; Menczykowski et al., 2018). As discussed, the detrimental effects separation and hospitalisation has on preterm infants and their families is both destructive and superfluous, therefore reducing this separation time for infants and families should be prioritised in neonatal care. As quoted

in the British Association of Perinatal Medicine (2017, p.1), **"**The question should not be whether mother and baby can be cared for together, but rather why should they be separated".

Limitations: The limitations acknowledged in the literature were the lack of feeding guidelines or tube wean guidelines for preterm infants, a crucial part for safe transition from NGT to oral feeds to ensure feeding success, an accomplishment that extends into childhood (Philbin & Ross, 2011; Krom et al., 2018; Edwards et al., 2016). There is a gap in the literature regarding transition from NGT to oral feeds in the community setting (Greene et al., 2013) and although there are many international tube wean programmes described there is limited evidence as to the safety and validity of these programmes (Gardiner et al., 2014). The literature highlighted even when parents are given the opportunity to take their infants home early from the neonatal unit, they are still apprehensive and need reassurance from healthcare practitioners such as nurses (Boykova & Kenner, 2012; Larsson et al., 2016). Parents often have mixed emotions of both anxiety and happiness when taking their infants home from NICU (Osorio Galeano et al., 2017). Community nurses provide the link to the hospital (Osorio Galeano et al., 2017) and 24-hour phone support with neonatal nurses and video-conferencing were referred as the "lifeline" by some parents (Menczykowski et al., 2018, p.303). The importance of staff encouraging parents to be involved and to take part in their infants care as soon as possible is an area that may need improvement. Transitional care supports parents in bonding and becoming more interactive and comfortable in their infant's cares and is likely a key step towards good transition from the neonatal unit. Enabling parents to room in with their infant before taking them home with ongoing support from community nurses would provide a supportive and reassuring approach to this stressful transition period (Aloysius et al., 2018). The limitations discovered from the early discharge programmes reviewed within New Zealand are the lack of outcome indicators or audits, however as discussed, these programmes are all newly introduced so the data has not yet been collected and collaborated. If audits or data has been collected these are yet to be published.

Challenges: The challenges for this project was obtaining the information required, which I truly underestimated. While the New Zealand neonatal units were forthcoming with information and willing to help out, responses from international units were limited and slow. After repeated emails, being deferred onto different people responsive for early discharge programmes, I eventually aborted this search for information about international programmes. The other challenge I had was sourcing a cost analysis for SCBU inpatient stay and a neonatal homecare visit. Initially the figure I was given was for Lakes Intensive Care Unit in Rotorua. Fortunately, near the end of my project our accountant emailed me with updated data which was much needed for validity of the cost saving for the pilot project and will be useful for the upcoming business case to secure MDT supports ready for the early discharge pilot programme. Another challenge I had in this project was the response to the staff

survey. Although I was disappointed with the initial uptake, my supervisor reassured me this was a normal response completion rate. The final challenge I experienced throughout this project was incorporating Rosswurm and Larrabee's steps into my project sections. Although I did find this framework relatively simple to apply, I came to a standstill when preparing this report. Although the steps and phases of Rosswurm and Larrabee's model are straightforward and pragmatic they do not fit the traditional format of a thesis and I therefore found the framing of this report to be challenging.

Recommendations and Implications for practice: It has become evident in this project there are areas that need improvement in the practice of early discharge for preterm infants partially tube fed. Firstly, it would be useful for feeding plans to be in place well before the infant is planned for discharge home. These should be individualised to each infant and with the proviso to amend these plans along the way as the infant progresses. Individualised feeding plans would ensure both staff and parents are on the same pathway and will likely reduce conflicting advice and confusion. The research findings reinforced the need to utilize parent rooms/transitional nurseries (British Association of Perinatal medicine, 2017). Parents should be given the opportunity to room in with their infant to develop confidence in handling and caring for their infants and getting to know them, with education from nurses and allied staff on infant communication and moving towards cue-based rather than volume driven feeding to ready for home.

One of the key issues that arose during this project was in relation to breastfeeding codes. Education on breastfeeding codes in Hawkes Bay's Paediatric ward has been addressed, after speaking with Nurse P and the children's ward ACNM I was asked if I could present and discuss the codes on a Paediatric study day which I was happy to do.

Nurse Specialist/nurse led clinics: Gardiner et al. (2014), suggests it may be preferable to have a limited number of clinicians with experience and a special interest in tube weaning to lead practice change as opposed to staff having formal training in this area. Experts leading early discharge programmes experienced with preterm infants and their unique feeding cues/habits such as neurodevelopmental therapists and speech language therapists are important for programme success (Syrmis et al., 2020; Bathie & Shaw, 2013). My aim is to have an education session on a SCBU study day prior to the implementation of the pilot programme to educate staff on tube weaning, signs of readiness, cue-based feeding, and introducing alternative breastfeeding codes more relevant for preterm infants that were sourced from the literature and other neonatal units. Resources such as switching from tube to oral- regime from Little Steps (Lubbe, 2018) will be introduced in the hope to increase staff confidence in weaning preterm infants to support the pilot programme. Switching from tube to oral-regime is a useful, visual feeding-on-cue wheel aimed for preterm infants transitioning from NGT to oral feeds. It may be beneficial to have one or two key nurses responsible for infants going home early partially tube feeding to make up feeding plans in collaboration with parents. The

idea being the plan should not be altered without discussion with parents or the nurse allocated to that infant to reduce discrepancies in tube feeding and weaning practices and conflicting advice for parents and unfamiliar staff in SCBU.

Feasibility of an Early Discharge programme for preterm infants partially tube feeding in my practice area: The results of this extensive literature search for already established early discharge programmes for infants partially tube feeding throughout New Zealand, Australia and The United Kingdom, was reassuring. The results were predominantly positive and highlighted with key support clinicians in place to support these infants from SCBU/NICU to home this practice should prove successful and without unfavourable consequences for infant and family. After discussions with key stakeholders in Hawkes Bay SCBU I was inspired with the interest and acceptance of this early discharge programme. Areas discussed focussed on education for staff and parents on feeding cues and moving from scheduled feeding to responsive feeding. The main emphasis throughout the MDT meetings were the suggestion of the much-needed allocated hours for lactation consultants for SCBU, the children's ward and in the community to enable the success of a pilot programme in SCBU. A proposed business case is the next step in the implementation of a pilot programme for early discharge for partially tube feeding preterm infants in Hawkes Bay SCBU, an exciting prospect and one which I hope will improve infants and parents experience both in SCBU and at home.

CONCLUSION

This project explored the practice of early discharge for preterm infants partially tube feeding for the purpose of implementing a pilot programme for Hawkes Bay Special Care Baby Unit (SCBU). The specifics of already established early discharge programmes nationally and internationally were examined and modified for implementation to Hawkes Bay SCBU. An extensive literature search was completed to determine the safety, benefits, risks and outcome indicators for early discharge programmes. Based on the findings from the literature review, this practice is appears to be safe and results in positive outcomes, by reducing inpatient stays for infants in neonatal units subsequently minimising separation for infants and their families which is at the forefront of neonatal nursing.

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APPENDIX 1: Criteria for Hawkes Bay's Neonatal Homecare

Criteria for SCBU Homecare follow-up:

- Infants born below 34 weeks gestation
- All infants weighing 2kgs or less at discharge
- Infants requiring NG feeds at home
- Infants requiring home O2 or those discharged home on Caffeine
- Infants needing repeat oximetry's at home
- Infants requiring continued blood monitoring, e.g. SBR/TFT/FBC
- Infants for palliative care
- NAS infants
- Any infants with additional needs as requested by the Medical team

Supplies needed for Home O2:

- Nasal prongs x2 sets (infant size usually fine) check what size they are currently on
- Extension tubing x2 and swivels x2
- Saline and 1ml white BD syringe that fits inside them (remove needle)
- Comfeel if using in SCBU
- Hyperfix (cut off a length of this)
- Remover wipes

When parents bring in their 'own' regulator please write on a piece of tape what their prescribed flow rate is on discharge and attach to the regulator by the dial as we have had some parents putting their baby on 0.03L rather than 0.3L.

Please remove the brown ID tapes off babies' legs when they are discharged- they are very hard to remove at home esp. if parents don't have remover wipes

APPENDIX 2: HBDHB tube feeding policy 'naso-gastric, orogastric and naso-jejunal- insertion and management of'

HAWKE'S BAY DISTRICT HEALTH BOARD	Manual:	Communities, Women & Children Directorate Policy and Procedure Manual
Naso-Gastric, Orogastric and Naso-Jejunal Tube - insertion and Management of	Doc No:	CWC/SCBUPPM/853
	Date Issued:	May 2002
	Date Reviewed:	May 2019
	Approved:	Clinical Nurse Manager
	Signature:	Michelle Robertson
	Page:	1 of 5

PURPOSE

- To administer enteral Feeding
- To administer medication
- For infants requiring gastric drainage
- For infants with impaired suck or swallow reflex.
- To assess signs of food tolerance
- To provide venting in infants with respiratory difficulties
- To administer naso-jejunal feeds in infants and children who are not tolerating gastric feeds.

PRINCIPLES

1. Insert with skill and accuracy into the stomach or jejunum.
2. To have the tube secured appropriately so that inadvertent removal of the tube is avoided thus preventing aspiration.
3. Aspirate gastric contents with skill and accuracy to be aware of signs of feeding intolerance.

SCOPE

All medical and nursing personnel.
Student nurses inserting NGT under the direction of the registered nurse
.

NASO-GASTRIC AND ORO-GASTRIC

Equipment:

Appropriate sized gastric tube
- Size 5 tube for infant <1kg
- Size 6 tube for the majority of infants
- Size 8 tube for large infants or for gut drainage.

3mL syringe
Litmus paper
Hypafix white tape
Stethiscope

PROCEDURE:

1. Inform parents of procedure

2. Check emergency equipment is working and accessible, e.g. suction and oxygen.

3. Assemble equipment.
4. Wash hands.
   - Measure the distance from either the nostril or the mouth (depending on insertion site) to the tragus (lobe of the ear) to the half way point between the xiphisternum and the umbilicus

5. Wrap baby and on right side.
6. Cut hypafix to appropriate size and attach to infant's cheek.
7. Hold infants head and gently place the tube in the infant's nostril OR mouth advancing quickly to the required length along the floor of the nostril to the oesophagus observing the infant all the time for any sign of distress, e.g. cyanosis, apnoea or bradycardia. Aspirate the feeding tube with the 3ml syringe and check secretions for acidity with litmus paper(blue to pink)
8. If unable to obtain any secretions, plunge 1 – 2 mls of air down the tube while listening to the stomach with a stethoscope. You should be able to hear a swoosh as the air enters the stomach.
9. Attach the NG tube securely with hypafix.
10. Date with a small piece of brown tape on tube, when tube has been inserted.
11. Renew tubes every 28 days or as required. Document time, date and length of insertion in patient notes and on daily check sheet.

Safety of Infant is Maintained

Follow the steps below to ensure the safety of the baby is maintained.

1. Ensure tube remains in correct position. Check before first feed on each shift with litmus paper.
2. Visually check position of tube before each feed. If in doubt aspirate to check position.
3. Check that hypafix tape is firmly attached to the tube.
4. Aspirate PRN as ordered or if uncertain of placement. Return aspirate unless contraindicated e.g.; frank blood or bile.
5. Observe for abdominal distension.

Specifics

All babies not on full volume feeds via nasogastric or orogastric tubes must have gastric residuals checked 6 hourly.

Inform medical staff if:

- Infants abdomen becomes distended, tense or tender
- Abdominal wall has erythema present, or has visible bowel loops
- Bowel sounds are absent
- Bile or blood stained aspirates obtained
- Blood stained stools

APPENDIX 3:

Data collection for all infants <37 weeks gestation discharged home from SCBU on full oral feeds 2022-2023

GESTATION AT BIRTH:	NUMBER COLLECTED	AVERAGE GESTATION AT DISCHARGE:	AVERAGE INPATIENT DAYS IN NICU/SCBU
25/40	1	Still inpatient 19/03 @34+3	
26/40	0		
27/40	0		
28/40	1	36+3	58
29/40	5	38+2; 1 still inpatient 19/03 @31+5	52.5
30/40	2	38+5	59.5
31/40	3	38+1; 1 still inpatient 19/03@35+3	45
32/40	3	37+3	35
33/40	4	38+6	36.7 (?37)
34/40	13	37+5	22
35/40	11	37+2	11.7 (?12)
36/40	6	37+5; 1 still inpatient 19/03@37wk;	15.6 days

Average discharge age from SCBU overall= 38 weeks

Average inpatient stays for all infants below 37 weeks= 40 days

APPENDIX 4: Qualtrics survey questions

Please select your gender

- Male
- Female

What is your main profession?

- Nurse- neonatal
- Paediatric nurse who occasionally works in SCBU
- Paediatrician, registrar or SHO
- Lactation Consultant
- Speech language therapist

If your main field is neonates, how many years experience have you had?

- 0-3 years
- 3-5 years
- 5-10 years
- 10-20 years
- 20+ years

Do you use the breastfeeding codes to guage how much top-up an infant requires?

- Always
- Never
- Sometimes

Do you find the breastfeeding codes useful as a guide for top up amounts? Please add comments

Do you routinely do test weighs to determine how much top-up is required post breastfeed?

- Yes
- No
- Sometimes

Do you have any concerns when reducing tube top-ups?

- Yes
- No

If you answered yes to question 7, please explain your concerns below

What factors make you think the infant may be ready for tube weaning?
Please rank the following:

- Most Important
- 0
- 20
- 40
- 60
- 80
- 100

Infant is waking for feeds or between scheduled feeding times

Infant appears unsatisfied with NG feeds

Mum is available to either stay in parent suite overnight or can be in SCBU for most of the day feeds

Infant is >36 weeks gestation

Mum has a good breastmilk supply

Infant is bottle and NG feeding

Infant has had good weight gains

Infant is off respiratory support

Infant is no longer having apnoea/bradycardia events

Infant has stable blood sugar levels

Infant can maintain their temperature in a cot

Have you had any formal training on tube weaning before working in Hawkes Bay SCBU?

- ○ Yes
- ○ No

Would you like more education in regards to tube weaning premature infants?

- ○ Yes
- ○ No

Do you think individualised feeding plans would be benficial for infants, their families and staff in SCBU?

- ○ Yes
- ○ No
- ○ Maybe

If you answered Yes to Q11 please comment how you think feeding plans could be useful in SCBU

Please rank your confidence level when teaching parents each of the following tasks:

	Not confident/need support	Mostly confident	Very Confident
Teaching parents how to measure NGT with infant	○ Not confident/need support	○ Mostly confident	○ Very Confident
Teaching parents how to insert NGT	○ Not confident/need support	○ Mostly confident	○ Very Confident
Teaching parents how to tape and secure NGT	○ Not confident/need support	○ Mostly confident	○ Very Confident
Teaching parents how to test to ensure the NGT is in the correct position	○ Not confident/need support	○ Mostly confident	○ Very Confident
Teaching parents how to administer a milk feed via the NGT	○ Not confident/need support	○ Mostly confident	○ Very Confident
Trouble-shooting possible scenarios and solutions that may occur with the NGT	○ Not confident/need support	○ Mostly confident	○ Very Confident
Discuss with parents who they need to contact if they need assistance	○ Not confident/need support	○ Mostly confident	○ Very Confident

APPENDIX 5: MDT agenda and minutes 2nd August 2022

Tube feeding MDT 2nd August 2022 1-2pm Minutes

Invited: [redacted] NDVT, [redacted] SLTs, [redacted] Dietitian, [redacted] (NNHC), [redacted], [redacted], [redacted] (LCs). [redacted] (ACNM SCBU)

Attended: [redacted], [redacted], [redacted], [redacted], [redacted], [redacted], [redacted], [redacted], [redacted]

Apologies: [redacted] on nights, [redacted] bereavement leave

THE AIM:

Discharge late preterm infants home partially NG feeding so they can complete their transition to full oral feeds at home to reduce their SCBU stay and reunite with their families

SUPORT AT HOME REQUIRED FOR THIS TO BE SUCCESSFUL:

Homecare nurses

Weekly visits as per normal with infants <34 weeks and or infants going home with NG insitu, this will increase your already busy workload but could also justify another working day= potentially less overtime! Provide support around NG tube, reinsertions, and supplies, reinforce trouble shooting, after hours support (this info will be given in a package & discussed prior to dc). Provide the link to the hospital/Paediatricians

Further input/comments:

Homecare are moving into doing clinic days once a week so this could be timely for F/U of tube fed infants as well as potentially justifying more allocated hours to their service

Spare rooms in Villa 7 Tue and Fri afternoons for clinics

Tube feeding support at home is not a new concept for the Homecare girls as they occasionally have babies at home tube feeding but these babies tend to be ones who will be unlikely to achieve full oral feeds at term due to complications, i.e. Cardiac, cleft palate, extreme prematurity, severe reflux.

Supply list would need to be sent to? [redacted] or [redacted] CHU for these infants

Need to give parents a guide as to when we predict their baby with will be fully orally feeding (40-42weeks depending on birth gestation)

Transition room ideal for these families when learning to do tube feeds prior to discharge

Speech language therapists

Could you add these infants into your fortnightly feeding clinic? And/or fit in home visits when required. Support with feeding comfort, feeding cues, supply/suggest alternate feeding products Dr Browns bottles etc.

Further input/comments:

No such thing as a feeding clinic and hast been for a few years now says [redacted]

We wouldn't necessarily be referring all of these babies onto [redacted] *and* [redacted] *unless there are any feeding issues/concerns, babies with major issues may not meet the criteria for home tube feeding as runs the risk of tube dependency. If the Homecare girls have concerns once in the community they can refer as required.*

Maybe it would be a good idea to have the babies that are selected for home tube feeding to have a one-off review by [redacted] *or* [redacted] *while feeding prior to discharge?*

Dietician

Support either face to face or over phone with advice on formula, reconstitution to reduce volume requirements, additional calories, advice for breastfeeding Mums ?LC ask if [redacted] would like to be involved

Further input/comments:

*Looking at the Wellington DOTS (**D**ischarge **On T**ube **S**upport) package babies are excluded from home tube feeding if they're on any additives or have dietician concerns which we discussed we probably wouldn't follow. Often babies on the community are on special formulas, Calogen and/or concentrated formula feeds so they require less volume at each feed.*

Reducing volume for feed comfort, i.e. if spilly reduce volume slightly

[redacted] *supports SCBU and Homecare infants currently and would be referred all babies who go home tube feeding*

Lactation Consultant

Support with breastfeeding in hospital [redacted] and potentially in [redacted] clinics (depending if day suits?) ([redacted] & [redacted])

Further input/comments:

No more feeding clinics with [redacted]

What days do you work [redacted] *and* [redacted]*?*

Do you have the scope for home visits for these babies if required?

Education on avoiding mastitis, and when and how to reduce pumping once home

Neurodevelopmental therapists

Support around feeding cues (how prems differ to full term babies) and bonding/NBOs

Further input/comments:

Really good opportunity to have more allocated time for NDVTs in SCBU as well as follow-up at home as well. Would provide more of a wraparound service. [redacted] *would like to see more cue-based feeding happening rather than a medical model with calculated feeding volumes. We discussed how Mums are motivated to getting their baby breastfed or bottle fed and would potentially have more time to watch for feeding cues and demand feed at home, normal newborn feeding rather than scheduled.*

Paediatricians

[redacted] is supportive of my project, says it will be similar to any other Homecare baby in that the team can contact the Paediatrician responsible for the infant with any concerns/questions

THE RISKS:

-Infants become orally aversed/tube dependent

-Issues with NG (not aspirates to test placement, infants pulls NG out frequently meaning returning to ED and exposure to other viruses while there).

We compared the inclusion criteria from Wellington NICU and Starship and all preferred Starship's criteria that the baby should be have at least 50% of their feeds orally rather than Wellingtons 3 oral feeds in 24hrs before being considered for home tube weaning. Seems less risky and one would hope these babies are less likely to become tube dependent. This is subject to Paediatrician approval

WHAT I WILL PROVIDE:

-Feeding plans from tube insertion to exit

-Supply list for NNHC

-Education list for parents learning how to tube feed

-Discharge support package similar to DOTS/Corpack tailored to HB SCBU

INCLUSION CRITERIA (subject to Paediatrician's approval):

36 weeks or more (38 weeks for extreme premature)

2kgs or more

Off all monitoring

Maintaining temperature in a cot

Stable blood sugars

Medically fit for discharge other than feeding, taking more than 50% of their feeds orally

Good growth, following a growth curve

Parents have been engaged and are willing to take their baby home tube feeding

All discharge education to be completed as well as tube feeding demonstration- parents to be supervised by RNs with 5 tube feeds and to discuss trouble shooting, i.e. if they don't get a pre-feed aspirate, who to contact if the baby pulls the tube out

The family are within NNHCs catchment area and they have the capacity to take the baby

No ongoing social issues putting the teams at risk for home visits

APPENDIX 6: Meeting agenda and minutes from MDT 14th March 2023

Early discharge for preterm infants partially tube feeding

MDT CDU 'blue room' 14th March 2023; 1400-1500hrs

Invited: [redacted]

Attendees: [redacted]

Apologies: [redacted]

Agenda:

-To discuss potential pilot programme for early discharge with outcome indicators

-Discuss research findings for early discharge partially tube feeding

-To look at discharge criteria that all are comfortable with- presented criteria from Wellington NICU, Starship, Waitakere and one from Nepean Blue Mountains (Australia) as examples

-To explore scope for each MDT service and what is needed for success of the pilot

Evidence from the literature:

-Increase in breastfeeding rates/ or no differences in some studies

-Reduced cost for NNHC vs inpatient days

-Parental satisfaction

-Readmission rates 5-10% in early discharge groups (some studies don't specify if this was due to the NG or growth or for i.e. unrelated respiratory illness)

-Reduced LOS 9 days on average

-Infants weaned form NGTs earlier than if they were inpatients

-Improves discharge planning

Outcome indicators for my project:

-Reduced LOS

-Breastfeeding success rates (more infants BF when discharged earlier rather than switching to bottles to get out the door quicker)

-Infants weaned off NGTs sooner than if remain in SCBU

-Cost effectiveness

Outcome of meeting:

Discharge criteria discussed for the early discharge programme:

36 weeks corrected

>1800grams

Can maintain temp in open cot

Off all monitoring for 48hrs

BSL stable

Stable weight gain

Medically fit for discharge

Infant able to take >50% of all suck feeds

No upper airway or functional swallowing abnormalities

Parent/caregivers have completed the necessary NGT teaching and proven good attenders/motivated

No social work concerns

NNHC have the capacity to visit in regards to their current workloads and depending on the location of the family

I think we were overall happy with the above criteria?

[redacted] pointed out some infants will be suitable candidates for the programme but won't necessarily tick all of the above boxes, can be under discretion of the Paediatrician. Please email any further comments/concerns.

[redacted] SLT mentioned infants don't develop their suck coordination until 36 weeks and can be detrimental for their long-term feeding success if they are bottle fed earlier than this or before they're developmentally ready- some infants tend to get force fed to get them home. SLTs in Palmerston North do an initial assessment of preterm infants when first bottle is introduced (at 36 weeks) to ensure they are ready/managing the feed. Discussed the importance of elevated side lying for bottle feeders.

[redacted] has concerns that infants in SCBU have access to MDT support SLT/NDVT/Dietician/LC but not as readily available in the community setting. Suggested a business case to gain allocated hours for services to have the capacity to spend time both in SCBU and in community for support to ensure the success of an early discharge programme.

[redacted] acknowledged to take caution to not overload services but rather specify what is required for this to be successful, more hours for SLT/NDVT/Dietician/LC in SCBU and community, extra days for NNHC

[redacted] discussed NNHC having clinics or to do more Zoom meetings to reduce to travel time. Specified home visits are still important and not wanting these to completely stop. Potential for additional homecare days for projected increase in workload for early discharges. Utilize transition room for early discharges tube feeding.

Discussed feeding trends in SCBU and trying to move away from scheduled feeding times, less or no top ups for breastfeeding infants when Mums are available (for infants that are feeding well/Mum has good supply etc). Discussions had around cue-based feeding and the importance of this for parents to read infants cues and to normalise for home.

[redacted] said it would be good if infants have a tube exit plan. I have found some really good resources on how to wean infants from NGT. Paula has read studies on removing NGT once infant is taking 80% volumes orally, I have read a study suggesting to remove once infants are taking 75% of volumes. As [redacted] discussed can always trial for 5-days and if not successful reinsert NGT.

Where to next:

-Design pilot study

-Business case

-Determine what is required from each service for this to work well

-Ensure all involved are comfortable with this practice change

Please email me with any further comments or suggestions- or anything that I missed from the meeting that you think is relevant for those who couldn't make it

[redacted], [redacted], [redacted], [redacted], [redacted], [redacted], [redacted] and [redacted]- Can each please email me back with what would be required for you to be able to support these families in SCBU/community to support early discharges for preterm infants.

Thanks again to those that made the meeting, your input is valuable

Andrea

APPENDIX 7: Supply list for NGT feeding at home & neonatal homecare follow-up

Supplies:

Nasogastric tube x2 for home

Hyperfix tape

Scissors

Litmus paper

5ml and 30 ml syringes

Measuring cup

Lubricating jelly

Duoderm (if using)

Remover wipes

Scales

Neonatal Homecare plan for visits:

- Meet with families in SCBU on discharge planning days
- Review infants individualised feeding plan made up with parents and staff
- Discuss with families the days you work and the support you provide on visits
- Discuss with families the options for meeting, i.e. zoom, clinic, phone call- ascertain appropriate devices they have to access this
- All families will be provided with a nasogastric feeding at home package, providing details on who to contact if any concerns, instructions on how to insert NGT (if they have been taught this) and troubleshooting, i.e. if unable to get an aspirate.
- Meeting with families x3/week for the first week at home, one of these visits should be a face to face visit the other two can be via phone or zoom depending on the support required of individual families and what you consider is required based on your judgement.
- The usual recordings collected at visits for weight (once a week is fine) and please assess infants for signs of dehydration and discuss these with parents (this will also be included in their support package). If any concerns with weight loss, dehydration, alteration to infant's state (infant is more drowsy than usual, etc) or if you have any other concerns with infant's wellbeing, please discuss with their Paediatrician and have them reviewed in PAU if required as per normal protocols
- Gather information from parents to monitor feeding progress. Parents will be given feeding charts similar to the ones we use for the transition parent room so you can assess when infants are ready for NGT removal/trial. Please asses for hydration measures every 48hrs post wean.
- Depending on the family's program they may wish to breastfeed during the day and just give NGT feeds in the evening/overnight.
- If you have concerns with reduced volumes, weight loss, stool changes, intolerance or vomiting weight loss please contact Paula
- If you have any concerns with parental bonding and lack of assessing infants feeding cues please get in touch with [redacted] SLT

APPENDIX 8: Contact information for parents with infants on home tube feeds

If urgent please call 111 and perform CPR on your infant if required.

Do NOT drive your infant by car if they are needing urgent support

Weekdays if non-urgent, i.e. tube dislodgment or needing advice:

Neonatal Homecare Service

Nurses: Sarah & Amanda

Hours: Monday, Wednesday and Friday 8.30am- 5pm

Phone: 0273535920

Paediatric Homecare Service

Nurses: Jen, Joy, Rochelle & Lisa

Hours: Monday-Friday 8am-5pm

Phone: 0274535295

After hours or weekend:

Special Care Baby Unit (SCBU):

Hours: All

Phone: direct dial 06-8781315

SCBU staff can give advice over the phone and together you can decide if your infant requires to come into hospital for a medical review. If your infant needs to be readmitted, you will be admitted to the Children's ward and will be able to stay with your infant for the duration of their admission

Hawkes Bay Hospital:

Phone: 06-8788109 (you will be directed through to the call centre after voice prompts)

APPENDIX 9: Parent information regarding early discharge partially tube feeding

While in SCBU you have observed your baby being fed via his/her nasogastric tube. You have the opportunity if you chose to take your baby home and continue to feed them via the nasogastric tube to supplement baby's breast or bottle feeds until they have the stamina to fully oral feed. The expectation is that your baby will be off NG feeds after 4 weeks of being at home.

What this means for you:

You get to take baby home earlier than if you stay in SCBU until s/he is fully oral feeding

You can further establish breastfeeding at home

Your separation time is reduced (we acknowledge how difficult this is for families)

You have the support of the neonatal homecare nurses who can visit you at home, in a hospital clinic or via phone/zoom to support you in addition to other services available 24 hours a day to contact if needed.

You will still have scheduled paediatric outpatient appointments with baby's assigned Dr if they were born less than 34 weeks at delivery in conjunction with other services that your baby may be referred to such as a neurodevelopment therapist, dietician, speech language therapist.

What is required before discharge:

You will be required to complete all discharge education including CPR, safe sleeping and Power to Protect

Your nurse will show you how to insert a nasogastric tube for baby (this is not compulsory if you don't want to do this).

You will be taught how to administer baby's nasogastric tube feeds and to administer medications. Your nurse will run through trouble shooting scenarios with you for general care and maintenance of the nasogastric tube

You must have access to a phone and car day and night

APPENDIX 10: Project Timeline

Date:	Activity:	**Comments/Reflection:**
27th January 2022; 12.00-12.45pm	1st Group Supervision child health practice projects Julie Blamires, [redacted]	-Discussions around a good literature review, with use of Boolean woods, 20-25 relevant articles appropriate, divide articles into themes. -Discussed using Prisma guidelines, literature matrix, excel spreadsheets. -Draft questions for Qualtrics survey -Look at background information for DOTS support package (Wellington NICU). -Record everything to do with project, phone calls, emails, etc.
24th February 2022; 12.00-1pm	Group supervision Julie [redacted] (had to decline as working nightshifts to cover SCBU)	Email received from Julie asking if I could send her an update on where I'm at. Replied to this on 17th Feb discussing the new search terms I had used to try and find more articles, and sample questions I had drafted for Survey Monkey.
3rd March 2022; 11-11.30am	Teams meeting Julie Blamires	-Discuss my project with management and research committee re 'quality initiative' -Collect data for NG fed infants in SCBU past 6mths.
16th March 2022; 11-12pm	Group supervision with Julie Blamires and [redacted]	Complete Qualtrics survey, send to Julie to look over and ask [redacted] if she would mind if I test it out on her given she is also a SCBU nurse, she is happy to do same. Julie suggested I make an appt with AUT library staff for help to find more articles and there is a lack of these on my topic, she sent me the email link for this.
21st-24th March 2022	Emails back and forth to/from Supervisor Julie Blamires	Having trouble with survey monkey free trial, discovered it's very limiting with the type of questions I can ask and the results available to me at the

		end, and asked if AUT have a premium subscription for students. Julie advised I contact the research team at AUT for support with this.
21st March 2022	Emailed AUT PG Researcher Development Coordinator	Dr [redacted] replied no access available for students for advanced Survey Monkey, she suggested I either check with the PG team in my Faculty if they have access or to try using Qualtrics as this is the tool AUT uses for surveys.
24th March 2022	Feedback from [redacted] after completing my survey	Useful feedback from [redacted] question numbers were not visible when she did the survey despite being on my end, contacted Qualtrics for support with this. Lauriane also suggested I open the survey up to NDVT as well.
28th March 2022 11.00-11.30am	Zoom with [redacted] Research help	Really useful meeting with [redacted] we went through article results that I currently have found, [redacted] reassured me that I was using good search methods/tools and had covered my basis well, suggested I try doing individual searches as my question covers 3 different areas.
28th March	Emailed [redacted] our Trendcare coordinator	Asked [redacted] if there is an easy way to pull tube feeding data from SCBU for the past 6mths, he showed me how to do this which was a great help and a big time saver
4th May 2022 11.00-12.00pm	Group supervision on Teams with Julie Blamires and [redacted]	Touched base with where I'm at, felt like I hadn't done a lot but Julie reassured me I've done heaps since we spoke last. I have gathered data on how many babies in past 6mths have been NG fed in SCBU. Sent out survey to staff- Julie suggested to extend timeframe and send out again to get more results. Discussed with Julie that one of our Paeds is wanting to do a pilot study on early dc on NG feeds- hold him

		off! Found further research using Clinicalkey as [redacted] suggestion. Found thesis support on AUT website that looked useful, Julie showed me where to find example thesis and ones using same methodologist. Julie stressed the importance of writing each process down as I go, i.e. Sent out survey to [redacted] tweaked a few questions as per her feedback, etc.
14th July 2022 1100-1200	Zoom with Julie Blamires	Discussed upcoming MDT with Julie Julie suggests I start writing now Look at other thesis- Julie will email me some from past students Look on AUT website for past thesis and writing a thesis workshop
2nd August 1-2pm	MDT with stakeholders	
11th August 1-1.30pm	Zoom meeting with Julie Blamires	Discussed progression to date Julie emailed me a link to creating long documents Julie suggested I start writing draft literature review + headings and appendices
13TH Sept 2022 1-2pm	Teams with Julie Blamires	Format template for practice project Julie suggested I start using Endnote or Mendaly for references? Can reference other people's projects who used Rosswurm & Larrabee Write up literature review Can refer to myself/I in the project
14th Oct 2022 10.30-11am	Zoom with Julie Blamires	Sent Julie a draft Chapter One to review Julie suggests to move on from editing and start literature review and send to her for comments. To meet every 2weeks from now to keep the momentum going

1st Nov 1-1.30pm	Teams with Julie Blamires	Voiced feeling overwhelmed and tired. Julie suggested I put the literature review aside and move onto Methodology. Do a 'brain dump'. Look at [redacted] project to see how she has inter linked Rosswurm & Larrabee. Meet again in 3weeks
23rd Nov 1-1.30pm	Teams with Julie Blamires	Did the 'brain dump' as suggested which I found helpful and made me realize I have achieved quite a bit. Two funerals since we spoke last so very little progress gained after this, aware I will have 3kids home in 2weeks time/Xmas/school holidays and a trip to Aussie getting worried I'm not going to get this done in time frame- asked Julie about possible extension & applied for same
19TH Jan 2023	Teams with Julie	Julie suggested I start to pull my project parts together, write up a table of contents and start placing pieces into chapters to see how it flows, what I'm missing, what needs more editing/more content etc. Advised not to focus too much on re-creating parent documentation instead ask Wgtn/Starship if we can use theirs with adaptions for HBDHB. Suggested emailing stakeholders with a criteria for pilot to access everyone's acceptance/comfort with same. Julie said as I'm not using Endnote I will need someone to edit/check references for me as she can't do this.
Feb 2nd 2023 090-0930	Teams with Julie	General catch up, Julie says keep writing. Start on contents page so can see where things belong/what's needed. Discussed upcoming MDT with stakeholders
March 14 2023 0930-1030	Teams with Julie	Teams with Julie 0930-1030. Julie has concerns with how

		much work I'm yet to complete. ?need extension. Discussed what needs to be in Chapter Two- Methodology. Asked for project to be sent a one piece and table of contents so we can both see where we're at, if its achievable.
March 21st 2023	Teams with Julie	Julie made some recommendations around my literature review presenting the search methods etc.
March 29th 2023	Teams with Julie Blamires	Connection lost due to wild winds at home, Julie emailing me some feedback from the draft I sent in next few days
April 3rd 2023 1300-1330	Teams with Julie Blamires	A few questions for Julie around project content in general. Julie sending me a link for Canvas to submit my project to Turnitin. Work on polishing chapter 5 and good discussions around results of survey etc.