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2 July 2019

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RE Official Information Act request CDHB 10117

I refer to your email dated 4 June 2019 requesting the following information under the Official Information Act from Canterbury DHB.

- **Can you please provide me with the most recent reviews of the maternity and NICU units?**

Please find attached as **Appendix 1**, the Neoview Project – Neonatal Service External Review (2016), the most recent review of the maternity and NICU units. The only other review relevant to your request is the document we are providing to you in our response to your Official Information Act request CDHB 10125 (Clinical Indicator Analysis 2016).

I trust that this satisfies your interest in this matter.

Please note that this response, or an edited version of this response, may be published on the Canterbury DHB website after your receipt of this response.

Yours sincerely

Carolyn Gullery
Executive Director
Planning, Funding & Decision Support

vectorconsulting extend realise exceed

Canterbury
District Health Board
Te Poari Hauora ō Waitaha

Women's and Children's Services

NEOVIEW PROJECT

Neonatal Service External Review

December 2016

Prepared for
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"Awareness is the greatest agent for change" Eckhart Tolle

"Our health system is almost operating at full capacity, our resources are stretched, and our workforce is tired" Canterbury District Health Board Annual Plan (2015/2016)

Limitations and Assumptions

The analysis, synthesis and recommendations included in this report have been limited by the information able to be gathered through literature review, staff surveys, in-depth interviews, information accessed through stakeholder organisations and information made available by employees of the Canterbury DHB.

This report, which reflects the opinion of Vector Consulting Limited, makes recommendations for changes to the current Neonatal Service provision to meet expected challenges. Every attempt has been made to ensure accuracy, however the author will not be held liable for any inaccurate inferences drawn or assumptions made, and/or inadvertent errors

EXECUTIVE SUMMARY

Background

The NeoView Project was undertaken in 2016 to provide an external review of the Canterbury DHB's Neonatal Service. This review was undertaken due to the high level of pressure being experienced by the service, mainly driven by occupancy needs exceeding capacity for the care of Level 2 (Special Care) neonates.

The scope of the NeoView Project included evaluating the quality of patient care being delivered by the Neonatal Service, clarifying current and future challenges and agreeing possible solutions, in conjunction with management and clinical leaders. Key tasks were agreed by the Project Governance Group and delivered by the Researcher.

Canterbury DHB has a tertiary-level Neonatal Intensive Care Unit (NICU) serving Canterbury and the West Coast. Demand for NICU Level 3 care (of the 11 cots available) is relatively consistent at approximately 82% average hourly occupancy. Demand for Level 2 care is increasing nationally and in the 2015/2016 year the Canterbury DHB Neonatal Service experienced an average hourly occupancy rate of 107% (32 cots).

Concerns regarding patient safety and staff burnout in 2013 led to DHB approval of an additional three full-time equivalent (FTE) Resident Medical Officer (RMO) positions in December 2015. These positions have gone some way to addressing significant patient safety risks posed when the previously sole RMO or NP/CNS.ANP (Nurse Practitioner/Clinical Nurse Specialist-Advanced Nursing Practice) was required to assist in the Birthing Suite or pre/post-natal wards (especially overnight). However these additional roles have not addressed all of the issues when the unit is frequently required to operate above resourced capacity and 85% occupancy (resourced capacity includes cots, staffing, equipment and space). It is well understood that optimal unit efficiency is close to 85% occupancy; yet since mid-2012 between 69-96% of the time the Neonatal Service (Level 2 and 3 combined) has operated above 85% occupancy.

Methodology

The project was undertaken between March and December 2016 with data collection consisting of a range of primary and secondary research methods. These included:

- A baseline staff resourcing survey prior to the project formally commencing in November 2015, with a repeat survey in May 2016 (thus capturing data before and after the addition of the three RMO positions).
- In-depth interviews with 61 staff and key Neonatal Service stakeholders.
- A whānau phone interview survey with 12 parents.
- The Neonatal Service and/or the Researcher leading four workgroups to evaluate specific initiatives and/or commence improvement work including Neonatal base data improvements, a Transitional Care demand audit, identification of family-integrated care opportunities and privacy improvements.
- Integration of the Releasing Time for Caring (RTFC) programme as well as the Association of Salaried Medical Specialists (ASMS) job-sizing results.
- Observation of a variety of Neonatal staff across different shifts.

Findings

The findings of the NeoView Project were organised into seven areas:

1. The **Neonatal Workforce** is stretched to accommodate the needs of a unit operating consistently above resourced capacity. Clinicians (all registered health professionals) are highly skilled, patient focused and work as a high performing team; however there are significant challenges. This review identified that:
    - The nursing workforce is ageing and without workforce planning changes there will be significant shortages of experienced staff within eight years.
    - The Registered Nurses (RNs) and Senior Medical Officers (SMOs) currently have high leave balances reflective of heavy workload demands.

- The service is required to provide significant staffing expertise to the Birthing Suite and Post-Natal Ward.
- Patient demand is reasonably consistent across the 24-hour spectrum.
- The NP/CNS.ANP roster has not yet met the Multi-Employer Collective Agreement (MECA) requirements.
- The on-call load for SMOs is demanding with limited ability for relief cover following frequent night-time work.
- There are insufficient SMOs to improve the current rostering arrangements and meet expected conditions such as 30% non-clinical time for all SMOs.
- SMOs are not resourced at industry-recommended levels to support two consultants leading patient care during daytime hours.
- There is insufficient administration support resulting in clinicians undertaking time-consuming administrative tasks, which represent a waste of skilled clinician resource.
- Nurses are regularly caring for more infants than is considered safe by industry standards.
- There is insufficient Social Work resourcing or clinician consistency to meet the demand for the Neonatal Units level of social complexity and patient acuity.

2. The **Quality of Patient Care** provided was mostly considered of a high standard by parents, staff and the reviewer. Canterbury DHB is benchmarked for clinical outcomes by the Australia and New Zealand Neonatal Network (ANZNN) and the latest results are in line with other Level 3 units in Australasia. The Neonatal Service has an established improvement culture and little 'process waste', however the following challenges have been identified:
   - The quality of care is being impacted by the limited auditory and visual privacy in a crowded unit, particularly in the Special Care (Level 2) area. Staff recently implemented initiatives to address identified issues but are constrained by the unit's physical capacity.
   - The Infant Feeding Specialist is unable to meet demand for feeding support and there is insufficient Lactation Consulting expertise to maximise breastfeeding rates on discharge.
   - The restricted visiting arrangements when occupancy is greater than 41 infants has negative effects on family bonding and is incompatible with Māori need for whānau involvement.
   - Parents reported feeling rushed when trying to establish feeding with their infant.
   - Complaints from parents increase when the unit is over capacity.
3. The **Model of Care** in use in the Neonatal Service was appropriate when it moved to the current Christchurch Women's Hospital site in 2005 as the unit was accommodating considerably less infants, demand was lower, societal expectations and best practice recommendations were different and the ratio of non-shared parent rooming-in facilities to infants was higher. This review found that:
   - Low-acuity infants are currently cared for in the Unit as there is no other facility for them to be transferred to in Christchurch. This in effect blocks cot space for high-acuity infants, which is not appropriate for a tertiary facility. Approximately 10-15% of admissions to the Neonatal unit could be avoided if a Transitional Care level service was available in Christchurch Women's Hospital.
   - The need for family-integrated care is well researched and recognised as the optimal approach for neonatal care. However the current Model of Care requires unnecessary separation of parents and infants. Some solutions involve changing established practices and others relate to facility constraints.
   - Service provision should be a seven-day continuum to ensure that infants are not waiting for discharge over the weekend due to limited access to Social Work, Feeding or Outreach support.
   - Infant transport is a responsibility of the Neonatal Service including retrieving and returning neonates as well as infants for the paediatric service. The service was active for 11- 27 days per month in 2016 and as designated staff are not supernumerary, this impacts on unit staffing levels.
4. A **Demand and Capacity** analysis has identified that there are greater numbers of infants requiring Level 2 care, which is not related to birth rates (the birth rate has declined since 2010 with a small rise in 2015) or increased population. The main issues identified include:

- The service has frequently breached its resourced capacity of 41 cots since 2013 and projections indicate that this is likely to continue (with a reducing number of months of average occupancy levels below maximum resourced cots).
- Average length of stay is increasing.
- High demand for Level 2 care results in a capacity block for Level 3 care, affecting the service's ability to deliver neonatal intensive care services. Since mid-2012 the Level 2 service has been experiencing demand greater than resourced capacity for 38-62% of the time.
- By late 2017 increasing intervention rates affecting demand is projected to necessitate an additional six to nine cots to bring the units resourced capacity to 47-50 infants (without significant changes in the Model of Care).
- Resourcing levels for mainstream Maternity Services and the requirement that midwives care only for well newborns impacts demand for neonatal care.

5. The **Neonatal Facility** space is problematic. This review found that:
   - The facility is often caring for up to 52 infants when it was designed for a maximum of 44.
   - The space allocated per-cot does not meet recommended guidelines for Neonatal Units even at the currently resourced level of 41 cots.
   - Efforts to improve space were initiated in 2016 by converting one parent room to a four-cot room.
   - Rooming-in facilities are limited for parents and have recently been changed from single parent rooms to shared rooms accommodating one parent only (to cater for rooming-in demand).
   - Overall parents feel that there is insufficient space to accommodate them and limited privacy.
6. The Neonatal **Service Culture** has considerable strengths, particularly the:
   - Quality of the leadership of the large nursing team.
   - Level of inclusiveness of the multi-disciplinary team.
   - High degree of patient/parent advocacy.
   - Broad educational opportunities and the quality of training and orientation of new staff.
   - Improvement-orientated culture.
   - Strong focus on patient safety and evidence-based care.
   - High degree of staff satisfaction with their role in the service, noting that this satisfaction decreased with over-occupancy.

   There were two aspects of the service culture that were identified for improvement: SMO communication style and Neonatal interface with other services. The Neonatal Service is isolated from the rest of Child Health due to its physical location and high level of autonomous functioning, which can limit consultation with the broader Child Health leadership group.
7. Improving the understanding of **Information Management** for the Neonatal service has been a focus of this review. A workstream has been set up to focus on better understanding the base data issues.

Recommendations

The 10 recommendations of the NeoView Project were developed from the findings above. They are interrelated and include the need to:

1. **Strategically plan to meet Neonatal Service demand** at 85% of occupancy rates with Child Health and Maternity Services focusing on the best solution for the 'whole of the system' rather than replicating the current Model of Care within the Neonatal Unit.
2. **Eliminate unnecessary admissions** without undue separation of parents and infants, especially for low-acuity patients by developing a Transitional Care service and resourcing Maternity Services to care for infants with low-care (but more than well-baby) needs.
3. **Reduce patient length of stay** by ensuring that staffing levels facilitate timely input from clinical/allied health specialists, that parents spend as much time as possible with their infant as well as supporting parent/infant feeding skill development (refer to point 8) and reduce overcrowding as it impairs patient flow.

4. **Focus on tertiary service provision** by providing Transitional Care for infants in an appropriate low-acuity setting, which will free up capacity to address the (at times) urgent demand for Level 3 (NICU) care.
5. **Address overcrowding and limited privacy** through initiatives that facilitate physical and auditory privacy for parents, some of which are being implemented immediately while others will require capital investment or challenge existing practices.
6. **Develop team communication skills** to enhance team dynamics and relationships with closely related services through role modeling of appropriate behaviour and the use of an external facilitator (to assist with improvements to established SMO communication practices).
7. **Work towards non-separation** and family-integrated care by considering the needs of parents and infants. Existing Models of Care will need to be challenged and staff educated to focus on facilitating the medical needs of low-acuity infants while encouraging parent-led care.
8. **Improve feeding support** by ensuring appropriate RN-to-infant ratios provide adequate time to support and teach parents how to feed their infant, and that sufficient Lactation Consultant advice is available.
9. **Plan for a sustainable workforce** matched to service demand and address the immediate staffing shortfall in the RN workforce (to address patient safety risks). Additional SMO, Lactation Consultant, Social Work and Discharge/Outreach support (amongst other positions) are required in the short-term if the increasing service demand and patient length of stay is to be managed appropriately.
10. **Improve care quality** through a range of additional initiatives outlined in detail in section 4.10 of this review. Work will continue beyond this review to improve the visibility of neonatal patient activity and demand and reduce the need to maintain manual data records that are not integrated into the Data Warehouse.

Conclusion

International research clearly concludes that Neonatal units operating above resourced capacity have higher transportation costs, increased nosocomial infections, increased workforce stress, disrupted staff training (and thus staff development) and significantly increased morbidity and mortality. Despite operating well above capacity since 2013, Canterbury DHB has managed to avoid significant harm and has maintained sound benchmarked clinical outcomes. This is a testament to a resilient and hard working team. However, it is neither sustainable nor prudent to continue.

In recognition of the stretched financial resources, the Neonatal Service has initiated efficiency improvements to utilise their current resources responsibly. They have added extra cots to current rooms (to care for more infants in the same space), altered rooming-in space from single occupancy to double occupancy, stretched staff to care for more infants (than current accepted practice advises), developed the role of Feeding Champions (to delay the need for additional feeding specialists), improved and documented processes to guide practice and generally instilled a culture of working smarter as well as harder, when faced with challenges. However it is now apparent that increased demand for Level 2 care is not a temporary challenge.

The immediate solution to meet the needs of the service requires an increase in the base RN FTE to care for close to 50 infants. The medium-term (six-12-month timeframe) solutions require the development of a new Model of Care that supports a Transitional Care service and resourcing of additional staff as outlined in this report. Longer-term solutions require the modelling of five-year projected demand to ascertain if the current Neonatal facility will be able to accommodate the projected number of infants and parents.

These recommendations have been developed in consultation with the Project Governance Group and represent the best investment to address current and future needs in a fiscally constrained environment. The Canterbury DHB's Neonatal Service now needs to take action with the support of executive management to implement the recommendations contained in this report. This is critical for the DHB's duty of care to both its patients and staff. It will ensure quality of care is not sub-optimal and prevent unacceptable patient safety risks, with a potential negative spiral of infant mortality, increased complaints, lower breastfeeding rates as well as further increases in patient length of stay. It will also help lower stress levels of staff currently operating on goodwill, and reduce likely future issues attracting and retaining staff.

CONTENTS

1.0 INTRODUCTION

1.1 Background to the NeoView Project

1.1.1 Canterbury DHB Neonatal Service current situation

The Canterbury DHB Neonatal Service provides neonatal intensive care (and special care) service to the wider Canterbury and West Coast population. The tertiary service cares for infants born prematurely or with surgical, congenital and medical complications, as well as providing the newborn paediatric surgery service for the South Island (excluding Nelson-Marlborough). The service is located in purpose-built facilities within Christchurch Women's Hospital and is resourced for 41 cots.

In 2007, a review of the service's Model of Care and full-time equivalent (FTE) requirement led to Executive Management Team approval of the changes outlined in the Neonatal Business Case Review.[1] Provision of current services is mostly consistent with this model, with a small number of nursing and support positions added between 2007 and 2014.

The Service had a combined Level 2 and 3 average hourly occupancy rate of 98% (40 cots) in the 2015/2016 financial year.[2] There is some day-to-day variability but no seasonal change. Occupancy in the unit is monitored internally to inform the ANZNN[3] data collection and to undertake an annual report of all admissions. Average occupancy rates are steadily increasing.[4] The intensive care occupancy is stable with Level 2 cot occupancy the main driver of increases (as explained in 3.4.2 Neonatal special care demand). As well as providing services to babies in the Neonatal Unit, the service also provides in-reach services to babies in their first few days of life (those requiring more than 'well-baby' care in the Maternity wards) and supports complex deliveries in the birthing suites.

Concerns regarding patient safety and staff burnout in early 2013 necessitated a request from the Neonatal Clinical Director for additional RMO positions. Three positions, commencing in December 2015, were approved for an initial 12-month period[5] to November 2016. However, despite this new resource, the service continues to experience a high degree of pressure, which is straining the Neonatal and Maternity Services and impacting negatively on staff and parents.

1.1.2 Commencement of the NeoView Project

The Neonatal (and Child Health) leadership team, consisting of Nicola Austin (ex-Clinical Director - Neonatology), Adrienne Lynn (Clinical Director), Debbie O'Donoghue (Neonatal Nurse Manager - Neonatal Service), Clare Doocey (Chief of Child Health), Lynne Johnson (Nursing Director - Child Health) and Anne Morgan (Service Manager - Child Health) clarified these combined challenges.

This team agreed that an independent person should undertake a review of the Neonatal Service (with consideration for neonatal services provided regardless of location) to quantify the issues and work together to suggest solutions.

The General Manager of Canterbury DHB Medical and Surgical and Women's and Children's Services requested that Megan Hopper of Vector Consulting undertake this review.

[1] Three documents relate to the internal review undertaken in 2007: the original business case (Proposal for the Revision of the Neonatal Service – Business Case Analysis – March 2007), the Neonatal Business Case Review – May 2007, the Response to the Neonatal Business Case Review – October 2007)
[2] Neonatal Occupancy and Capacity data summary provided by Decision Support – average hourly occupancy numbers and rates 2010-2016
[3] ANZNN= Australia New Zealand Neonatal Network
[4] Neonatal Occupancy and Capacity data summary– average hourly occupancy numbers and rates 2010-2016 and section 3.4.2 SfN charts
[5] CDHB Business Case, Paediatric Registrars July 2015

1.2 NeoView Project implementation

1.2.1 Project scope

The NeoView Project scope included the evaluation of the quality of patient care being delivered by the Neonatal Service, clarification of the current and future challenges and agreement (or delivery if possible) on possible solutions, in conjunction with management and clinical leaders.

The key tasks (as agreed on 10 May 2016) were to:

1. Evaluate the level of resourcing in the Neonatal Service before and after the addition of the three new RMO positions in late 2015.
2. Review Neonatal Service activity data from the Data Warehouse, Signals from Noise (SfN) predictive tool and internal Neonatal (Access) database and work to agree on a common data source to represent neonatal activity.
3. Research the current and future trends impacting on Neonatal services both within New Zealand and internationally.
4. Undertake extensive consultation with Neonatal staff.
5. Analyse current workforce utilisation for the service and develop a detailed workforce plan for the next five years.
6. Review the Model/s of Care in use.

The evaluation of the Maternity Services level of resourcing (and Models of Care) was considered **out of scope** of this review (although relevant to the success of the recommendations).

1.2.2 Project governance

A project Governance Group (consisting of the Neonatal Clinical Director and Nurse Manager, the Chief of Child Health, the Child Health Service Manager, Women's and Children's Nursing Director and a Planning and Funding Team Leader) provided leadership to ensure the Project achieved the key tasks. The Governance Group met four times during May to December 2016.

1.2.3 Project management

A research plan, methodology and project timeline were developed early in the project. The Researcher led the project, working closely with the Neonatal Clinical Director and Nurse Manager. In addition, regular informal meetings were undertaken with the Child Health Service Manager and the General Manager (to ensure the scope, expectations and timeframes were managed appropriately).

1.2.4 Project limitations

The Canterbury DHB Maternity service is the main supplier of infants to the Neonatal service, and the key interfacing Maternity staff and services (such as Obstetric SMOs, the Birthing Suite and Post-Natal staff) were consulted and considered as part of this review. However the quality of the Maternity service was not evaluated as part of this review.

1.2.5 Interests

Neither the Canterbury DHB or Vector Consulting Limited are aware of any conflicts of interest that should be considered with this review, however Megan Hopper wishes to disclose current interests.

Megan Hopper provides consultancy and advisory services to health (and other) sectors and is a Director of Equitas Care Limited and Vector Consulting Limited. In the past five years Hopper has led (in a contracted capacity) projects with other Canterbury DHB services including the 100 Days Programme, the General Surgery Lean Elective Pathway Project, the Cardiac Catheter Laboratory Optimisation Project and various projects for the Canterbury Initiative. Hopper also has a range of private sector health clients whom she provides services in an ongoing capacity.

Other Vector Consulting advisors have undertaken reviews and led projects at the request of the Canterbury DHB and other DHBs. Further details of work underway and completed is available on request from the Researcher.

2.0 METHODOLOGY

2.1 Project structure overview

This project was undertaken between March and December 2016 (with a baseline resourcing survey undertaken in November 2015) and included information gathering (baseline and repeat survey, project scope, research design, parent and staff consultation), information synthesis (service data analysis, workforce analysis, Model of Care review, literature review) that resulted in the findings, and the development of recommendations (final report). These timeframes and activities are outlined in Figure 1 below. Please note that the baseline staff survey was undertaken prior to the project formally commencing.

Figure 1: Project phases and timeframes

2.1.2 Research purpose and goals

The **purpose** of the research was to provide a framework for the collection and analysis of data, to assist with identifying solutions to address challenges for the Neonatal Service.

The research **goal** was to identify opportunities for improving the quality of neonatal patient care, as well as methods for the best use of staffing resources in the Neonatal Service.

Primary and secondary research was carried out, with research being of a predominantly exploratory nature. This involved the review of existing materials and discovery of ideas and insights, which is helpful to clarify concepts.

2.1.3 Data collection methods

Data collection consisted of the following primary and secondary research methods:

- Consideration for parallel evaluation activities being undertaken in Neonatal – Releasing Time For Caring (RTFC) and SMO job-sizing (primary research)
- Neonatal staff surveys (primary research)
- In-depth interviews with staff and parents (primary research)
- Ad-hoc feedback (primary research)
- Observation (primary research)
- Literature review (secondary research)
- Data review (secondary research)

The confidentiality of all respondents has been maintained and no interviewees are individually identified in the research findings. Refer to References (at the end of this report -page b) for literature consulted during the review.

2.2 Resourcing surveys (baseline and repeat)

All Neonatal (and key Maternity) staff were invited to participate in two online surveys (refer to Appendix 1: Neonatal staff resourcing survey for survey findings). Staff were sent a link by email, which contained instructions on how to complete the survey. It was understood that all staff have access to email and online applications, and are encouraged to use them.

The participation rate for the baseline and repeat survey was 71.8% and 45.1% respectively

The same survey was undertaken in November 2015 and May 2016 to capture the perception of the level of resourcing of the Neonatal Unit both before and after the addition of the three RMO positions (appointed December 2015). The survey was available online and in hard copy. Participation was encouraged through staff meetings and reminder e-mails. The participation rate for the second survey was 45.1% or 93 individuals. Table 1 outlines the Neonatal staff survey participation by professional group and a comparison with the baseline survey (which had an overall response rate of 71.8%).

Table 1: Neonatal Service repeat staff survey participation by professional group (with baseline survey response rate for comparison)

	Baseline Survey (18 Nov-09 Dec. 2016)	Repeat Resourcing Survey (26 May-23 June 2016)			
Professional Group[6]	Response Rate	Population	Responses	Response Rate	% Total Respondents
Senior Medical Officer (SMO) – Neonatal Paediatrician	100.0%	6	6	100.0%	6.5%
Senior Medical Officer (SMO) - Obstetrics & Gynaecology[7]	17.6%	17	3	17.6%	3.2%
Resident Medical Officer (RMO)	50.0%	10	9	90.0%	9.7%
Charge Nurse Manager (CNM)	100.0%	1	1	100.0%	1.1%
Clinical Midwife Manager (CMM)	100.0%	2	2	100.0%	2.2%
Clinical Support Staff (Outreach, Discharge Facilitator, Education, Equipment Technician) and Allied Health (incl. Māori Health Co-ordinator, Social Worker, Neurodevelopmental Physiotherapist)	35.5%	31	15	48.4%	16.1%
NNP/CNS.ANP	100.0%	5	3	60.0%	3.2%
Associate Charge Nurse Manager (ACNM)	100.0%	7	6	85.7%	6.5%
Registered Nurse (RN)	88.0%	100	33	33.0%	35.5%
Enrolled Nurse (Karitane Nurse)	100%	1	0	0.0%	0.0%
Hospital Aide/Milk Room Aide	75.0%	16	11	68.8%	11.8%
Administration	100.0%	4	1	25.0%	1.1%
Management (excludes CNM)	25%	4	1	25.0%	1.1%
Other 1. Midwifery Clinical Coordinator (Maternity & Birthing Suite) 2. Research Nurse Specialist	100.0%	2	2	100.0%	2.2%
	71.8%	206	93	45.1%	100.0%

[6] Respondents were asked 'Which best describes your primary role in the service?'
[7] Defined as 'Maternity Service' in survey

2.3 In-depth interviews

In-depth interviews were undertaken with a randomised sample of professional groups working in (or closely related to) the Neonatal Service. Sixty-nine individuals were invited and 61 interviews were undertaken. The sample was structured to be deliberately qualitative and open (to gather ideas and insights). The sampling procedure and individuals are identified in Table 2 and Table 3; refer to Appendix 2: NeoView Project research for the interview questions and individuals invited to participate.

Table 2: Neonatal staff in-depth interview sample

Neonatal Professional Group	Actual Interviews	Response Rate
Neonatal SMOs FTE = 5.4 (includes CD 0.1 FTE), Population = 6, Sample = 6 (100% of population)	6	100%
Neonatal RMOs FTE = 8.0 Population = 10, Sample = 6 (60% of population)	5	83.33%
Nurse Practitioner/CNS-Advanced Nursing Practice FTE = 4.4 Population = 5, Sample = 5 (100% of population)	5	100%
Senior Nursing Team (includes Nurse Manager and non-ACNM senior nursing roles) FTE = 8.8, Population = 9, Sample = 6 (66.6% of population)	6	100%
ACNMs FTE = 6.1 FTE, Population = 7, Sample = 4 (57.1% of population)	4	100%
Registered Nurses FTE = 65 FTE, Population = 96, Sample = 4 (4.1% of population)	3	75%
Hospital/Milk Room Aides FTE = 7.4, Population = 15, Sample = 2 (13.3% of population)	2	100%
Clerical FTE = 2.2, Population = 4, Sample = 2 (50% of population)	1	50.0%
	32	

In-depth interviews were also arranged with 29 key stakeholders from services outside of the Neonatal Service. The services/departments involved are identified in Table 3 below and involved a range of roles such as Chief, Clinical Director, Charge Nurse/Midwife Manager, Service Manager and other management and senior clinical staff who were available during the time of the review.

Table 3: Key Stakeholder Staff (external to Neonatal) in-depth interview sample

Service	Actual Interviews	Response Rate
Medical & Surgical Leadership and Administration/Finance	3	100%
Planning & Funding Leadership, Decision Support Analysts & Neonatal Portfolio Managers	4	100%
Anaesthesia Paediatric Anaesthetist	1	100%
Radiology Paediatric Radiologist	1	100%
Child Health Leadership, Administration and SMOs	6	85%
Women's Health Leadership, Administration and Obstetric SMOs/RMOs	6	60%
Allied Health/Other Maori Health, Social Work, Quality, IP&C, Technicians, SLT, Neurodevelopmental Physiotherapist	8	100%
	29	

2.4 Parent/Whānau voice

The voice of parents/whānau or caregivers of neonates was represented by a sample of 19 parents selected for a phone interview. These parents were selected randomly by the Neonatal Outreach Coordinator, from the population of recently discharged infants (less than one month) and included both mothers and fathers of twins and single births. Consideration was given to exclude parents of extremely unwell or palliative infants.

12 parents participated in a telephone interview

Both parents were invited by text message to participate in a brief telephone interview. Fifteen parents agreed to be interviewed and 12 could be contacted during the course of the review, representing a 63% response rate. The survey questions are contained in Appendix 3: Parent/Whānau consultation – survey responses. The parent interviews were undertaken during September 2016.

2.5 Workgroups

The Neonatal leadership team identified several areas for investigation or improvement work during the review. These areas covered: Neonatal data improvement, Transitional Care demand audit, family-integrated care improvement opportunities and privacy improvements. New initiatives relating to these areas are contained within this report.

The Project Governance Group provided guidance during the review, and was closely involved in the development of and publication of the final report.

2.6 Data review

Data pertaining to neonatal activity is complex as infants move frequently between Maternity and within Neonatal wards, sometimes with stays as short as three hours. External benchmarking reports and generic hospital-wide measures can be misleading when reporting on admissions or discharges alone. A more accurate measure of neonatal patient activity is a combination of inpatient admissions and transfers, commonly referred to as 'presentations'. A key outcome of this review is to understand the differences between the varying reports that can create onerous comparisons and lead to misunderstandings of neonatal patient volumes and service demand.

In addition, due to the need to be able to report detailed clinical outcomes to the ANZNN, the Neonatal Service has been maintaining its own database of all neonatal presentations since 1995. Comprehensive information of this kind is unable to be held within the current (CareSys) patient management system.

The data review included quantitative analysis on neonatal patient activity. This was accessed through electronic patient management systems and records made available within the service from Decision Support and Planning & Funding (for example the 'Tableau Maternity Wards at a Glance' and Signals From Noise [SfN]).

Data review included information provided by the Quality team and management. Analysis of the following reports/information was also undertaken: Neonatal staff rosters, on-call diaries, 'Transfer-out' records, Clinical Intensity Score (CIS) reports, the review of Neonatal workforce age distribution and implications for workforce planning.

2.7 Observation and analysis

The Researcher was present during a range of times to observe neonatal activity, in each of the areas where Neonatal staff work (NICU, SCU, birthing suite). This provided an insight into the patient journey, key risks, staff satisfaction, periods of fluctuating demand and other issues not identified at the outset. This research was deliberately undertaken at different times to ensure a range of shifts was observed, and the full spectrum of patient acuity was considered. Detailed 'follows'[8] were undertaken as part of the RTFC programme, which was being implemented in Women's Health at the time of the review. The outcomes of this programme have been considered as part of the primary research informing this review.

2.8 Ad-hoc feedback

The Researcher made her contact details available and was present during a range of shifts to provide an informal opportunity for staff to provide their thoughts and feedback. Several staff utilised these informal consultation opportunities to raise issues they believed important, which were not raised during their survey or interview responses, or as specific issues arose at the time.

2.9 Service comparison and benchmarking

Three tertiary Neonatal Units were identified (due to their similar service size, structure and population) for in-depth interviews to explore key themes and challenges, with five individuals interviewed. Interviews were conducted with Clinical Directors and Nurse Managers at Auckland DHB (National Women's Hospital), Waikato DHB and Hunter New England Health (Newcastle Hospital, Australia). Refer to Appendix 2: NeoView Project research for the parameters considered for service comparison and the interviews and **Table 9** for comparative data.

Neonatal Units at Auckland DHB, Waikato DHB and Newcastle (Australia) were compared as part of the review

[8] The process of evaluating the use of clinicians time – which is a formal tracking tool used as part of the RTFC programme.

3.0 FINDINGS (STRENGTHS AND ISSUES)

3.0.1 Neonatal care overview

Neonatal Intensive Care Units (NICUs) care for pre-term (less than 37 weeks gestation) and unwell newborns, as well as newborn infants requiring surgery. Pre-term infants have higher rates of mortality and morbidity than infants born at term (40 weeks). The risk of respiratory conditions, infection, and intra-cerebral haemorrhage increases with prematurity.[9]

Neonatology and NICUs have greatly increased the survival of very low birth weight and pre-term infants. Some of the past common reasons for admission have reduced (such as the need for exchange transfusions due to Rhesus incompatibility and necrotising enterocolitis) while other problems such as respiratory difficulties, intraventricular haemorrhage and infection are still common.[10]

Over the last 10 years, NICUs have become more parent-friendly, encouraging the involvement of parents with their babies. Cuddling and skin-to-skin contact ('Kangaroo Care') are seen as beneficial therapies for most babies. Evidence strongly suggests that care by parents as part of a family integrated Model of Care reduces length of stays and rates of infection.[11,12]

The Neonatal Service has managed to deliver sound infant care with robust clinical outcomes despite sustained high acuity and demand. Effective leadership, a strong focus on safety and the commitment of its staff have built a resilient service, however it has now been operating above 85% occupancy for more than five years. The many and interrelated consequences of operating above 85% occupancy are outlined in these findings.

3.0.2 Policy context and linkage with national and international Initiatives

The following key organisations recommendations and strategies have been considered as part of this review, and are explored in the following findings as relevant. Web links for further information are contained in the References, at the end of this report (page b).

- New Zealand Baby-Friendly Initiative
- Australian & New Zealand Neonatal Network
- Health, Safety and Quality Commission, Perinatal and Maternal Mortality Review Committee
- Newborn Services Clinical Network (New Zealand Child and Youth Clinical Network subgroup)
- New Zealand Ministry of Health, Child Health Strategy June 2008
- British Association of Perinatal Medicine guidelines (widely accepted as best practice in Australasia due to absence of locally published guidelines).

3.0.3 Findings structure

These findings are outlined in the following seven categories:

1. Neonatal workforce
2. Quality of patient care
3. Model of Care
4. Demand and capacity
5. Neonatal facility
6. Service culture
7. Information management

[9] Malatest International, Comparative Study of Maternity Services, 2012
[10] New South Wales Health, Report of Chief Health Officer, 2010 and 2014
[11] John Hunter Children's Hospital NICU Services Plan 2012-2016
[12] Charpak, N. et al. "Twenty-year Follow-up of Kangaroo Mother Care Versus Traditional Care." Paediatrics 2017; 139(1):e20162063

3.1 Neonatal workforce

3.1.1 General workforce overview

The Neonatal Service has a significantly sized workforce of 110 FTE. The workforce has a high degree of expertise and consists of Paediatric Neonatologists, RMO/NP/CNS.ANPs, a large specialised RN workforce and neonatology-focussed allied health and support staff.

Clinicians were recognised as highly skilled and extremely patient focussed

Interviews undertaken with a range of clinicians and management outside of the Neonatal Service (as part of this review) identified that the clinicians within the Neonatal Service were unanimously recognised as highly skilled and extremely patient focussed. The reviewer observed a high performing team[13] that is able to cope with long periods of operation at 20%[14] above resourced capacity (resourced capacity includes cots, staffing, equipment and space). Despite visible fatigue,[15] patient safety[16] has been maintained though effective leadership, robust protocol-driven decision-making and a team that is committed to meeting the demand for their services. Addressing this level of demand is challenging and unsustainable, with a greater likelihood of errors, increased infection rates,[17] and reduced morale with likely workforce retention issues in the long term.

Shift-to-shift nursing clinical coordination and leadership in the unit is provided by the ACNMs who are tasked with matching the demand to the resources available. However this is not always possible if the unit is well over capacity (and staffing, patient acuity needs and space constraints would make admitting additional infants unsafe). The ACNMs do not take a patient load unless exceptional circumstances necessitate their clinical support 'on the floor'. At least one Clinical Support Nurse should be allocated each shift to help with admissions, transfers and cover for meal breaks (but this is not always increasingly possible when patient numbers are greater than resourced levels). When over capacity, the leadership and support functions of the ACNM and Clinical Support Nurse roles are diminished and caring for infants takes priority.

When over capacity the leadership and coordination functions are diminished and caring for infants takes priority

The researcher and RTFC facilitators observed that when the unit's occupancy was around 50 babies, all members of the team were focused only on caring for infants, at the expense of shift coordination, forward planning, education, discharge planning and quality time with parents. This situation leads to an observed spiralling difficulty to manage fundamentals. Parents also reported this pressure as part of the patient consultation component of this review.

The Neonatal service is recognised as having a high nursing and SMO leave balance in relation to other services within the Canterbury DHB.[18] The Nurse Manager, who aims to allocate 360 hours of leave each week, is actively managing the high nursing leave balance. When occupancy numbers are greater than 41 cots (on which staffing is based) leave is difficult to grant, whilst maintaining patient safety with appropriate staff skill mix. ACNM roles are one of the most difficult to cross cover due to

[13] A team that was able to meet demand-exceeding capacity without any significant patient errors, decreases in staff engagement or turnover, and also maintain a calm environment for parents. The RTFC facilitators R. McKerras and M. Burns also observed this during the 'RTFC Follows' June-October 2016.
[14] Refer to section 3.4 where demand and capacity are explored in more detail.
[15] As observed by the researcher during time spent in the unit and during interviews (NeoView Staff and Key Stakeholder interviews June-July 2016)
[16] Almost all staff interviewed indicated that they felt that patient safety was maintained, even in periods when demand exceeded resourced capacity (NeoView Staff and Key Stakeholder interviews June-July 2016)
[17] John Hunter Children's Hospital NICU Services Plan 2012-2016
[18] As identified in 'High Leave Correspondence and Summaries' provided by D. O'Donoghue and Finance 2015 & 2016. As at 5 December 2016: 3 SMOs, 3 CNS.ANPs, 3 ACNMs and 24 nursing staff have in excess of 300 leave hours owing.

low numbers and as a result these staff have the highest leave balances. The current practice for the RMO/NP/CNS.ANP roster to be issued three months in advance means that short-notice leave is not possible for this group.

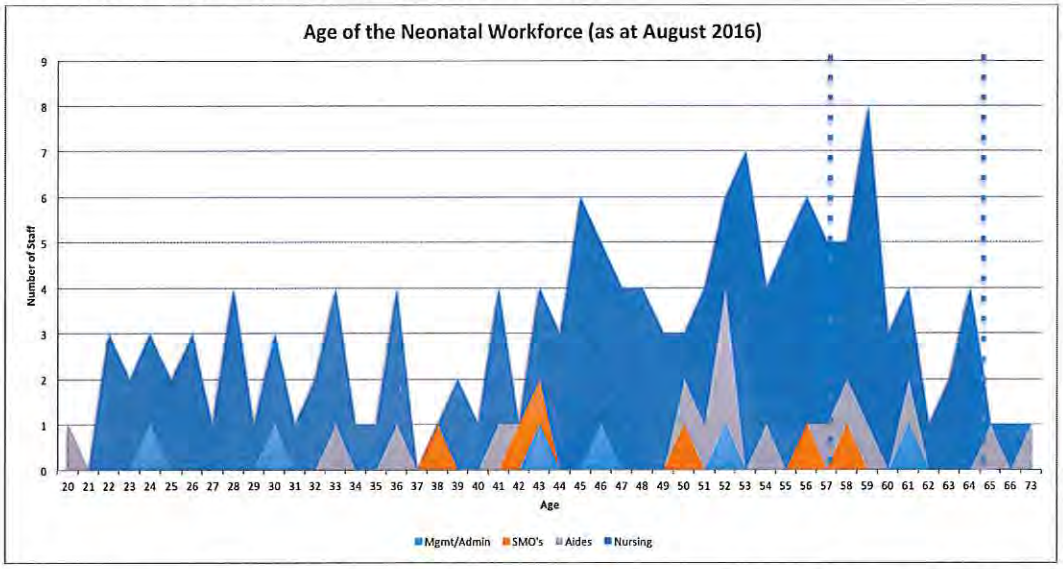
Registered Nurses, ACNMs and RMO/NP/CNS.ANPs are rostered to cover 24 hours a day. The specialist nursing roles (such as outreach, education, infant feeding) and allied health predominantly work business hours, as do the SMOs (excluding on-call weekends when they are in the unit for six-eight hours per day). This reflects historical role / rostering practices and the generally heavier workload demands that exist during business hours (compounded by investigations, surgery, education, teaching, patient review and meeting demands).

The separate professional groups that comprise the Neonatal workforce are covered in the following sections, as well as the overall workforce demographics, rostering practices and succession planning.

3.1.2 Neonatal workforce age distribution

This review finds that the Neonatal nursing and nurse aid workforce is ageing, while the SMO and management/ administration workforce are most broadly distributed in terms of age (as demonstrated in Figure 2).

Figure 2: Age of the Neonatal Workforce (as at August 2016)[19]

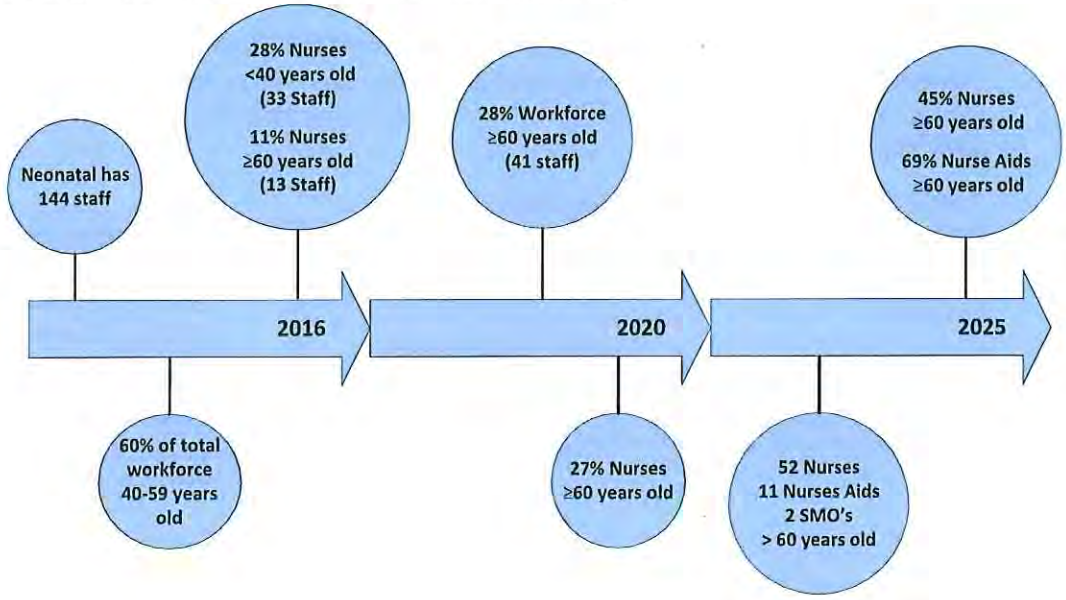


The age distribution of the Neonatal workforce currently provides the benefit of experienced staff, however projections between 2020 and 2025 point to a diminishing pool of skilled staff, in particular nurses. The need to work night-duty is a requirement of all RNs in the service, which means that retirement is likely to occur earlier than other services in the DHB where RNs have the option of day-only work.

Within eight years the Neonatal Service could lose between one quarter to half of the nursing workforce (based on the current age of the staff, earlier retirement age for Neonatal nurses and existing recruitment practices), with those nurses reaching retirement age between the dotted lines on the above figure. This is without any consideration for regular staff turnover and the likely need to increase staff numbers to meet demand. The outlook for the Neonatal workforce (based on current levels of resourcing) over the next three and eight years is outlined in **Figure 3** below.

[19] Date of birth supplied by Hannah Hardy-Jones (People and Capability Advisor, Women's and Children's Health CDHB) 28 July 2016

Figure 3: Neonatal workforce age implications from 2016 to 2025



3.1.3 Rostering practices in a 24/7 service

A majority of nursing staff interviewed favoured the 12-hour shift pattern and those who did not wish to work the longer shifts were able to choose eight-hour shifts. Preference for the eight-hour shifts increased with age. Many staff interviewed cited the 12-hour shifts as a big attraction to work in the unit due to the lifestyle opportunities it provided (with more days off per week).

Despite evidence of the impact of fatigue and errors with a 12-hour shift pattern,[20] staff and management indicated that by offering 12-hour shifts, this provided an effective recruitment and retention strategy (especially for younger nurses). The low level of clinical errors and incidents indicates that the risks associated with 12-hour shifts are being effectively mitigated by the service at present. Nurses were mostly highly satisfied with the 'self' rostering practices in the unit and a representative comment included that the roster team "do a great job of meeting our requests and managing the units RN staffing needs".

The updated RMO and NP/CNS.ANP roster (following the addition of the three RMO positions in early 2015) has been well received by staff, and is managed by an assigned SMO. RMO/NP/CNS.ANPs have formally reported[21] decreased fatigue and improved patient safety[22] even though the roster does not always meet the MECA requirements for the advanced nursing roles (due to long-day shift requirements, high rostered shift hours some weeks, insufficient break-time between some shifts and one split day-off every 13 weeks).[23]

The SMO roster is managed by the Clinical Director, which also includes the on-call roster. SMO roles include a significant on-call component along with a seven-day on-service period.

[20] NZNO Safe Rostering FACT SHEET 2016
[21] The RMO/NP/CNS.ANP Roster Coordinator (B. Dixon) undertook a roster survey following the additional RMO positions in March 2016.
[22] 90% of staff surveyed reported high to medium levels of fatigue on the old roster, this decreased to 67% on the new roster with most rating medium levels of fatigue (53%) and improved patient safety. Dixon, B. CNS-NNP/Reg. Roster Survey March 2016
[23] NZNO, Letter to Hannah Hardy-Jones (People and Capability Advisor) from Christine Watson (NZNO Organiser) Re: Neonatal Intensive Care Clinical Nurse Specialise Roster, 14 September 2015

3.1.4 Senior Medical Officer (SMO) workforce

The Neonatal SMOs undertake a role that is a mixture of NICU (inpatient) as well as Paediatrician Outpatient work, which has unique and complex rostering requirements. **Table 4** below, outlines the SMO workforce size and rostering practices. The on-call/service workload is evenly shared amongst the SMO team members.

Table 4: SMO Workforce size and rostering practices

SMO workforce size	5.3 FTE	6 positions (2 part-time)
On-service	7 day duration (0830 - 1700hrs weekdays, 0830-at least 2pm weekends and then on-call)	1 in 6 weeks rotation (Approx. 9 weeks per year)
Night and Weekend on-call	Weekday duration 1700 – 0830	Weekend duration Friday - Saturday / Sunday 0830 – 0830 (48-72 hour period)[24]
On-call/on-service coverage	Neonatal unit, birthing suite, post-natal ward, antenatal counselling for foetal abnormalities, referrals from Paediatrics, primary birthing units and retrieval transport.	Ward round every morning at 0830 & 1600 weekdays and 0830 on Saturday and Sunday

When not on call, SMOs work predominantly business hours. During weekend on-call service, the SMO is always present for a ward round in the morning and is usually required to spend six to eight hours on-site (on both Saturday and Sunday). SMOs generally work two regular on-call nights per fortnight (although this is flexible to cover for sickness and leave and when two SMOs are on leave one SMO needs to cover two weeknights on-call). All SMOs phone the on-duty Neonatal RMO/NP/CNS.ANP[25] from offsite between 2200-2300 hours to discuss any unstable patients or concerns.

Paediatric and Obstetric SMOs felt that the on-call load for Neonatal SMOs is demanding

The on-call load for SMOs is considered demanding by the surveyed Obstetrics and Paediatric SMOs (during depth interviews and also identified in the ASMS Draft Job Size correspondence).[26] To evaluate the on-call workload as part of this review, the on-call diaries of two Neonatologists were analysed. This analysis of on-call work undertaken in 2014 demonstrates some variability (in the number of on-call days as well as the number of call-backs and days with time working on-site after hours). However there is consistency with regards to the significant amount of after-hours work required. These 2014 diaries were the only available 12-month records but are believed to be at least representative of current demands.

The data in **Table 5** indicates that for two SMOs in 2014, more than half of their on-call days required work on-site (57% and 74% of the on-call days required after hours work on site) and there were a significant number of call-backs in addition to this after hours work (37% and 48% of days on call required after hours attendance in the Neonatal Unit or birthing suite). Most call-backs necessitated attendance for two to three hours to stabilise extremely unwell or premature infants.

A review of the 'Category One' Caesarean section call back practices for SMOs has identified that this protocol has increased Neonatal SMO workload since it was implemented in December 2012. Both Obstetric and Neonatal services indicated that this protocol represented good clinical risk management despite the increased demands on Neonatal SMOs.

When not on service, the specific roles that require the Neonatal SMOs to be rostered include:

- Weekly Echocardiography clinic
- Daily foetal medicine consults cover
- Tongue Tie referral clinics[27]
- Monthly Neonatal follow-up clinic.

[24] There is some variation to the weekend night combination depending on SMO preference.
[25] One SMO chooses to attend the unit in person to undertake the RMO/NP/CNS.ANP discussion.
[26] ASMS Letter to Michele Pringle, People and Capability Manager CDHB dated 30 August 2016
[27] Note this practice is changing in February 2017 at which time the outpatient clinic will be triaging Tongue Tie referrals and the intervention rate will decrease with a reduction in the need for Tongue-Tie clinic frequency.

Table 5: Summary of 2014 on-call diaries for two Neonatology SMOs[28]

Type of on-call after hours support	SMO A	SMO B
Number of days on-call in 2014.	58	64
Number of on-call days with **no phone calls or on-site work** (% of total on-call days without phone call).	5 (8%)	16 (25%)
Number of days with **on-site work after normal working hours** or on weekend days - includes evening ward rounds, call backs, weekend work when on call (% of total on-call days requiring on-site work).	43 (74%)	37 (57%)
Number of days with **after hours call backs** (only days are counted, some days/night have multiple call backs and these can be in addition to after hours work already undertaken).	28 (48%)	24 (37%)

Other specific SMO responsibilities include:

- Weekly Paediatric outpatient clinic (specific sub-clinics include: Neonatal follow-up, enteral feeding, feeding difficulties, virtual renal follow-ups).
- Weekly Neonatal Abstinence clinic.
- Service meetings – X-ray, Foetal Anomaly Advice Committee, Morbidity and Mortality meetings
- Guideline, protocol development, service improvement and quality initiatives.
- Weekly journal club.
- Multidisciplinary teaching – registrars, nurses, midwives, obstetrics, medical students, allied health.
- Regional and National committees.
- Research.

The absence of a Neonatal Fellow means that SMOs do not have the significant support that this role offers to ease workloads and focus on high value SMO tasks (such as communication with families and other initiatives to improve patient care). A Fellow role assists the service by: overseeing staff undertaking procedures, attending high risk deliveries, orientating, teaching and facilitating additional time to supervise junior medical staff.

Administration of the combined RMO and NP/CNS.ANP roster task requires a 40-hour block of SMO time (every four months) to write the roster and then one to two hours every week to manage the roster. Whilst this task requires SMO oversight, it is a waste of a valuable (and expensive) SMO resource to have an SMO administering this task, as the roster does not need to be written by a member of the medical team.

The writing of the RMO/NP/CNS.ANP roster takes one SMO 40 hours every four months (+ 2 hours every week to administer)

SMOs have administration support for typing of dictation and clinic bookings from the Child Health administration pool, but limited accessible administration support on the Unit for all six SMOs. This has resulted in SMOs doing frequent basic administration tasks.

SMO feedback from the in-depth interviews has identified that:

- The combination of being on-call overnight and on service the next day can be exhausting for SMOs, as the likelihood of being called or called-in overnight is high.
- SMOs don't need to lead all meetings (e.g. "The Thursday morning (sit-down) ward round does not need to be led by an SMO on-service - it could be led by one of the other disciplines and this would help to relieve their workload when on-service and to share the leadership roles"). Note: since this review commenced the service has now changed the ward round leadership from the SMOs to the Discharge Facilitator.

[28] Based on the on-call diaries of two SMOs provided by the Clinical Director on 7 July 2016

- The NP/CNS.ANPs are not well utilised by SMOs in the Level 2 ward rounds ("they could be leading the Level 2 ward rounds", but it was acknowledged that the short number of continuous days rostered in Level 2 mean that there is not currently enough continuity to support this working well).
- The on-service week is deemed stressful by SMOs due to the heavy workload. Most SMOs indicated the workload is "unsustainable" in that all other SMO duties are neglected for the week. When Level 3 demand is heavy there is little time left to communicate with Level 2 parents and care for infants. Parents interviewed also echoed this sentiment (refer to Appendix 3: Parent/Whānau consultation – survey responses).
- Routine pre-discharge tests are not always completed prior to discharge, as the on-service SMO is too busy with acute tasks (for example, a heart murmur heard during a baby check on the day prior to discharge but no one was free to complete the Echocardiogram prior to discharge thus requiring the baby to return for the Wednesday echo clinic).
- There is a desire to decrease the rate of tongue-tie intervention by the Neonatologists in line with contemporary practice.
- There is no facility in the current roster arrangements to give an SMO relief after working the previous night.
- The SMOs feel that the pressure of the on-service week impacts on the quality of their communication with the Neonatal team.
- The SMOs do not undertake formal professional supervision.

Comparisons with other Neonatal Services both within New Zealand (Section 3.3.9) and internationally[29] indicate that the service is resourced at the lower level of sustainable SMO resourcing. This assessment was also confirmed by the ASMS draft job-size exercise undertaken in August 2016.[30]

The current SMO numbers are insufficient to provide two consultant-led teams as recommended by the BAPM

The current SMO numbers (six) are insufficient to provide two consultants during normal daytime hours as recommended by the British Association of Perinatal Medicine[31] (for NICUs undertaking more than 2500 intensive care days per annum; the Canterbury DHB has approximately 3200 intensive care days per annum).

Not all SMOs working in the Neonatal Service have 30% of their time allocated to non-clinical tasks, as the number of SMOs is insufficient to achieve this with the current day-to-day clinical demands.[32] All SMOs have allocated portfolios and these are currently being reviewed and re-allocated by the CD, to ensure even workload distribution amongst the SMO team.

The current SMO workforce size and roster demands have been analysed and identified as a constraint to facilitating improvements. Two of the six SMOs are part-time, and with consideration for leave time, there are not enough SMOs consistently working to improve the rostering arrangements with a two-person team on service. Leave is difficult to facilitate for SMOs with current numbers. For instance, if two SMOs are approved for leave at the same time, the remaining four SMOs have to work significantly longer hours to cover for their absence. Three SMOs have significant leave balances.[33]

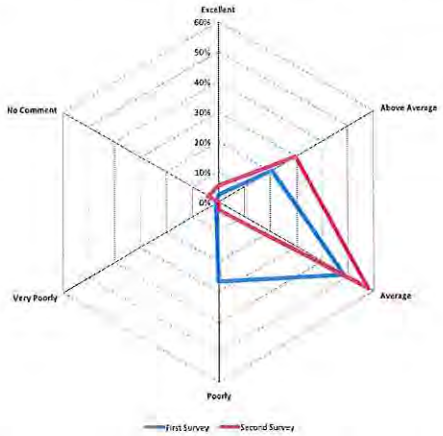
[29] With consideration for Hunter New England's SMO workforce (Table 4, Section 3.3.9) and the guidelines of the British Association of Perinatal Medicine – Optimal Arrangements for Neonatal Intensive Care Units in the UK, including guidance on their Medical Staffing – A Framework for Practice (June 2014)
[30] Association of Salaried Medical Specialists, "NICU Job Size." Letter to Michele Pringle (People and Capability Manager) from Dianne Vogel (Industrial Officer) 30 August 2016.
[31] British Association of Perinatal Medicine – Optimal Arrangements for Neonatal Intensive Care Units in the UK, including guidance on their Medical Staffing – A Framework for Practice (June 2014).
[32] Association of Salaried Medical Specialists, "NICU Job Size" Letter to Michele Pringle (People and Capability Manager) from Dianne Vogel (Industrial Officer) 30 August 2016.
[33] Three Neonatology SMOs have leave balances in excess of 300 hours as at November 2016.

3.1.5 Resident Medical Officer (RMO) workforce

There are currently eight RMOs representing 8.0 FTE working for the Neonatal Service. The RMOs share a roster with five NP/CNS.ANPs. RMOs interviewed indicated that they enjoyed their six-month rotation in Neonatal and some had chosen to come back for a second rotation. RMOs identified that they were well supported by the SMOs and found the assistance from the NP/CNS.ANPs valuable and reassuring, especially at night or when undertaking a new procedure on an infant.

The additional three RMO positions (3.0 FTE) added in December 2015 have improved rostering practices for the RMOs and NP/CNS.ANPs. These additional positions have ameliorated the risks to patient safety at night, eliminated the need for RMOs to be on-call and brought the Canterbury DHB in line with currently accepted international recommendations for NICUs with more than 2,500 intensive care days per annum.[34] In the repeat Neonatal Resourcing Survey (Appendix 1) clinical staff were more likely to feel that RMO resourcing was 'above average' or 'average', with a considerable decrease in the number of clinical respondents feeling that the resourcing was 'poor'. These findings are outlined in Figure 4.

Figure 4: Staff rating of RMO resourcing in the Neonatal Service – Comparison of Surveys



The Neonatal Fellow role is currently open and has been sporadically filled in the last 10 years (three full-time Fellows in 2008, 2009 and 2015 and one part-time in 2011). The position is unfilled for 2017. The service believes this role is difficult to recruit as Christchurch is not seen as attractive place to come and live for one year, and the current Fellow employment and rostering practices also make this role unappealing. The Fellow role (and FTE) is part of the RMO workforce, which means they are required to undertake shifts on RMO roster, with limited protected time (to complete research and project work), almost no supernumerary time to undertake more senior roles as well as a heavy night duty component (as compared to their general paediatric roster).

3.1.6 Nurse Practitioners/Clinical Nurse Specialists (Advanced Nursing Practice)

There are five NP/CNS.ANPs covering 4.4 FTE for the Neonatal Service who provide 24hr/day on-site medical cover for the service (along with the RMOs). There is one qualified NP and two of the CNS.ANPs are well progressed towards completing their Nurse Practitioner qualification. In practice the CNS.ANPs undertake similar (but not identical) roles to the NPs, as permitted in their expanded scope of advanced nursing practice. There is an expectation from the Canterbury DHB Department of Nursing that CNS.ANPs will make progress towards NP status.

[34] British Association of Perinatal Medicine – Optimal Arrangements for Neonatal Intensive Care Units in the UK

NP/CNS.ANPs expressed a sound awareness of their scope of practice and the importance of working within this scope. Even though the NP role has existed in New Zealand Neonatal Services since 2001, many aspects of the role are still being established, such as boundaries in relation to medically orientated tasks and working conditions. Some of the challenges of developing a new role and establishing its position in the service are outlined below, as well as representative quotes:

"Having two RMO/NP/CNS.ANPs working overnight is now much safer and enjoyable"

- The NP/CNS.ANPs interviewed felt that their role is not yet fully developed.
- The group feel frustrated that the NP/CNS.ANP roster still does not meet MECA requirements, however the limitations of their group size mean that all the MECA conditions are unable to be met, despite efforts by the service to achieve these roster arrangements. Additional payments are provided in-lieu of the variable 13-week roster pattern.
- "NPs are looking for a stretch, which is of value to the service". The group feel that they could expand the role to include, for example, responsibilities for outpatient clinics, resuscitation training for parents, additional teaching or portfolio responsibilities.
- Professional mentoring is provided by SMOs, however NP/CNS.ANPs would prefer if it was provided external to the department, as "it's not much use if my frustration is with one of the SMOs".
- "The NP role does not look that attractive to younger nurses as it requires so much night shift, pay is not that great, roster does not meet MECA and this is probably why the youngest team member is 44 years old".
- "The study is relentless and the study leave is insignificant to get through the papers".
- "As a group we can feel quite frustrated as we're in-between the medical and nursing workforce".
- The group were unanimous during the individual in-depth interviews that having two RMO/NP/CNS.ANPs working overnight and evenings is now much safer and enjoyable (than when there was one on night shift pre-December 2015), and can also assist in completing discharge summaries for babies on the post natal ward if the night is quiet. The value of this additional role was also reinforced by one of the ACNMs "The additional RMO/CNS/NNP on night shifts has made a positive impact on the staff and safe service delivery."

3.1.7 Nursing workforce

The nursing workforce is the largest professional group working in the Neonatal Service and whilst the NP/CNS.ANPs undertake some medical tasks, they remain part of the nursing team.[35] The nursing workforce components are outlined in **Table 6**. Nurses work a mixture of eight and 12-hour shifts. 35% of nurses choose to work eight-hour shifts with the majority (65%)[36] of the nursing workforce choosing to work 12-hour shifts. As at late 2016 the trend towards eight-hour shifts is increasing.

The Level 3 service when appropriately staffed, works on a ratio of 1:1 or 1:2 nurses to infants, and the Level 2 service on a ratio of 1:4. When the unit is over capacity it can change to 1:3 nurse to infant ratio in Level 3 and 1:6 in Level 2). The recognised safe operating ratio for the Level 2 service is one nurse to four infants[37] although with pressure on occupancy levels, this ratio is not often achieved. In between Level 3 and 2 is often an intermediate step (High Dependency) where infants are receiving high care inputs but not quite at intensive care level.

[35] Nurse practitioners are expert nurses who work within a specific area of practice incorporating advanced knowledge and skills. They practice both independently and in collaboration with other health care professionals to promote health, prevent disease and to diagnose, assess and manage people's health needs. http://www.nursingcouncil.org.nz/Nurses/Scopes-of-practice/Nurse-practitioner

[36] As taken from the Neonatal RN Roster 28 November 2016 to 8 January 2017

[37] British Association of Perinatal Medicine – Service Standards for Hospital Providing Neonatal Care, 3rd Edition August 2010 http://www.bapm.org/publications/documents/guidelines/BAPM_Standards_Final_Aug2010.pdf

Table 6: Summary of Neonatal Nursing FTE and number of staff

Nursing Role	FTE	Number
Nurse Practitioner/CNS-Advanced Nursing Practice	4.4	5
Senior Nursing Team (includes Nurse Manager and non-ACNM senior nursing roles, e.g. Infant Feeding Specialist, Educators, Outreach/Discharge Facilitators)	8.8	9
ACNMs	6.1	7
Registered Nurses	65.0	96
Total	84.4	117

Staffing ratios are adjusted as required to accommodate fluctuations in patient need. The nursing levels are adjusted to meet demand, and where possible quieter times are used to undertake mentorship post-orientation and training of existing staff (for new task and skill development). Representative staff feedback on nurse to patient ratios includes the following comments:

- "We have insufficient RN resourcing during times of high acuity or when more than 41 cots are in use."
- "When the nurse to patient ratio is greater than 1:4 in the Level 2 service it is unsafe – it is often 1:5."
- "It can be a real struggle to care for 5-6 babies when we are full, and it's not like you just have to worry about the babies, there's often a Mum and a Dad too. That can be up to 18 people you need to care for on a shift, and I am just one person" (RN).

Nursing workforce demands are consistent across the 24-hour spectrum

The nursing roster is managed by the Roster Team, which consists of an ACNM and a RN (from the floor) with administration support from a Ward Receptionist. The roster is published 12 weeks in advance. Nursing staff interviewed were mostly satisfied with the roster allocation and the degree of control they had over their rostered shifts. A few staff felt that they were "not given enough opportunity to work with the extremely sick babies".[38]

Covering for sick leave is a significant component of the ACNMs responsibilities. The monthly Clinical Intensity Score reports[39] indicates that there are between 39-121 shifts per month that need to be covered for sick leave. 121 shifts requiring cover is at the high end of the spectrum with the range normally around 40-70 shifts per month.

The nursing workforce demands are similar across the 24 hour spectrum due to the consistent nature of infant admissions, transfers and discharges occurring across the day and night. A typical shift requires minimum nursing staff as outlined in **Table 7**. Staffing is adjusted as required due to the number and acuity of infants requiring care. The roster is always staffed with a Transport (credentialed) RN, Level 3 requires of a minimum allocation of seven Level-3 trained RNs (but the service prefers to allocate eight nurses if available). The remainder of nurses are allocated to Level 2, with a minimum of 13 RNs required to cover the whole unit (excluding the ACNM).

Table 7: Summary of agreed *minimum* Neonatal Nursing staff required over a 24 hour period to cover the care of inpatients (when at or below 41 infants)

Nursing Role	0700 -1900	1900 -0700
ACNM (one required per shift)	1	1
RN's L3 (includes Clinical Support Nurse and Transport Nurses)	7	7
RN's L2	6	6
Total	**14**	**14**

[38] This sentiment was also reflected in the RTFC staff survey results.
[39] Clinical Intensity Score Reports for December 2015-September 2016 were reviewed – these reports are manually collated.

Actual RN location on the day of shift is adjusted by the ACNM to ensure appropriate skill mix and support for junior staff. The number of staff outlined above represents the minimum safe staffing levels and many factors necessitate an increase on these base numbers, such as the number of inpatients, clinical intensity or a heavy transport load. With the combination of eight and 12-hour shifts, the need to cover breaks and handovers, the staffing numbers are variable during the course of the day.

The nursing team's ability to cope with demand exceeding resourced capacity was observed by both the reviewer and the RTFC facilitators. The nursing team demonstrated considerable resilience[40] in the face of sustained periods of high demand, maintaining a relatively calm atmosphere in the unit even when crowded. The leadership, coordination, outreach and education roles that have specific functions relating to service improvement and organisation were aside and the team worked cohesively to meet the high demand. Whilst this is an effective short-term strategy to ensure service needs and patient safety is maintained, it compromises shift leadership, planning, orientation of new staff members and discharge planning, amongst many other responsibilities.

The nursing team demonstrated considerable resilience in the face of sustained periods of high demand

The nursing team interviewed expressed general satisfaction with how their unit is run, how their manager treats them, the degree of professionalism (with the running of the 'business') and the culture of collegial support that is promoted in the unit.

The financial budget[41] for the nursing workforce is understood to be set at 90% of the average occupancy (i.e. 37-38 cots). This budget was set in 2007 and the current budget does not reflect workforce needs for cot numbers greater than this. The service is constantly requiring an extra RN per shift, which is reflected in an overspend of approximately $510,000 in the 2015/2016 financial year. Until early 2015 the Neonatal Service was working within budget, but sustained high infant inpatient numbers now mean the budget cannot be achieved, whilst also maintaining safe staffing levels.

When compared to similar-sized Neonatal units (refer to 3.3.9 Neonatal service comparison below) the Canterbury service is running a lean nursing workforce. The nursing workforce is ageing as outlined in 3.1.1 General workforce overview above) and has a heavy reliance on the casual nursing pool (which reduces significantly during school holidays).

The commitment to training graduate nurses (and nurses new to NICU) requires sufficient time to ensure appropriate supervision and support for skill development, and many nurses interviewed felt that this time is being eroded with sustained high occupancy.

Providing cover for ACNMs is difficult due to the small pool of ACNMs, however deputies and Senior RNs through the 'walking in my shoes' opportunities are gaining skills (as well as opportunities for career progression) to cover for ACNMs. The high leave balances[42] for this group reflect the difficulty in getting cover to facilitate appropriate breaks from work. ACNMs are experiencing increasing pressure as a result of the high occupancy numbers as well as erosion of their protected specialty portfolio time. The stresses on the ACNM role are exacerbated with high baby numbers as the need to frequently attend meetings and support complex neonatal care in the birthing suite, in addition to their leadership role.

Cover for the Neonatal Outreach/Discharge Facilitators and Educators is provided by their peers or RNs seconded from the unit. There is no cover for the Infant Feeding Specialist, and when on leave there is limited specialist feeding advice available (and the likelihood of extended patient length of stay if this advice is required prior to discharge).

[40] A Resilient Health Care system is a system that can adjust its functioning prior to, during or following changes and disturbances, so that it can sustain required operations, under both expected and unexpected conditions. As defined by Lane, P in "Resilience and Patient Safety".
[41] As outlined by E. Kidd during a meeting with the finance team on 12 August 2016 and demonstrated in Operating Statements 2015/2016
[42] Three ACNMs have greater than 300 hours of annual leave owing

3.1.8 Administration support

The Neonatal Senior Administrator (1.0 FTE) provides administration support to the Clinical Director and Nurse Manager. Three Ward Clerks (1.2 FTE) manage the reception for the unit (as well as undertaking clerical/administration duties) and the Senior Administrator provides sickness cover for the Ward Clerks.

There is limited administration support available to clinical staff (in particular SMOs), with the exception of Outpatient Clinic appointment management and clinical typing (provided by the Child Health administrators with some support from the Neonatal Administrator). There is no administration support provided for the SMOs managing the RMO/NP/CNS.ANP and SMO rosters. A ward receptionist is part of the Nursing Roster Team and this role manages the 'Microster' administration requirements.

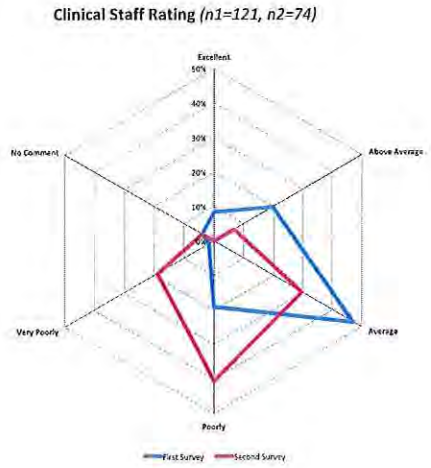
3.1.9 Allied health workforce

The allied health workforce supporting Neonatal consists of a Neurodevelopmental Physiotherapist (0.6 FTE), a Dietician (0.4 FTE), two Social Workers (1.7 of 2.0 allocation), a (shared) Māori Health Worker, Pharmacist (0.4 FTE) and Speech-Language Therapists (approximately 0.3 FTE). The respective allied health teams employ these clinicians but they dedicate a significant amount (if not all) of their working time in the Neonatal Unit.

Whilst demand for services provided by these allied health professionals is mostly sufficient when the unit is running at resourced capacity, recent changes to the Social Worker resourcing has impacted negatively on infants and their families.

This reduction in Social Worker resourcing in the unit (by 0.5 FTE from 2.5 FTE) is demonstrated in Figure 5 (which represents staff perception of the level of resourcing of Social Workers at the November 2015 survey and at the repeat May/June 2016 survey). Seventy-one per cent of respondents to the second staff survey felt that resourcing of social workers was 'average' or 'poor'. Neonatal staff and the Social Workers (allocated to the Neonatal unit) were not consulted on the change in Social Worker resourcing for the unit. Social Workers interviewed reported high levels of satisfaction with their role in the Neonatal team but less engagement and support from the Social Worker team. In addition to the reduction in Social Worker input for Neonatal, the practice of rotating Social Workers in and out of Neonatal mean that the high level of expertise required is not consistently available in the unit, impacting on the quality of support provided. No other allied health group working in the unit rotate their clinicians.

Figure 5: Staff Rating of Social Worker Resourcing in the Neonatal Service – Comparison of Surveys



The working practices of the Speech-Language Therapist (SLT) and team were identified as an ideal model to support the Neonatal Service – as the team flexes the number of neonatal-capable SLTs as required to meet demand. The team borrow colleagues from other less acute services to support the Neonatal SLT when demand in the unit exceeds the allocated SLTs capacity. The level of responsiveness of the SLTs was identified by staff as positive (when not affected by sickness or leave), and parents also highlighted the value of SLT in helping them to recognise feeding cues when learning to bottle feed their baby.

The Dietician, Pharmacist, Māori Health Worker and Neurodevelopmental Physiotherapist undertake valuable roles within the multi-disciplinary team and their contribution to the service was recognised by staff during the depth interviews.

Literature outlines the considerable benefits of family support provided by a Clinical Psychologist in the NICU

A number of staff interviewed felt that if the service had access to a Clinical Psychologist with expertise in the care of the Neonate this could help parents in a proactive capacity. Literature outlines the considerable benefits of family support provided by a Clinical Psychologist to rapidly assess and intervene early in an infant's life for NICU parents (who experience an increased risk of postpartum depression and post-traumatic stress disorder).[43] Research has shown that an emotionally traumatic experience in the NICU[44] can have long-lasting adverse effects on the quality of the parent-infant relationship and on both parents' and the infants functional health and wellbeing.[45]

3.1.10 Management

The Clinical Director (CD) manages the SMO and RMO workforce. The CD has 0.1 FTE contracted CD component of their role, with the remainder being clinical. The Neonatal Nurse Manager (1.0 FTE) manages the Neonatal Unit nursing, administration and nurse aid workforce.

The Nurse Manager and Clinical Director have an effective working relationship, as evidenced by constructive and frequent communication, collaboration on significant decisions and improvement planning. The unit is effectively managed by the two roles, both of whom are capable leaders and focussed on an efficient and goal-orientated service. The Nurse Manager has contributed to an established culture of collective decision-making and effective communication with her team – as observed by the researcher and identified by staff during the depth interviews.

The Nurse Manager reports directly to the Nursing Director (Women's and Children's) and the Clinical Director to the Chief of Child Health, for professional accountability. Both roles report to the Child Health Service Manager for operational issues. The service is self-contained managing the day-to-day operations of the service and as such has limited need for daily interaction with line management. This was observed by the researcher to have positive benefits in terms of responding to patient demand and managing staff autonomously, but is limited in terms of collaboration with leadership roles and strategic planning outside of the Neonatal Service.

3.1.11 Hospital/Milk Room Aides

There are 15 Hospital/Milk Room Aides (7.4 FTE) providing 20hrs/day of non-patient care support for the service. The Aides have a six-week rotating roster working mornings or afternoons seven days a week with a casual pool that covers for leave and ad-hoc roster gaps. A Hospital Aide manages the

[43] The Workgroup on Psychosocial Support of NICU Parents (Convened by National Perinatal Association) Interdisciplinary Recommendations for Psychosocial Support of NICU Parents (2015)
[44] It has been estimated from research in the NICU that 20% to 30% or higher of NICU parents experience a diagnosable mental disorder during the first postpartum year as outlined in Recommendations for Psychosocial Support of NICU Parents
[45] The Workgroup on Psychosocial Support of NICU Parents (Convened by National Perinatal Association) Interdisciplinary Recommendations for Psychosocial Support of NICU Parents (2015)

Aide roster with support from the Nurse Manager. There are insufficient Nurse Aides to cover all shifts each week, however a regular week with a full team has the staffing levels outlined in **Table 8**.

Table 8: Summary of normal Neonatal Nurse Aide staff levels

Aides	0700-1530	1500-2330	2300-0300
Milk Room and Hospital Aides	2	2	1
Note: There is no Aide working between 0300-0700 hours			

Generally there appears to be sufficient Aide cover (when Aides are not on leave and the service is operating at resourced capacity). Milk Bank demands can be heavy for the Aides. The service is considering utilising the Aides to assist the RNs with non-complex infant care, such as comforting babies that are unsettled or not getting enough handling/close human contact (in a similar approach utilised by Adult services who have Hospital Aides working as patient 'watchers').

Whilst the number of nurses can be increased through overtime and use of casual staff, the Nurse/Milk Room Aides are not so easily flexed up due to their low workforce numbers. This has contributed to the support workforce reportedly being "too busy to take breaks and feeling less satisfied with their roles, as demands are constant".

3.1.12 Succession planning

The need to plan for an ageing nursing workforce was identified in 2010, at which point final year Bachelor of Nursing students were encouraged to undertake placements in the unit and consider applying for the NEtP (Nursing Entry to Practice) positions offered by the Neonatal Service. This has been a successful programme with four graduate nurses employed each year, and some of the early graduate nurses are now undertaking senior roles in the NICU and transport teams.

Other opportunities to foster Nurses interest in career-progressing ACNM, Nurse Educator, Nurse Practitioner and Discharge Facilitator roles have been undertaken through the 'walking in my shoes' programme. This programme supports interested staff to spend the week working with their colleagues to learn more about the different roles and identify any skill gaps that could be addressed with education and training.

Even for experienced RNs new to Neonatal there is an appreciable lead-in time to develop the level of competence required to work independently in the unit.[46] For RNs that wish to undertake the Post Graduate qualifications in Neonatal Nursing, funding is available from Health Workforce New Zealand. There is also a significant and challenging lead-time to develop NP/CNS.ANPs (around five-seven years due to practical and academic requirements).

Within five years, two SMOs will be over 60 years of age and considerations for their replacement will need to commence. The inability of the unit to attract Fellows means that there are no suitable potential new SMOs working in the service. However, it is understood that there is an oversupply of qualified Neonatologists in Australasia and recruitment into SMO roles should not be difficult when required.[47]

[46] RNs with no Neonatal experience require one-month super numerary as part of their orientation then 9-12 months experience before they are able to work in Level 3 (NICU). This is outlined in detail in the NZNOs Neonatal Nurses Knowledge and Skills Framework 2014

[47] Both of the Clinical Directors interviewed at Waikato and Auckland DHB Neonatal Services, as well as A. Lynn indicated that there were a large number of Neonatology Paediatric trainees who have almost completed their sub-specialty training in Neonatology.

3.2 Quality of patient care

3.2.1 Clinical outcomes

The Canterbury DHB is member of the Australasian Neonatal Clinical Outcome Programme managed by the Australian and New Zealand Neonatal Network (ANZNN). ANZNN publish an annual clinical report for each service, which benchmarks services providing the same level of care. The report of babies born in 2014[48] demonstrates that the Canterbury DHB is performing especially well in comparison to other Level 3 units. The report identified that the service had:

- A higher proportion of Level 2 babies than other units in the Network.
- Infrequent retrieval of babies less than32 weeks (as the optimal clinical outcomes occur when these very premature babies are born in a tertiary centre – Canterbury DHB is committed to transporting these mothers to a tertiary centre prior to the delivery of their baby).
- A 100% follow-up rate for getting head ultra sounds performed.
- No cases of severe intraventricular haemorrhage.
- A 100% follow-up rate for eye checks for 'retinopathy of prematurity'.
- No severe Grade 3/4 'retinopathy of prematurity'.
- Low or average rates for late onset sepsis.
- Infant survival rates similar to benchmarked services.
- Very few incidences of necrotising enterocolitis (this severe bowel complication is rare and contributing factors may be due to the human milk bank service and use of probiotics[49]).
- Very low transfer-out rates (compared to ANZNN units, as there are few options for transfer in Canterbury).
- Higher rates of chronic lung disease - 34% (than the benchmarked average of 25%). Note: from 2016 a lung function assessment at 36 weeks is being undertaken so all units will have standardised measurement data on this outcome. If the Neonatal service does not fit within benchmarked parameters corrective action to address will need to be initiated.

The Canterbury DHB's human milk bank is the only milk bank in the country that has made pasteurised human donor milk available for neonates when their mother is unable to provide the milk. This is likely to have decreased the incidence of morbidity relating to bowel complications as a result of necrotising enterocolitis.[50]

3.2.2 Needs of parents

Consultation with 12 parents randomly selected from discharged infants provided valuable perspectives of the Neonatal service. The parents were overwhelmingly positive about level of care provided by the staff, as detailed in the survey responses (in Appendix 3). The key areas where parents suggested improvements included:

- More information – parents can't get enough and this information needs to be repeated at regular intervals.
- Lack of privacy in a constrained space – is a challenge to be managed by staff on a daily basis.

[48] ANZNN Individual Unit Feedback report 2014 – current published report as at late 2016

[49] Necrotizing enterocolitis (NEC) typically occurs in the second to third week of life in premature, formula-fed infants and is characterized by variable damage to the intestinal tract, ranging from mucosal injury to full-thickness necrosis and perforation. NEC affects close to 10% of infants who weigh less than 1500 g, with mortality rates of 50% or more depending on severity, but may also occur in term and near-term babies. http://emedicine.medscape.com/article/977956-overview Medscape Website accessed 06 October 2016.

[50] ibid

- Visitor management – most parents did not like lots of visitors in the room their baby was residing, however they were keen for more of their family to be able to visit but recognised the limitations of the facility.
- Unhurried feeding support – parents indicated that they would like feeding support to be unhurried and from the nurse caring for them and their baby. They preferred hour-by-hour support that it is not time dependent or needs a 'feeding specialist'.
- Consistent advice between staff – parents identified that inconsistent feeding advice was the most common frustration they experienced.
- More contact with their baby's Consultant – parents highlighted their interactions with their infants' SMO and the importance of hearing how their baby was doing from the SMOs perspective. Some parents indicated they would like contact with their infants Consultant during the evening.

3.2.3 Privacy

The lack of auditory and visual privacy for patients in the Neonatal unit is well recognised by staff. Significant effort is made to utilise portable screens and undertake ward rounds with only the infant's parents present. However auditory privacy is almost impossible to fully ensure when up to 12 babies and their parents/whānau can be residing in the same room (up to 36 people without staff).

Auditory privacy is almost impossible to ensure when up to 12 babies and their family/whānau are in the same room

Visual privacy is considered important for a service that is trying to promote 'skin to skin' time for neonates with their parents, and promote breastfeeding (as recommended by Baby-Friendly Aotearoa).[51] The benefits of skin-to-skin time for neonates is significant with a recent (20-year) study identifying that continuous skin-to-skin time as part of Kangaroo Care has noticeably improved clinical outcomes.[52]

3.2.4 Feeding support

The need for additional feeding support for parents (from Infant Feeding Specialists, Lactation Consultants and nurses) was identified during depth interviews with staff, the two Resourcing Surveys and during parent/whānau consultation. Successful feeding is a prerequisite for discharge and the lack of support in this area impacts negatively on breastfeeding rates, the parents' perceptions (of the benefits of breastfeeding) as well as overall length of stay. Representative comments from the staff interviews and Resourcing Survey (refer to Appendices for results) explain the challenge:

Successful feeding is a pre-requisite for discharge

- "Infant feeding is the most important part of what we do, if more babies had their feed observed and supported when the baby/parent is struggling, more would go home sooner."
- "There continues to be insufficient Lactation Consultant support to achieve the BFHI standards and our goal of increasing the discharge breast feeding rate."

[51] http://babyfriendly.org.nz/going-baby-friendly/baby-friendly-hospital-initiative-bfhi/frequently-asked-questions/skin-to-skin-contact/
[52] Charpak, N. et al. "Twenty-year Follow-up of Kangaroo Mother Care Versus Traditional Care." Paediatrics 2017; 139(1):e20162063

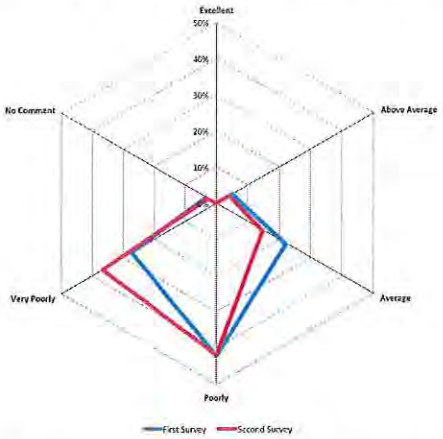
Parents interviewed were keen to talk about feeding, as it was a big part of their experience of their infants stay in the unit. Feedback included:

- "Breastfeeding advice was inconsistent"
- "More support for breastfeeding would be really good"

Canterbury DHB has identified the importance of breastfeeding from a population health perspective in the 2015/2016 Annual Plan, with an articulated goal of 'more babies are breastfed.'[53] Parents interviewed often felt rushed with feeding as their baby moved through the service and their acuity decreased. Nurses interviewed also felt pressured when caring for up to six babies in the Level 2 rooms, and indicated that they did not have enough time to help with feeding in an unhurried manner. A compounding factor in the low-acuity care service is that these are the first areas where staffing needs are reduced when staff numbers are low (due to the low level of clinical risk); and when baby numbers are greater than resourced levels, nurse-to-patient ratios are further diluted if additional staff cannot be found.

All staff interviewed felt that the current Infant Feeding Specialist was unable to meet demand for feeding support. In the repeat Neonatal Resourcing Survey, 78% of clinical respondents indicated that resourcing of Lactation Consultants was 'poor' or 'very poor'. This was rated less favourably than in the initial survey (November 2015). Refer to **Figure 6.**

Figure 6: Staff rating of Lactation Consultant resourcing in the Neonatal Service – Comparison of Surveys



The Neonatal Service has worked to address the demand for breastfeeding support within current resources by educating RNs as 'Feeding Champions'. These 12 nurses have been provided with specialist training from the Infant Feeding Specialist to support parents and other staff with baby feeding challenges, thereby reducing demand for the Infant Feeding Specialist. This is consistent with parent preferences, that feeding support is available from the nurses caring for them and their baby – however it is difficult for staff to provide unhurried feeding assistance when baby numbers are above resourced levels. One RN has completed and two RNs are currently studying towards Lactation Consultant certification. Whilst the unit will benefit from their skills when qualified, without dedicated time (or roles) to undertake this work the benefits to parents and infants will be limited.

The Neonatal service has developed the role of 'feeding champions' to support the feeding specialists

3.2.5 Families with social complexity/additional needs

There is a significant cohort of vulnerable infants journeying through the Neonatal service, with complex social problems, some of which the service focuses on addressing prior to discharge. The

[53] Canterbury DHB Annual Plan 2015/2016, page 19

reduction in Social Worker resourcing in the Neonatal Unit has been perceived negatively by Neonatal staff (as outlined in 3.1.9 Allied health workforce, above). Neonatal staff feel that the reduction in Social Worker time in the unit has resulted in longer lengths of stay caused by waiting for Social Worker input. The mental health challenges facing Canterbury are well understood[54] and the impact on young persons (who can represent the parents of these infants) is significant. Demand for post-earthquake mental health support has increased by 60% for the Canterbury DHBs Child, Adolescent and Family service in 2016 (since 2015).[55]

Staff indicated a concern that some vulnerable children are going home to environments that are unsuitable - and they do not have the ability to affect changes to improve the suitability of the infant's home environment. One of the Neonatal SMOs pointed out that "We have lots of parents struggling financially and if we don't assist with the core problems these babies go home to problems and don't do well. Social work support is critical to getting this right and we have had it reduced. It's very frustrating." Other staff also mentioned the ongoing health, educational and social work interventions required if struggling families are not supported early in the infants life.

3.2.6 Systems to guide practice and quality improvement

The Neonatal service has a comprehensive Neonatal Handbook to guide practice and decision making, which is regularly updated and well utilised by all staff. RMOs particularly appreciated the comprehensive handbook when they commence their rotation in Neonatal.

Neonatal are visibly practising many of the principles of Lean Production Systems,[56] such as standardised work (as outlined in the Neonatal & Maternity Handbooks and use of NEWS), Load Levelling (as much as possible by delaying appropriate induced births, transfers back to regional hospitals and discharges home), reduction of waste (relating to unnecessary movement and fetching of stock/equipment) and 'mistake proofing' services (with the use of checklists and protocol driven practice, clinical supervision and coordination roles). The RTFC 'follows' demonstrated that compared to Adult ICU, for all occupational groups evaluated, NICU staff spend less time in 'motion'.[57]

Neonatal are visibly practising many of the principles of Lean Production Systems

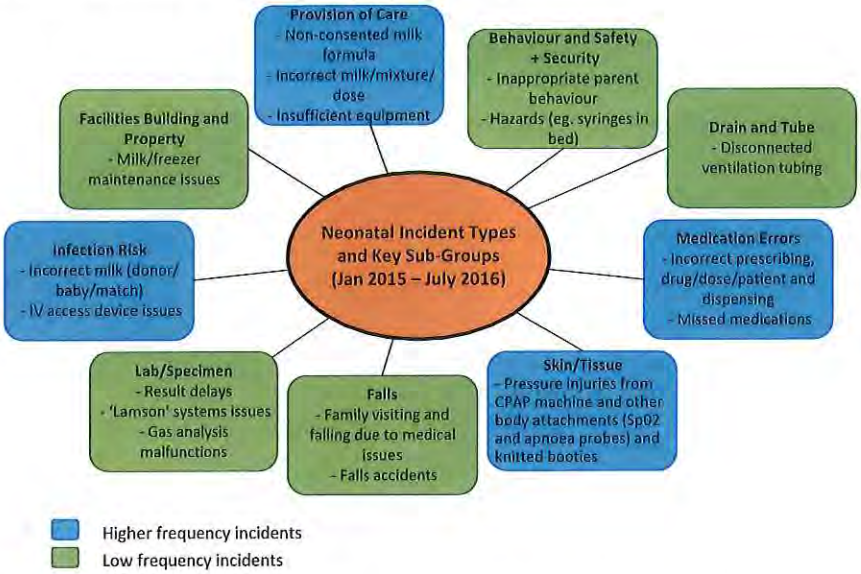
The service has an established culture of corrective action planning for any issues identified as well as areas where feedback has indicated the service could be improved. A Women's and Children's Service high level risk register is in use, where risks escalated to the attention of the Executive Management team are documented. The risk reporting, complaint and incident management systems, as well as improvement initiatives are well supported by the Quality Coordinator (Child Health) and the Women's and Children's Quality Manager.

A review of incidents (general and medication related) identified the following key themes, outlined in **Figure 7**. The four types of incidents, which have the most frequent occurrence include: Provision of Care, Medication errors, Skin/Tissue injuries and Infection Risk. The frequently occurring compounding factors that the incident investigations identified as contributing to the incident included: high workload (when the unit was over capacity), not following organisational policy (mostly in relation to

[54] The Press Editorial: 'Mental health funding cuts a disgrace' Last updated 05:00, February 17 2016 http://www.stuff.co.nz/the-press/opinion/76934698/Editorial-Mental-health-funding-cuts-a-disgrace and Canterbury DHB Annual Plan (page2)
[55] The Press 'Young Cantabs seek mental health help 35,000 times in a year' Last updated 13:55, July 18 2016 http://www.stuff.co.nz/national/health/82109962/young-cantabs-seek-mental-health-help-35000-times-in-a-year
[56] IHI Comparing Lean and Quality Improvement http://www.ihi.org/resources/pages/ihiwhitepapers/comparingleanandqualityimprovement.aspx
[57] RTFC NICU Results August/September 2016 –unpublished, provided by R. McKerras.

the second-checker for medications) and distractions/interruptions (especially from parents and other staff when preparing / administering milk).

Figure 7: Key themes from recent Neonatal incident reports



The NEWS (Newborn Early Warning Score) system in use augments clinical decision-making in early detection of the deteriorating baby in the post-natal ward. This prompts communication with clinicians and escalation to higher levels of care, normally involving neonatal staff assessment, advice or transfer to the Unit, to improve outcomes.

Areas where the quality systems in use for Neonatal were observed to be limited include:

- Lack of a regular patient/parent experience survey undertaken by Neonatal to provide feedback information on the parent experience of having a baby in the Neonatal Unit. A Parent Information Group meets every two months to review information provided to parents but this group has limited feedback functions.
- The MDT Pathway Booklet is not used consistently by all staff as identified during the depth interviews. Feedback from staff on this booklet included the following representative comment "The MDT Care Plan/pathway booklet is not fully utilised. If feeding intent is documented and referred to then staff can better support the parents with their decision, reduce confusion between staff and repeat questions for parents". This booklet was designed to assist in integrating the care provided by the Neonatal staff and support consistency of practice and reduce duplication of questions to parents and unnecessary communication between staff. The need for this pathway to document the infants care requirements, so that they can be supported in a consistent manner is significant. Feedback from parents (in the survey as well as formal and informal complaints) indicated that one of their biggest frustrations is inconsistent feeding (and positioning) advice from the nurses.

The MDT clinical pathway booklet is not used consistently

3.2.7 Meeting the needs of Māori patients and whānau

Staff interviewed (including the Māori Health Worker) felt that the unit generally respects the needs of Māori patients and is aware of the importance of Te Whare Tapa Whā[58] (four cornerstones of Māori health). No parents identifying as Māori were captured in the parent consultation sample.

[58] With its strong foundations and four equal sides, the symbol of the wharenui illustrates the four dimensions of Māori well-being. Should one of the four dimensions be missing or in some way damaged, a person, or a collective may become 'unbalanced' and subsequently unwell. For many Māori, modern health services lack recognition of taha wairua (the spiritual dimension). In a traditional Māori approach, the inclusion of the wairua, the role of the

A formal complaint received by the unit in 2015 identified that the restricted visitor policy (when the unit is over-capacity) was incompatible with Māori need for Whānau involvement in the care of a neonate.[59]

3.2.8 Impact of sustained periods of over-capacity

Staff interviews (as part of this review) were mostly undertaken in June 2016, when the unit was well over capacity (around 50 babies). The effects of this demand were clearly noticeable and included the following impact on staff and infants/parents:

- Fatigued staff who indicated that "we're always full and we're not resourced to cope with high numbers of babies, and it feels unsafe and stressful."
- Parents reported that they felt rushed, especially when trying to establish feeding with their infants.
- Teaching is eroded as educators need to work on the floor or staff are not able to be relieved for teaching.
- Staff go into 'rescue' mode and take a task approach to their work (rather than a holistic approach).
- Discharges are delayed due to lack of support to establish functional feeding patterns for the baby and parents.
- Discharge planning suffers when the unit is over capacity, increasing patient length of stay.[60]
- Nursing staff indicated that their strong collegially supportive team culture is negatively impacted when the unit is over capacity, with one SMO commenting that during this time "the nursing staff no longer have the capacity to help each other - they are just surviving their shift."
- Maternity staff expressed frustration when the Neonatal Unit is running above capacity as it increased their workload, representative feedback provided by staff interviewed is that "The unit is always really busy so we're always negotiating, I don't feel the unit is staffed to current demands" (Obstetric SMO).
- When the Neonatal Unit is full (or over capacity), noise levels are difficult to control impacting on the ability of infants to learn to feed effectively. Infant feeding is a neurodevelopmental skill and the environment affects whether a baby will successfully feed.[61]
- Complaints from parents increase when the unit is over-capacity.[62]
- Likely increase in sickness rates (although this was difficult to quantify in comparison to other services due to lack of data).

3.2.9 Visiting hours

The challenge of getting visiting hours right for all families, in a space-constrained unit, is difficult. The common sentiment echoed during the parent/whānau consultation was that most families did not like many (unknown) people around them and their infant's cot area. However the restricted visiting numbers (two per cot) means that families with siblings cannot come together to visit their new family member.

Visitor numbers are restricted when the unit is over capacity

During periods of sustained over capacity, the unit limits the visitors to immediate

whānau (family) and the balance of the hinengaro (mind) are as important as the physical manifestations of illness.

[59] CDHB Neonatal Complaints Summary (September 2011 – September 2016) provided by L. McKechie (02 November 2016)

[60] Length of stay is explored in detail in section 3.4.7

[61] Developmental care for promoting development and preventing morbidity in pre-term infants http://www.cochrane.org/CD001814/NEONATAL_developmental-care-for-promoting-development-and-preventing-morbidity-in-pre-term-infants

[62] Verified by A. Morgan (Child Health Service Manager) on the 2 December 2016

parents/caregivers only (in special circumstances a nominated support person may also be granted permission to visit). This is to protect the privacy and risk of cross-infection for parents and babies in the unit, but has obviously negative implications for family time and infant bonding.

3.3 Model of Care

3.3.1 Transitional care

The Neonatal Service at Christchurch Women's hospital is the only secondary and tertiary service in the Canterbury region for neonates, however it also combines the care of lower-acuity infants in the unit. As mothers cannot be accommodated in the Neonatal Service for more than a few days (in a rooming-in capacity immediately prior to discharge), this results in what many staff, parents and contemporary good practice indicates is unnecessary parent-infant separation. These low acuity babies occupy space in the secondary/tertiary service which means that when full, the service cannot accept high acuity infants requiring Level 3 care and they are required to be transferred in-utero to another tertiary centre. Transitional Care is the care of low-acuity infants undertaken with their parent or caregiver present and often combines Maternity and Neonatal care in the same unit.

A **retrospective audit** over three months duration (June-August 2016) was undertaken by the Clinical Director to quantify the number of babies that presented to the Neonatal service that could be cared for in a Transitional unit (with their parents) if this facility was available in the hospital. The clinical criteria for a Transitional level of care were defined (as distinct from NICU and Post-natal ward level of care). Some of the babies would need to be admitted to NICU for stabilisation prior to being appropriate for Transitional Care but many would be able to be admitted direct to a Transitional Care service. The audit identified that approximately 10-14 infants per month could be transferred directly to a Transitional Care unit, preventing unnecessary admissions to the NICU. The length of stay of these infants would vary but could be as long as four weeks (in the audit sample evaluated). Research indicates that infants are generally discharged sooner[63] when their parents is able to stay with them, so these lengths of stay have the potential to decrease.

Approximately 10-14 infants per month could be admitted to a Transitional Care service if one was available

Research undertaken as part of this review indicates strong support from the Maternity service to develop a Transitional Care service. It is well recognised by Neonatal and Maternity services that lack of Transitional level of care is a major operational issue for Canterbury DHB and that it will increase as this segment of the infant patient population represents high (and growing) demand.

Staff feedback from the depth interviews and Resourcing Surveys yielded much discussion about the need for Transitional Care and also the impact of the level of staffing in Maternity services:

- "We admit a lot of babies to NICU that other services would not, they should be in a Transitional Care unit but we don't have one here and the midwives don't have the skills to care for them in the Maternity ward" (Obstetric SMO).
- "We do have a lot of unnecessary separation of mothers and babies here as the midwives don't want to learn how to care for slightly unwell babies" (Obstetric SMO).
- "We have long stays due to the lack of Transitional Care" (Neonatal RN).
- "The staffing on the Maternity service is inadequate to care for complex mothers (post caesarian, diabetes or with pre-eclamptic toxemia) as well as a baby with more than well baby needs, especially on the night shift." (Neonatal SMO)

[63] Neonatal Couplet Care: The Next Evolution In Family Cantered Neonatal Care http://keynurseleaders.com/wp-content/uploads/2014/01/B.Neff_Neonatal-Couplet-Care_-Next-Evolution.pdf

- "The midwives do not have the time to adequately supervise the late pre-term (35-36/40) or smaller babies (2300-2500 grams) with their mums and they subsequently get admitted to us cold and with low blood sugars. In many cases the admissions could have been avoided with adequate clothing, warmth and regular/sufficient feeds. The midwives are happy for these babies to be on NICU as it lessens their workload, but there is nothing wrong with these babies and they are being unnecessarily separated from their Mums" (Neonatal NP/CNS.ANP)
- "A Transitional Care [service – author change from 'nursery'] would help to care for these small and late pre-term babies adequately if the Maternity and neonatal staff collaborated effectively, and this service could also look after the Mums and babies undergoing Methadone treatment." (Neonatal NP/CNS.ANP)
- "It would be great if we could have a Transitional Care ward for the late pre-term, extended stays for antibiotic therapy, phototherapy, four day stays for low birth weight etc. would take pressure off the wards and provide an environment that caters to the needs of this particular group of babies" (Neonatal SMO)

3.3.2 Family-integrated care

Despite staff commitment and innovations to provide integrated family-integrated care, the current Model of Care results in sub-optimal separation of parents and babies. The recommended practice is to keep mothers and their infant together 24-hours a day.[64] Many staff interviewed felt that the service could do more to promote family-centred care despite the limitations of invasive neonatal care and the physical constraints of the unit. Suggestions from a range of professional groups included:

- "If we had improved flexibility in the way support is provided to patients, with less focus on the medical model we would be much more family friendly" (Neonatal SMO)
- "The family should be the predominant carers, with us supporting them" (RN)
- "The mothers should be able to do the tube feeds" (SMO, RNs and Allied Health)
- "I had lots of ideas of how to be more family friendly when I started in the unit but they were all quickly thwarted due to space limitations" (RMO)

Since this review commenced, the service has initiated improvement activities to support greater family- integrated care. Two members of the nursing team are leading these initiatives supported by two SMOs:

- A personal communication board for each parent to hang on their infants' cot (the team would prefer a communication white board but there is not sufficient space for a white board at each cot).
- Planning is underway to prepare for teaching identified parents how to tube feed their infant.

Since this Review commenced the Neonatal service has initiated improvements to support family-centred care

3.3.3 Feeding and growing infants

A significant number of SMOs and nursing staff interviewed (from both within and outside the unit) felt that the number of babies that were in the unit for 'feeding and growing' (with low acuity needs) was too high and that they did not need to be managed with daily Neonatologist review. Staff reported that at busy times these babies occupied space in the unit that could be better utilised for infants with higher acuity needs.

[64] Crenshaw, Journal of Perinatal Education Care Practice #6: No Separation of Mother and Baby, With Unlimited Opportunities for Breastfeeding 2007.

Both nursing and medical staff indicated that there were opportunities for the unit to adjust its Model of Care to allow the Nurse Practitioners/CNS.ANPs to lead the care of these babies, with SMO oversight, and that this could free up some SMO time.

The main limitation to preventing admission of low-acuity infants (or moving these infants out of the tertiary unit) is the lack of a Christchurch-based Transitional Care facility. Timaru (South Canterbury DHB) has a Level 2 facility. Greymouth has a Level 1 facility. Both Timaru and Greymouth support the mother (or parents) and baby being cared for together (when the babies medical needs are not high). The proportion of infants discharged to districts other than Canterbury is low. 2015 patient volumes for Inter District Flows represented 6.7% of total infant discharges.[65]

3.3.4 Post-natal unit care of infants with additional needs

Neonatal SMOs, RMOs and NP/CNS.ANPs provide medical oversight and care of babies in the Maternity ward who require more than 'well baby' care. These babies are located on level 5 of Christchurch Women's Hospital (CWH) with their mothers.

The current Model of Care and staffing levels on the post-natal ward do not support midwives or nurses caring for babies with additional, low-complexity needs. Feedback from staff in the Maternity and Neonatal Services indicate that Midwives are not confident, or keen to provide this level of care. Staff in both services indicated that the workload in Maternity is not matched with sufficient resource to keep babies with slightly more than well baby needs safe. This necessitates transfers to the Neonatal service that with sufficient staffing and nursing skill would not be required (primarily for tube feeding and hypoglycaemia).[66]

The current resources on the post-natal ward does not support the care of infants with additional, low-complexity needs

Maternity staff have indicated that babies that return to the post-natal unit on three-hourly feeds or requiring intravenous antibiotics are too intense for the service to manage effectively with the current staffing levels.

3.3.5 Medical leadership of patient care

Feedback from SMOs working closely with Neonatal (but outside the service) indicated that whilst the quality of the care provided by the service is of a high standard ("I'm quite proud of the Neonatal Service, I feel the care is Rolls Royce" - Obstetric SMO) there were some areas that could potentially improve clinical outcomes and working relationships with services outside of Neonatal. These are outlined below:

- Neonatal SMOs do not have admitting rights to Child Health inpatient wards, however some infants are still under the care of the Neonatologist as their primary Paediatrician, which can be confusing for Child Health inpatient services.
- The inconsistent follow-up practices by Neonatologists can be frustrating for general Paediatricians to know who is to lead (some Neonatologists follow-up their patients to 15 years of age and the other Neonatologists transfer responsibility of care from two years of age to the general Paediatric team or other subspecialties). Whilst this is understandable for Neonatologists who have had general paediatric training, it is potentially unnecessary clinical variability and sub-optimal use of specialist Neonatologists time.

"It's frustrating when high-acuity babies are turned away due to being clogged up with Level 2 babies – it's a tertiary service not a nursery"

[65] As demonstrated in a summary of Discharged Neonatal IDF patients 2010-2016, provided by N. Nicholson (Decision Support) 07 December 2016.
[66] Unnecessary transfers were also observed by the RTFC Facilitators who described the Neonatal service as 'rescuing' the Maternity service. NICU RTFC Report.

- Perioperative care could be more progressive and less 'medically' orientated e.g. Current staffing models don't support rapid extubation when required (e.g. an inexperienced RMO may not be confident extubating infants post-operatively).
- Other medical specialists caring for neonates would like to be more involved in their care (as it relates to their area of expertise) as well as share clinical case review opportunities.
- Concerns regarding SMOs taking Echocardiographs. These include the accountability channels, processes for identification of structural abnormalities (e.g. co-arctation of the Aorta) and peer review or training to address any skill deficiencies in this technically specialised area. Note: Neonatal SMOs are aware of the need to have specialised skills to take Echocardiographs and have achieved the CCPU (Certificate in Clinician Performed Ultrasound).[67] The Neonatal SMOs would like to have greater support or skill development to undertake heart scans, which are often required to be undertaken after hours or at short notice.
- "Frustrations when high acuity babies are turned away due to being clogged up with Level 2 babies – it's a tertiary service not a nursery" (Paediatric SMO).
- "The service is doing too many tongue-tie interventions" (A range of SMOs/Management). Note: The Neonatal service is keen to reduce the intervention rate for tongue-tie procedures[68] as indicated by current literature from 8% of births to 4% of births. The criteria for acceptance for intervention has been revised to achieve this reduced intervention rate and is being led by the Clinical Director, an SMO and the Canterbury Initiative.

3.3.6 Infant transport

The Neonatal service is responsible for facilitating the transport of neonates both into Canterbury and back to their DHB of domicile (or to another DHB) as well as within the Christchurch Hospital campus for tests and surgery. The transport needs of the unit are met through a specific roster allocation to the transport team, which includes a NICU RN and RMO/NP/CNS.ANP on a 12-hour shift (this position is not supernumerary).

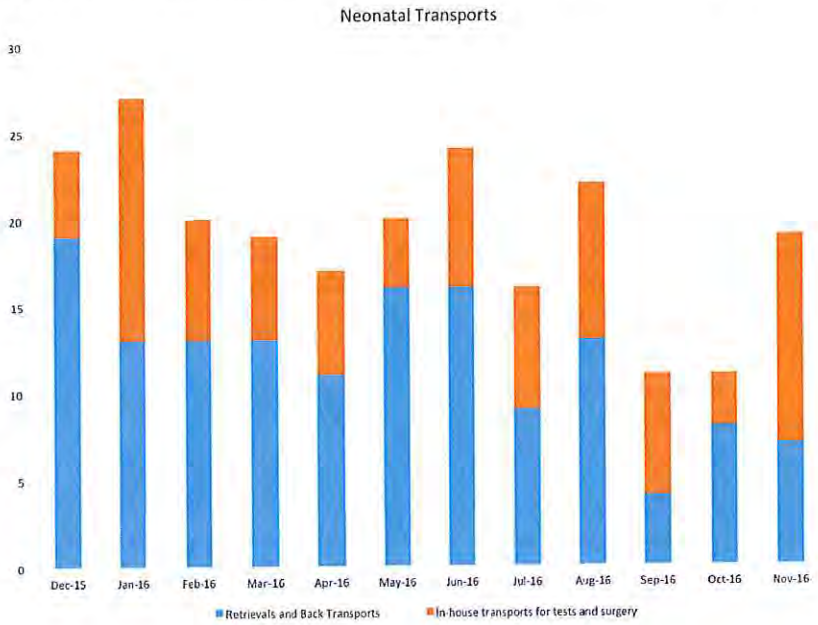
Consultation with Paediatric SMOs indicated that transport of a non-neonate (but young/small) infant is sometimes difficult to arrange. Adult ICU collects children older than six months of age. However only Neonatal have the equipment and expertise to retrieve infants in an incubator or care for small babies. The responsibility for the transporting of infants for paediatrics is viewed by Neonatal as a responsibility of Child Health (that the Neonatal service is required to undertake - without staff cover).

The number of Neonatal transport missions undertaken for the past 12 months is shown in **Figure 8** below. There is considerable statistical variability, however most months the number or retrievals is between 10-24. The majority of retrievals and transfers are outside of the campus and a small proportion within the campus.

[67] This course is provided by the Australasian Society for Ultrasound in Medicine http://www.asum.com.au/files/public/Education/CCPU/CCPU-Course-Brochure.pdf

[68] Auckland DHB Newborn Services Clinical Guidelines Ankyloglossia (Tongue Tie) http://www.adhb.govt.nz/newborn/Guidelines/Nutrition/Ankyloglossia.htm

Figure 8: Number of Neonatal transport events per month (December 2015-September 2016)[69]



3.3.7 Discharge planning and outreach service

The service has 3.6 FTE Discharge Facilitation/Outreach nursing roles (undertaken by five RNs). These roles support active planning for discharge of infants from the unit as well as a community-based nursing support service for parents of neonates. Parents interviewed were very appreciative of the skilled support provided by the outreach nurses undertaking these roles.

Parents interviewed were very appreciative of the skilled support provided by the Neonatal Outreach nurses

Awaiting feeding support was the most common reason staff cited for delayed discharge along with the limitations of outreach support days of operation (which is not normally provided over the weekends). Infants can be discharged with tube feeds, but this requires significant support from the service, especially early in the discharge period. The capacity of the outreach service is a limitation for discharging infants with high needs, even when the home situation is suitable and the parents capable. The increasing demand experienced by the Outreach service is due to patient and family complexity (and social circumstances) as well as the increased amount of travel required. Actual patient referral volumes are not increasing.[70]

Feedback from Lead Maternity Carers indicated that they would appreciate greater communication from the Neonatal Outreach nurses and that they would like this to be provided electronically.

3.3.8 Weekend clinician cover

The Neonatal unit provides a round-the-clock service to neonates, however the bulk of specialist Neonatal clinicians are available Monday to Friday. SMO cover is provided 24 hours a day (on call in the evenings and overnight, with ward rounds undertaken by the on-call SMO on Saturdays and Sundays).

[69] As provided by A. Lynn on 13 December 2016 (from the transport records, manual data source).
[70] As verified by D. O'Donoghue 08 December 2016

Other clinicians such as Discharge Facilitators/Outreach nurses, allied health professionals (SLT, Dietician, Physiotherapist, Social Workers) and the Infant Feeding Specialist work weekday business hours. The Māori Health Worker is not available after hours. Since early 2016 an on-call Social Worker can be accessed after hours (through Women's Health). Staff interviewed indicated that they were often keeping infants as inpatients over the weekend as they were waiting for specialist clinician input, such as Social Work or Infant Feeding /SLT advice to facilitate timely discharge.

3.3.9 Neonatal service comparison

The following Neonatal service comparison (**Table 9**) is indicative of similar services in terms of staffing, cots and facilities. Please note:

- The figures for health services other than Canterbury have been provided by the service (during a phone interview) and have not been externally verified.
- The information below has been compiled for consideration only. Comparisons such as these include inconsistent parameters (for comparison).
- Even data as uncomplicated as birth rates produce different results when comparing Statistics New Zealand information with DHB data sources and the split between L2/L3 care within the one service is not simple to delineate – especially for Canterbury and Auckland.

Waikato DHB, Auckland DHB (National Women's Hospital) and Hunter New England Health (Newcastle, Australia) were chosen with consideration for their similarities of regional population, number of admissions per annum and level of service provided.

Table 9: Neonatal Service Comparison with three other health services

Parameter for Comparison	Canterbury DHB	Waikato DHB	Hunter New England Health (Australia)	Auckland DHB
DHB Population	543,820[71]	400,820[72]	844,765[73]	510,450[74]
Birth numbers for health service district 2015	6064[75]	5607[76]	6,500[77]	6297[78]
Total number of infants presenting (2015) Infants by level of care (L3/L2)	1056[79] (827/229)[80]	835 (270/565)	1100 (440/660)	953 (510/443)[81]
Percentage of births represented in the neonatal population presenting to unit	18%	15%	17%	15%
Main reasons for admission Cardiac/Medical/General Surgery/Neurosurgery	Medical, Surgical No cardiac	Medical, Surgical Limited Neurosurgery No cardiac	Medical, Surgical No cardiac	Some cardiac surgery done in NICU otherwise to PICU in Starship
Cot Numbers (L3 ICU / L2 Special Care)	41 (11/30)	41 (17/24)	42 (18/24)	40 (16/24)
L2 Units in tertiary catchment area Medical care is provided by Paediatricians	Timaru	Tauranga Whakatane Rotorua Gisborne New Plymouth	9 Level 2 units throughout northern NSW region	Middlemore L3/L2 North Shore Waitakere Whangarei
In-utero transfer numbers in 2015	17	12	Nil	No records kept but transfers occur

[71] Population estimate provided by the MoH http://www.health.govt.nz/new-zealand-health-system/my-dhb
[72] ibid
[73] 2012 figure provided by HNE Health Service
[74] Population estimate provided by the MoH http://www.health.govt.nz/new-zealand-health-system/my-dhb
[75] 2015 calendar year. Canterbury DHB live birth data provided by N. Nicholson (Decision Support)
[76] 2015 calendar year – live birth data by DHB - provided by Statistics NZ
[77] Approximate number provided by HNE Health Service (not verified)
[78] 2015 calendar year – live birth data by DHB - provided by Statistics NZ
[79] There were 1065 babies in 1056 events that spent time in NIC and NSC in the 2015 calendar year. These babies could have been admitted and discharged from anywhere (but spent time in Neonatal at some stage) provided by Neroli Nicholson (Information Analyst, Decision Support) 23 November 2016
[80] NIC/NSU split provided by Neroli Nicholson (Decision Support). Babies that spend time in NIC are then usually transferred to NSC 13 December 2016
[81] This NIC/NSC split is approximate only for ADHB

Parameter for Comparison	Canterbury DHB	Waikato DHB	Hunter New England Health (Australia)	Auckland DHB
Ex-utero transfer numbers in 2015	Nil	1	Nil	Nil
Senior Medical Officers FTE (Actual staff)	5.3 FTE (6)	4.2 FTE (5)	5.8 FTE (7)	5.8 FTE (8)
SMO on-call rotations (Length of on-call/service period)	1 in 6 (7 days)	1 in 5 (12 days)	1 in 6 (One night per week + weekends as rostered, 2xSMOs on duty at any one time)	1 in 8 (Two week on service block, on call roster separate)
Cover post-call relief for SMOs (Post on-call weekend or when called in overnight)	No	No	No ("But team are good at sending home colleagues when have a shocking night")	No ("But we work collegially to provide cover for a bad night")
Rostering of non-clinical time (Requirement for time to be spent in the department)	No (No)	Yes (No)	No (But SMOs have specific responsibilities to deliver on) (No)	Yes Yes (As per DHB requirements)
SMO Credentialing Process Details	No Yes in 2004, re-starting again soon. Annual performance reviews in place)	Yes ("We did it once many years ago")	Yes Plus annual performance reviews	Yes (For specific skills e.g. ultrasound, ventilator use, transport and follow-ups)
RMO FTE (actual staff)	8 FTE (Fellow part of RMO #'s if appointed) (8)	2 FTE (2)	5 (+ 2 Fellow FTE) (7)	8 FTE (+ 2 Fellow FTE) (10)
Nurse Practitioner/CNS-Advanced Nursing Practice FTE (actual staff)	4.4 (5)	7 FTE (7)	6.8 (8)	8 FTE (8)
RMO/NP Roster combined	Yes	Yes	Yes	No Separate NP roster (meets MECA as far as understood)
Retrieval Service Roster Details of staff who undertake retrieval	RMO/NP/ CNS.ANP (A rostered 12 hour shift but not supernumerary must be covered by peers)	RMO/NP (But not allocated to retrieval/must be covered by SMO)	RMO/NP (But not allocated to retrieval/must be covered by SMO)	RN (Transport roster for RNs but required to be backfilled as have patient load)
Senior Nursing Team (incl. Nurse Manager and non-ACNM senior nursing roles) FTE (actual staff)	8.8 (9)	4.4 (6)	7.5 (8)	4.8 (6)
ACNMs FTE (actual staff)	6.1 (7)	5.6 (7)	2.5 (3)	6 (6)
Registered Nurses FTE (actual staff)	65 (96)	90. 1 (135)	102.1 (170)	86.9 (104)
Hospital/Milk Room Aides FTE (actual staff)	7.4 (15)	2.2 (3)	1.0 (1)	2.7 (4)
Clerical FTE (actual staff)	2.2 (4)	2.1 (3)	2.0 (2)	7 (4.0)
Rooming-in beds/rooms	10/5 (Shared rooms)	6/6 (Individual rooms)	Nil (Two rooms planned in the new facility)	4/4 +10 (Four single rooms, additional 10 rooms shared with post-natal)

3.3.10 International developments in Neonatal care

The principles of non-separation and family-integrated care are significant developments in the provision of Neonatal services internationally and they are already in use in Canada and Scandinavian countries and being planned in Australia.

1. Progressive Neonatal services are working towards or practicing non-separation of parents and infants from birth. This is requiring a considerable change in the approach to the provision of neonatal services, where the nursing staff are educators and facilitators of care that is provided mostly by the parents. This non-separation is driven by the evidence[82] that the parent's presence enables prompt responses to infant cues as they 'tune-in' to the signals of the infant.
2. The Karolinska Institute (Maternity hospital in Stockholm, Sweden) has practiced 'Family Centered Couplet-Care' for the past 10 years. Couplet care minimises separation, supports the parents' confidence and facilitates bonding and attachment.[83] Evidence suggests that Couplet Care decreases the overall length of infant stay.[84]
3. The need for Neonatal Services to change their Model of Care to a model that is family-integrated (where parents are more involved in the care of their baby) has been recognised by the John Hunter Children's Hospital (Newcastle, Australia). Planning for this changed Model of Care commenced in 2012 and will require more space and staffing within the service but should result in decreased average lengths of stay and increased positive outcomes for infants and parents.[85]

These principles of non-separation and family integrated care are focussed on providing the environmental conditions to support optimal development for the infant as well as the psychological process of bonding and attachment between parents and the infant (which are crucial for long-term infant health and development). These initiatives are not only infant and family friendly but they have economic benefits and improve the long-term development of the child.[86]

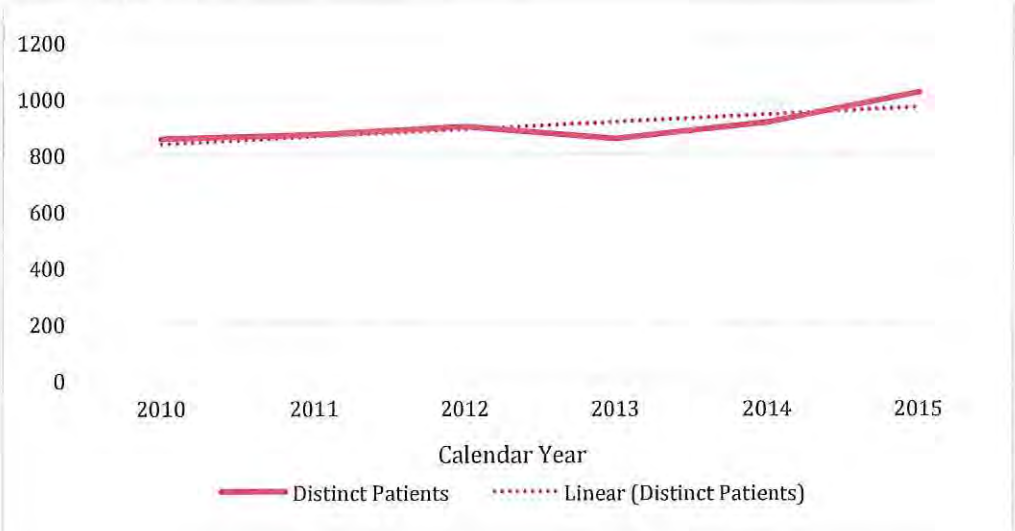
3.4 Demand and capacity

The Neonatal Unit is currently resourced for 41 cots in terms of staff at recommended ratios and physical facilities. These are allocated as 11/30 NICU/Special Care split, however the reality of managing the unit is that the level of care provided for the 41 cots swings between these allocated levels of care, as dictated by patient demand. In 2015 an extra four to five physical cot spaces were created[87] to provide the appropriate space for times when the number of infants in Level 2 exceeds 30.

The Neonatal Unit had 1,056 infants present in the service in the 2015 calendar year and the number of presentations is demonstrated in **Figure 9** as increasing steadily since 2010 when the total number of infants accessing the service was approximately 883.[88] Neither the Neonatal staff, Information/Data Analysts[89] working on this review, nor the reviewer have identified any significant seasonal trends affecting patient demand.

[82] Karolinska Institute Sweden https://www.catholicmedicalcenter.org/uploads/familycenteredneonatal.pdf
[83] ibid
[84] Neonatal Couplet Care: The Next Evolution In Family Centered Neonatal Care http://keynurseleaders.com/wp-content/uploads/2014/01/B.Neff_Neonatal-Couplet-Care_-Next-Evolution.pdf
[85] Hunter New England Local Health District, John Hunter Children's Hospital Neonatal Intensive Care Services Plan 2012-2016
[86] American Academy of Paediatrics, Family Centred Developmentally Supportive Care http://hw-fs-neoreviews.highwire.org/content/15/8/e325
[87] The extra space created by the addition of Room 7 was facilitated during essential post-earthquake repairs and the need for space to decant infants within the department as rooms were repaired. It was then decided that due to recurrent overcapacity in the unit that the extra-designated space could assist in lessening the risk of cross infection and allow the appropriate standard of physical space available to care for patients. There has not been any staff resourcing matched to this additional space (it has been staffed by stretching the current resources and is often not used due to inadequate staffing levels).
[88] There were 1056 babies in 1065 events that spent time in NIC and NSC in the 2015 calendar year. These babies could have been admitted and discharged from anywhere (but spent time in Neonatal at some stage) provided by N.Nicholson (Information Analyst, Decision Support) 23 November 2016 and confirmed by Decision Support Business Analysts and Developers (23 November 2016)
[89] The following Planning and Funding staff provided considerable data analysis support for this review: N.Nicholson (Decision Support), K.Hoeben (Operations Manager Canterbury Initiative) and S.Labbe-Hubbard (Data Analyst)

Figure 9: Number of distinct infants presenting to the Christchurch Neonatal Unit (NICU and NSU combined) by calendar year



In general terms the Canterbury DHB Maternity service cares for infants greater than 2.3 kilograms, and infants less than this weight (or with any other complications) are transferred to the Neonatal Unit. Normally the unit only accepts newborns and does not admit infants from the community (to minimise the cross-infection risk) however there are some community admissions in the first two to three days of life or where NICU level care is required, as well as a few re-admissions. Canterbury DHB does not have a paediatric ICU (Child Health has a paediatric High Dependency Unit and the adult ICU can admit children). Some infants under one-month old will at times be re-admitted (if appropriate) or the baby transferred to the Starship paediatric ICU.

The following table provides a summary of Neonatal Occupancy and Capacity using data extracted from the Canterbury DHBs data warehouse for the financial years commencing in 2010/2011 to June 2016. The 2016/2017 financial year data is YTD figures to November only and is incomplete. This data summary was compiled as the agreed figures to be used as the basis of this review by the NeoView Project Governance Group. The table is separated into the two main levels of care (NICU and NSC). The data contained in **Table 10** is explored in detail in the following sections on Demand and Capacity, and the shortcomings of Neonatal data correlation between data sources is explained in 3.7 Information management (below).

Figure 10 demonstrates the frequent breaches and sustained demand above physical capacity that the unit has been experiencing since 2013 (as measured by occupied beds at 8am in NICU and NSC combined).

Figure 11 contains the weekly average occupancy projections to November 2017 (the green dotted line). This demonstrates that the average weekly occupancy, assuming the current demand remains, is likely to continue to increase with fewer weeks of average occupancy levels below maximum resourced cot numbers.

Table 10: Neonatal Occupancy and Capacity Data Summary 2010-2016

Neonatal Occupancy and Capacity 2010-2016

Figures for consultation as part of the NeoView Project (Updated 29 November 2016)

Decision Support

Average Hourly Occupancy Number and Rates

	2016/17		2015/2016		2014/2015		2013/2014		2012/2013		2011/2012		2010/2011	
Neonatal Service	38	93%	40	98%	39	95%	40	105%	36	95%	34	89%	34	89%
Level 3 NICU	9	82%	8	73%	9	82%	10	100%	9	90%	9	90%	10	100%
Level 2 NSC	29	97%	32	107%	30	100%	30	107%	28	100%	24	86%	24	86%

orange cells indicate >85% optimal efficency occupancy rates

% Time Over Resourced Capacity

Neonatal Service	678	19%	3601	41%	2745	31%	5551	63%	2665	30%	1194	14%	1031	12%
Level 3 NICU	951	26%	1239	14%	1895	22%	4092	47%	2164	25%	2507	29%	3209	37%
Level 2 NSC	1390	38%	5467	62%	4232	48%	5201	59%	3695	42%	1463	17%	1875	21%

% time over resourced capacity = the percentage of time in hours in the year that the neonatal unit is over capacity

% Time Over 85% Occupancy

Neonatal Service	2509	69%	6856	78%	6971	80%	8442	96%	7372	84%	5413	62%	5716	65%
Level 3 NICU	1801	50%	2971	34%	3988	46%	5435	62%	3512	40%	3788	43%	4467	51%
Level 2 NSC	2436	67%	7156	81%	7148	82%	7781	89%	6317	72%	4739	54%	3891	44%

Cot Numbers (denominator)

Neonatal Service		41		41		41		38		38		38		38
Level 3 NICU		11		11		11		10		10		10		10
Level 2 NSC		30		30		30		28		28		28		28

85% capacity (denominator)

Neonatal Service		35		35		35		32		32		32		32
Level 3 NICU		9		9		9		9		9		9		9
Level 2 NSC		26		26		26		24		24		24		24

May/June 2014 capacity was 11 in NIC

NOTES:

The Neonatal Service uses 8am per day as the occupancy count and averages those figure across the year.

Decision Support/SFN uses data points on the hour every hour across the year and averages those figures. When the ward averages are calculated separately they will not always equal the combined ward average.

Data prior to the 2010/11 Financial Year has been removed (as there was no NIC/NSC ward split but an Intermediate Nursery).

Figure 10: Occupied beds at 8am for NICU and NSC (daily average from February 2010 to October 2016)

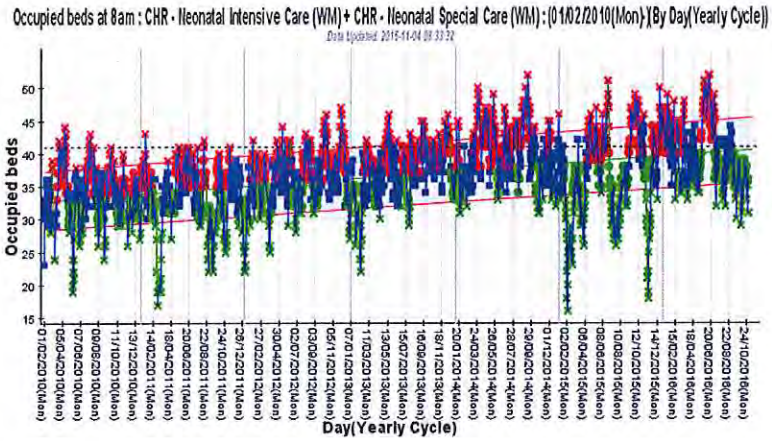
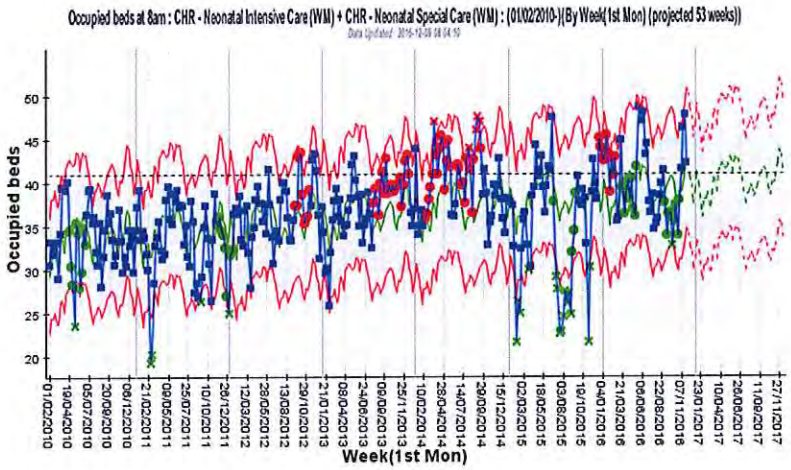


Figure 11: Occupied beds at 8am for NICU and NSC (weekly average from February 2010 and projected to August 2017)

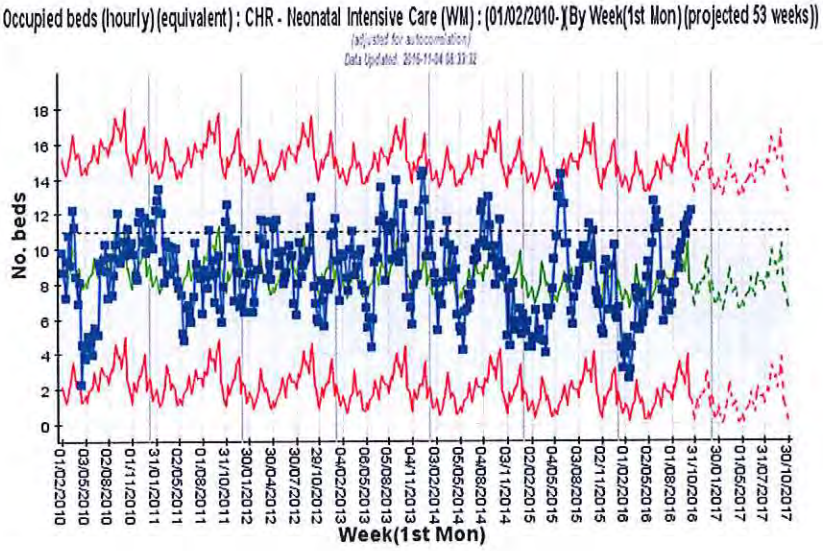


3.4.1 Neonatal intensive care demand

Table 10 (above) demonstrates that the average hourly occupancy in NICU has remained relatively consistent over the past three years, ranging between 8-10 cots (73-100% occupancy). The unit is currently resourced for 11 NICU (Level 3) cots, which was increased from 10 cots in early 2014. This increase in Level 3 cots resulted in a drop of average hourly occupancy from the 90-100% range in 2012-2014 to 73-82% in 2014-2016. Whilst there are sufficient intensive care cots to meet demand for NICU level of care, the challenge remains for the unit when Level 2 is well over capacity and the overflow infants occupy Level 3 space and staffing resources, effectively blocking capacity for high needs infants.

The following chart (**Figure 12**) demonstrates that the average demand for Neonatal intensive care is remaining relatively consistent at around 9 cots per week. The broken black line indicates the 11-cot resourced capacity.

Figure 12: Occupied Beds (Cots) in the Neonatal Intensive Care Unit (weekly average 2010-2017 including projection)



The number of multiple births (of twins or triplets) born at CWH has remained relatively steady over the past five years. Data from 2010 to 2015 as contained in **Table 11** indicates that between 169 to 209 infants were born as a multiple birth. The percentage of infants admitted to the unit is also relatively consistent (representing between 54-75% of Canterbury DHB multiple-birth infants).

Table 11: Multiple Births Admitted to NICU 2010 to 2014[90]

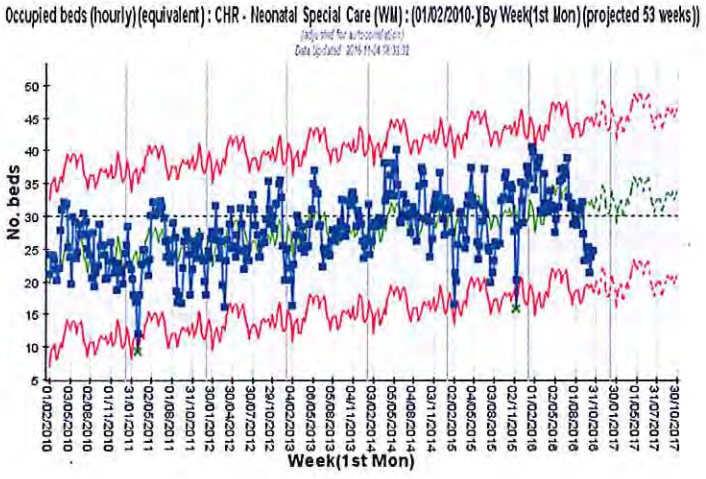
Year	Number of Canterbury DHB multiple-birth infants (live born at CWH)	Number of multiple-birth infants (live born at CWH) admitted to the Neonatal Unit	Percentage of CWH born multiple births admitted to the Neonatal Unit
2016 (YTD Jan-Nov)	163	96	59%
2015	209	156	75%
2014	188	101	54%
2013	185	106	57%
2012	197	126	64%
2011	169	98	58%
2010	195	107	55%

3.4.2 Neonatal special care demand

Since 2013, Neonatal services (nationally) have observed the social and demographic impact on the demand for Level 2 care. The reasons for this include increasing maternal obesity, morbidity (especially gestational diabetes), increased ultrasound monitoring of foetal development, multiple births, maternal age, social complexities alcohol/substance abuse and smoking by mothers/most often Māori women.[91,92]

Table 10 (above) demonstrates that Special Care (Level 2) demand since 2013 is more than 80% of the time above 85% occupancy[93] and around 50% of the time above resourced (maximum) capacity (i.e. actual physical cots, space and staffing resources). The following **Figure 13** demonstrates that demand for Neonatal Special Care is consistently growing since 2010. The weekly average hourly occupancy is frequently breaching the physical 30-bed capacity of the unit.

Figure 13: Occupied Beds in the Neonatal Special Care Unit (weekly average 2010-2017 projection)



[90] Data provided by N. Nicholson (Decision Support) on 13 December 2016. Data warehouse figures exclude infants admitted to the unit but transferred in from other centres. These figures differ slightly from those captured by the service due to the method of counting by calendar year.
[91] Malatest International – Comparative Study of Maternity system – November 2012
[92] Smoking rates are decreasing for all ethnic groups except Maori, 42% of Maori women smoke. Source: http://www.smokefree.org.nz/smoking-its-effects
[93] The healthcare industry norm considers a 75% occupancy rate to be optimal in terms of efficiency and ability to cope with unexpected demand. Neonatal specific indicators both nationally and internationally concur that 75% occupancy is required to decrease the need for transport of sick infants. Reference: Review of Intensive Care Provision in NZ (2004). For the purposes of this review 85% occupancy was agreed as a balance between efficiency and safety.

3.4.3 Neonatal intensive care capacity

Table 10 (page 38) illustrates that the current capacity for NICU is mostly sufficient to meet the demand for intensive care for newborns requiring this level of care. From July 2015 to June 2016, the unit was over resourced capacity 14% of the time (the percentage of time 'in hours in the year' that the Level 3 service had more infants than it is currently resourced) and over 85% occupancy (the target for optimal efficiency) 34% of the time. This means that there is very little, if any spare capacity in times of peak demand. Note: The data presented in this report does not include the intensive care days for Canterbury-domiciled infants born in other DHBs (due to lack of capacity in Canterbury) prior to their return.

Although the demand for NICU level 3 care is remaining relatively stable overall, there are regular instances when mothers are transferred out with babies in-utero, as the unit is full. The presentation of twins during busy times means that they are unlikely to be able to be accommodated and they will be transferred in-utero.[94]

The consequences of transfer to another tertiary Neonatal Unit due to insufficient capacity are significant for the parents, the infant and the service. Infants requiring NICU level of care can be inpatients for up to five months and not being able to be cared for in their local hospital is considerably disruptive for families and adds further stress. It also does not support providing 'services as close to peoples home as possible'.[95] The Service endeavours to bring infants back to Christchurch as soon as capacity allows, but this still requires the parents and family/whānau to be away from home, regular support networks and employment, sometimes for up to three weeks.

The transfers are missed opportunities for the Paediatric Surgeons, Neonatologists, nursing and allied health staff to utilise and maintain their skills in caring for complex infants. There is also considerable (unrecognised) workload by Canterbury DHB staff attached to overseeing the care of Canterbury infants located in other centres. Canterbury DHB is required to provide transport back to Christchurch when space permits as well as cover the cost of the inter-district flow treatment and family expenses whilst away.

The following **Table 12** demonstrates the number of babies transferred out of Canterbury over the past four years due to lack of capacity in the NICU, representing the unmet need. The 2016 year-to-date data shows that 15 infants were transferred in-utero and 17 were transferred in 2015.

Table 12: Number of infants transferred out (or redirected) from Canterbury DHB 2013-2016[96]

Year	Babies In-utero
2016 (Calendar YTD November)	15 (4 sets of twins)
2015	17 (3 sets of twins)
2014	14 (4 sets of twins)
2013	20 (6 sets of twins)

3.4.4 Neonatal special care capacity

Neonatal Special Care is experiencing consistent demand for this level of care that is beyond the current resourced levels. As identified in section 3.4.2 and **Table 10** (page 38) demand for Level 2 care is growing steadily and well above 85% occupancy (and 70-80% of resourced capacity) for the past four years. The compounding challenges for Canterbury in the provision of Level 2 care are that the service has no (geographically close) Level 2 services that it can transfer infants for the provision of lower acuity care, to free up capacity in the unit. This structural challenge, along with a stretched (and

[94] Late November 2016 the unit was running at approximately 49 admissions and three sets of twins were required to be transferred in-utero to deliver in other centres. One delivered en-route. D. O'Donoghue 29 November 2016.
[95] Canterbury DHB Annual Plan 2015/16 page 17.
[96] Data supplied by C. Carroll (Neonatal Administrator) who maintains a spreadsheet of transfers in/out or re-direction of patients on 7 October 2016